

Underpricing in Corporate Bond Issues: An Explanation Based on Information Problems

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Abstract

This paper represents the first of its kind on the Swedish market as well as the first on the European market in over two decades. Through analysis of 1-day excess return observations for 457 bond issues on the Swedish corporate bond market ranging from June 2003 to February 2015, we investigate how information problems relate to underpricing. Our empirical evidence indicates that Swedish corporate bond issues are on average underpriced and that this underpricing is strongly related to the issuer status, where first-time issuers and, in particular, first-time issuers who are private underprice the most. While we find no evidence in support of the winner's curse theory and the asymmetric information theory, we do find that underpricing relates to the information acquisition theory and is used to extract information from investors. Awareness of the underpricing drivers and pattern has several implications and may assist stakeholders involved in price setting and assessment of corporate bond issues.

Keywords: Corporate bonds, underpricing, information problems.

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1 Introduction

Corporate bond financing has historically been considered a secondary funding source in the Swedish market as firms have traditionally financed their businesses through bank loans. However, as a consequence of the 2008 financial crisis the financing environment has undergone a regulatory transformation, which has encouraged firms to seek alternative funding sources, such as corporate bonds. Consequently, the Swedish corporate bond market has experienced continuous growth since 2011 and has become an increasingly important part of the Swedish capital markets.

One of the most interesting concerns in corporate bond issues relate to the phenomenon of underpricing. While the existing literature on the topic of underpricing and its determinants in equity offerings is vast and has been thoroughly investigated over the past decades, the corresponding literature on corporate bonds has been surprisingly limited. In contrast to equity that is typically issued infrequently, many firms rely on corporate bonds as part of their continuous funding, which therefore constitute an important part of firms' capital structures. Nevertheless, previous studies have found that underpricing exists and that the magnitude typically varies with firm and bond characteristics (such as issue size, maturity, credit rating, whether the firm is a first-time or seasoned issuer and more).

While the existing underpricing literature has focused almost exclusively on US corporate bonds, this study represents the first of its kind on the Swedish market as well as the first on the European market in over two decades. Consequently, this study not only provides a current estimate of underpricing but also extends existing research by analyzing the degree of underpricing and its determinants using observations from the Swedish corporate bond market where the institutional trading characteristics and regulations are different from the US. As the importance of the Swedish bond market is increasing, we believe that this topic is a contemporary field of study that is interesting to both academia and market practitioners. In contrast to earlier studies, we measure underpricing using clean rather than dirty prices and argue that clean prices provide a more accurate measure of underpricing. While the direct implication of this is that our results are not directly comparable in absolute terms to previous studies, the links and relationships that we find are certainly comparable.

The purpose of this paper is to investigate corporate bond underpricing in the

context of the Swedish corporate bond market and examine some of the possible explanations as to why underpricing exists. Based on results in earlier studies and conversations with market practitioners, we hypothesize that corporate bond issues on the Swedish corporate bond market are on average underpriced and that this underpricing is related to information problems. Similar to Cai et al (2007), to narrow down which information problems that underpricing solves, we test three separate information problem theories based on asymmetric information between uninformed and informed investors, between underwriters and investors and between managers and investors.

Using 1-day excess return observations for 457 bond issues on the Swedish corporate bond market ranging from June 2003 to February 2015, we find that corporate bond issues are on average underpriced by c. 0.21%, thereby confirming earlier findings by Wasserfallen and Wydler (1988), Datta et al (1997), Helwege and Kleiman (1998), Welch (2000) and Cai et al (2007). Moreover, we find that this underpricing is related to information problems, as suggested by Welch (2000), Hale and Santos (2006) and Cai et al (2007). Specifically, we find that underpricing is strongly related to the issuer status, where underpricing in first-time issues is more than twice as high as in seasoned issues (0.45% vs. 0.17%). Based on the average issue amounts in our sample for first-time and seasoned issuers (c. EUR 116 million vs. 150 million), we note that first-time issuers pay c. EUR 0.52 million in absolute terms in underpricing while seasoned issuers pay c. EUR 0.26 million. Regrettably, we are unable to fully investigate how the firm status (private vs. public) affects underpricing, as robustness tests indicate that outliers might affect results for the observed underpricing for the firm status variable. Nonetheless, we are able to assert that first-time issuers who are private underprice the most (c. 0.53%).

In line with Cai et al (2007), we find no support for the notion that issues which target a higher degree of uninformed investors are subject to larger underpricing, as explained by the winner's curse theory. On a similar note, in contrast to Hale and Santos (2006) and Cai et al (2007), we find no support for the asymmetric information theory. On the other hand, we do find evidence that underpricing is used to extract information from investors and functions as an economic motivation to investors to truthfully reveal their demand, as explained by the information acquisition theory, which confirms earlier findings by Cai et al (2007).

As the Swedish corporate bond market is currently gaining significant momen-

tum, we argue that our empirical findings have implications for many stakeholders, such as issuers, underwriters, debt investors and shareholders in the issuing firms themselves. Being aware of the drivers of underpricing and its pattern may assist stakeholders involved in price setting and assessment of corporate bond issues. For instance, short-time investors seeking to benefit from underpricing could choose to commit resources to issues where underpricing has been shown to be the highest. Moreover, our results suggest that firms that choose to rely on the corporate bond market for funding should consider whether they can commit to this funding source and frequently issue bonds and preferably issue small bonds regularly rather than large bonds irregularly, as underpricing is evidently lower in such cases.

1.1 Paper outline

The remainder of this paper is organized as follows. In section 2, we provide a brief overview of the Swedish corporate bond market and shortly describe determinants of corporate bond prices. In section 3, we discuss previous studies on underpricing in corporate bond and equity offerings and other related studies in order to develop an understanding of how underpricing has previously been examined as well as plausible drivers of underpricing. In section 4, we present information problem theories and hypotheses on which analysis in this paper is based. In section 5, we present the methodology and provide a detailed description of the dataset. In section 6, we present empirical results using both univariate and multivariate analyses to establish relationships and links as well as discuss a number of robustness tests. In section 7, we present limitations and suggest areas for future studies, after which we conclude the thesis in section 8. Appendix A includes supplementary tables related to the main analysis in the thesis. Appendix B includes tables related to robustness tests.

2 Background

2.1 Brief overview of the Swedish corporate bond market

The Swedish corporate bond market is currently experiencing growth in both outstanding volume and number of issuers, which comes primarily from an increased interest for corporate bond financing. Swedish firms have historically used bank loans as their primary source of funding. However, following the 2008 financial cri-

sis, bank loan funding has become more expensive and difficult to obtain. This has spurred interest for alternative capital financing methods where corporate bond financing has presented an opportunity to reduce bank loan dependency. Consequently, Swedish corporate bond financing as a share of loan-based funding has grown constantly since 2011 as firms have progressively replaced bank loans with corporate bonds¹ (Bonthron, 2014).

One source of change in regulation is the ongoing Basel III implementation, which induces higher costs for banks by imposing stricter rules on liquidity requirements and risk-weighted capital (among other things). This pressures banks to hold less risky assets and has resulted in more expensive corporate lending, which market practitioners argue increases demand for corporate bond financing.

The growth in corporate bond financing has been met by an increasing investor demand. One explanation for the investor appetite is the current record-low interest rate environment that has emerged following many central banks' expansive monetary policies in the past years. This has led to a situation where investors search for higher-risk investments in order to achieve their required yields – a pattern that can be seen in corresponding corporate bond markets across the world (Joyce, Liu and Tonks, 2014; Bonthron, 2014).

As of mid-2014, the outstanding volume corresponded to SEK 370 billion and represented more than 10% of Sweden's GDP. Over 130 different firms have issued bonds on the Swedish market between 2001 to mid-2014. While a majority of the new bond issues represents investment grade bonds by major Swedish firms, smaller firms have increasingly begun to issue high-yield bonds to a greater extent than before² (Bonthron, 2014).

The primary market for Swedish corporate bonds is fairly transparent while the secondary market is largely non-transparent as most of the trading takes place over-the-counter ("OTC") where transaction information is not publicly available (Gunnarsdottir and Lindh, 2011). As a consequence, in February 2015, the Swedish Financial Supervisory Authority implemented new regulation on disclosure of transaction data to increase transparency. Prior to this change, indicative price quotes obtained through trading systems, such as Bloomberg, provided the only way of obtaining price information.

¹Swedish corporate bond financing as a share of loan-based funding accounted for c. 15% in 2011 while the corresponding figure was c. 20% in mid-2014 (Bonthron, 2014).

²The ten largest firms accounted for c. 70% of the outstanding volume in 2011 while the corresponding figure was c. 53% in 2013 (Bonthron, 2014).

2.2 A primer on corporate bond pricing

When considering the price of a corporate bond, market practitioners refer to one of two distinct price conventions: the clean price or the dirty price. The two conventions differ in whether or not they include accrued interest arising from coupon payments in the quoted price. Mathematically, the dirty price is expressed as the clean price plus the accrued interest. Put simply, one could separate a bond's price movements over time into (i) movements arising from accrued interest and (ii) movements arising from economic reasons (e.g. changes in the issuer's credit quality, changes in interest rates and other factors affecting the demand or supply of the bond). The size and frequency of the first type of price movements are identical throughout a bond's active life (assuming a fixed coupon and schedule) while the size and frequency of the second type of price movements will be irregular and random (similar to how stocks move in reaction to news, rumors and other factors that might affect the firm).

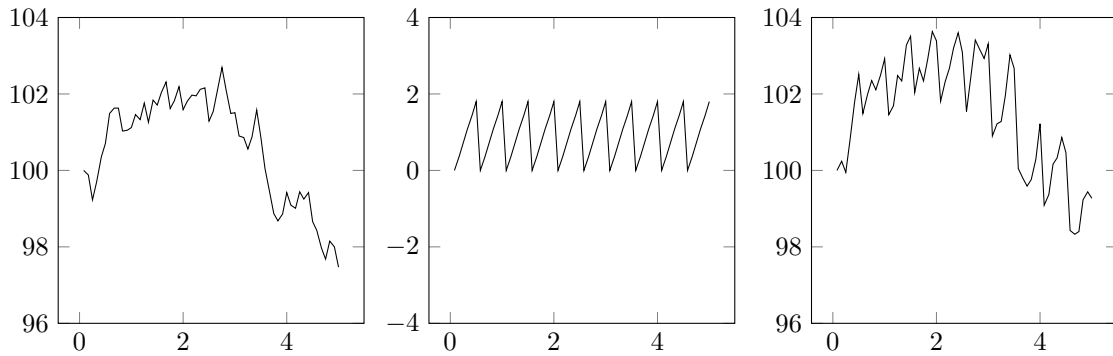


Figure 1: Illustration of clean price, interest accrual and dirty price movements over time.

Because clean prices are more stable over time and do not fluctuate with coupon accrual and payments, traders of corporate bonds generally refer to a bond's price in terms of its clean price (and therefore when corporate bond prices are quoted on Bloomberg they are quoted as clean prices). However, when a bond is purchased or sold it is obviously the dirty price that is paid or received (i.e. the clean price of the bond plus any accrued interest).

3 Literature Review

The following literature review is divided into three main categories: (3.1) a thorough review of previous studies on underpricing in corporate bond issues, (3.2) selected relevant and related studies on corporate bonds and (3.3) a brief overview of relevant studies on underpricing in equity issues.

3.1 Underpricing in corporate bond issues

Brimmer (1960) presented one of the first studies on underpricing in corporate bond issues and showed that newly issued bonds were offered to investors at yields substantially above yields on outstanding bonds of comparable quality and maturity, which he partly attributed to underwriters whom he argued priced issues below the true equilibrium price to reduce the risk of not selling the entire issue. This was further examined by Conard and Frankena (1969) who argued that differences in coupon rates between new and outstanding bonds of equal quality explained around half of the yield differences between new and outstanding bonds but also suggested that underwriters' pricing policies determine underpricing.

Ederington (1974) confirmed earlier findings and suggested that yields on outstanding bonds lag yields on newer issues but that these yields adjust within a month. Similarly, Lindvall (1977) also argued that yields on outstanding bonds lag yields on new issues but attributed this finding partly to the infrequent trading in the secondary market, which he argued made the market for outstanding bonds reflect new information more slowly than the market for new issues. In contrast, Weinstein (1978) employed an alternative methodology that focused on holding-period returns rather than comparing bond yields and suggested that newly issued bonds are offered at below-equilibrium prices and that new issue yields move toward yields of already outstanding bonds within a month (in contrast to what Ederington (1974) and Lindvall (1977) suggested). Correspondingly, Sorensen (1982), based on evidence suggesting that underwriters underprice new issues on average, also argued that new yields move towards yields on outstanding bonds.

In contrast to earlier studies, Fung and Rudd (1986) did not find clear evidence of underpricing in their sample. On the other hand, in the first study to examine non-US bonds, Wasserfallen and Wydler (1988) did find a slight underpricing using Swiss corporate bond data (although their sample also included government bonds to a certain extent), which they argued was related to unexpected changes

in interest rates over the offering period – an artifact of the Swiss issue process characteristics at the time. Contrary to previous studies where samples consisted of bonds issued by both first-time and seasoned issuers³, Datta et al (1997) studied only first-time issuers. Thus, light was shed on whether corporate bond IPO returns were similar to returns observed for equity IPOs. However, similar to Fung and Rudd (1986), the authors found no statistically significant underpricing for the sample as a whole, although their findings suggested that high yield bond IPOs were significantly underpriced (1.86%) whereas investment grade bonds were overpriced. Explaining these findings, Datta et al (1997) argued that high yield debt has a larger equity component, and consequently also a higher degree of information asymmetry, while investment grade debt is subject to more price competition among investment banks. Furthermore, the authors showed that underwriter reputation reduces information asymmetry and that underpricing is inversely related to this reputation where the more prestigious the investment bank, the lower is the underpricing for the corporate bond IPO (similar to findings reported in equity underpricing by Carter and Manaster, 1990). Helwege and Kleiman (1998) also studied bond IPOs but relied on a different source for bond prices and employed a slightly different methodology when computing excess returns. Their empirical findings indicated that first-time issuers underprice by 0.39%. Surprisingly, the results suggested that underpricing existed mainly among the more established firms that were presumed to have less information problems, which suggested that information problems could be less important in explaining underpricing in bond IPOs. Also, underpricing was found to be lower for firms that did not have equity outstanding or were smaller and only little underpricing was found for lower-rated firms. Welch (2000) examined bond issues by both first-time and seasoned issuers and found that corporate bond issues were underpriced on average by a small and significant amount (0.10%), although significantly larger for high yield bonds (0.54%), and that excess returns for bond issues vary non-monotonically across ratings, decrease in trading frequency after the issue and increase with the volatility in returns. Consistent with the winner’s curse theory, the findings also suggested that issuers underprice issues in order to make sure that uninformed investors participate in the offering.

However, up to this point in time, the existing literature had not made a

³For instance, Brimmer (1960), Conard and Frankena (1969), Ederington (1974), Lindvall (1977), Weinstein (1978), Sorensen (1982), Fung and Rudd (1986) and Wasserfallen and Wydler (1988).

distinction between bond IPOs and seasoned issues. Although Datta et al (1997) and Helwege and Kleiman (1998) studied bond IPOs they did not compare their results to bond issues by seasoned issuers. Using a sample of both IPO and seasoned bond issues, Hale and Santos (2006) provided empirical evidence that underpricing is slightly higher for IPO bonds in comparison to seasoned issues.

Cai et al (2007) further analyzed how underpricing is related to information problems and liquidity. Their findings showed that high yield bond IPOs were underpriced on average by 0.47% although statistically significant results could not be found for investment grade bond IPOs. Consistent with information problems, they were able to show that underpricing is larger for private firms for which the bond offering is a bond IPO, firms that have not been issuing for a long time in the market and firms that only recently issued equity. The authors also presented evidence indicating that liquidity do not drive underpricing. Similarly, Goldstein and Hotchkiss (2007) argued that underpricing is unrelated to liquidity but related to underwriters' pricing decisions before the issue and price dispersion in the after-market trading. Using a different price data source, their study found that high yield bonds were underpriced on average by 1.24% while investment grade bonds were underpriced by 0.45%. Using a sample of non-private firms, Kozhanov et al (2011) argued that new corporate bonds are overpriced. However, in contrast to previous research, their study used an estimation window up to 18 months following an issue, which is much longer than previously used. Nevertheless, their empirical findings suggested that their sample was underpriced by 1.16% when analyzing the period between the offer and end of first month, which is consistent with previous research.

3.2 Related studies on corporate bonds

Several studies on related topics are also interesting to keep in mind when examining underpricing in corporate bond issues.

Empirical findings suggest that issues are deliberately priced by underwriters slightly below the expected maximum price at which an issue can be sold in full to investors. For instance, Ederington (1976) showed that yields on negotiated issues are approximately seven to eight basis points higher than on competitive biddings (negotiated offerings tend to be the more common method), thereby supporting the notion that underpricing comes from underwriters' pricing decision. Moreover, Campbell and Taksler (2003) shed further light on corporate bond yields and

showed that equity volatility is able to explain much of corporate bond yield movements over the past decades.

Crabbe and Turner (1995) analyzed the effect of issue size on yields and found that there appears to be no relation between the two and argued that liquidity is not a function of issue size (despite larger issues having a perceived greater liquidity). Furthermore, Alexander et al (2000) analyzed how trading in a firm's corporate bond is affected by its equity status and showed that firms with private equity have more actively traded bonds, arguing that bonds of private firms present the only way of investing in such companies. In contrast, Hotchkiss and Jostova (2007) presented empirical evidence that firms with public equity have more actively traded bonds and that this was positively related to the trading activity of the stock⁴. In addition, expanding the findings by Crabbe and Turner (1995), the authors suggested that larger issues do trade more than smaller issues.

Similar to findings for corporate bonds, Ammann et al (2001) found empirical evidence of underpricing in convertible bond issues and a positive relationship between underpricing and maturity, which increases with maturity.

3.3 Underpricing in equity issues

A great number of studies on equity underpricing has been published over the past decades⁵ and one could realistically expect that results found in such studies are important when explaining underpricing in corporate bonds. This follows from the notion that corporate bonds can be thought of as being made up of a risk-free and an equity portion, where the riskier the bond is the larger is the equity portion (Chang and Pinegar, 1986; Blume, Keim and Patel, 1991; Shane, 1993).

Many of the theories researchers have put forward when explaining equity underpricing are based on information uncertainties and differences between the parties involved in the issue. Rock (1986) presented a model explaining equity underpricing based on the existence of informed and uninformed investors and argued that underpricing is used as an economic compensation to ensure that uninformed investors participate in the issue. Empirical support for the Rock model has been relatively positive (Koh and Walter, 1989; Michaely and Shaw, 1994). Situations where there is asymmetric information between investors and

⁴Hotchkiss and Jostova (2007) argued that the results of Alexander et al (2000) were based on a smaller and less reliable sample.

⁵See Ritter and Welch (2002) for a more thorough review of the equity IPO literature.

managers in which underpricing works as a signal of a firm's quality (i.e. signaling theory) has been considered by Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989). However, empirical support for signaling theories in equity offerings has been relatively mixed (Jegadeesh et al, 1993; Michaely and Shaw, 1994; Spiess and Pettway, 1997; Francis et al, 2008). Studies have also investigated how underpricing relates to the information acquisition theory and how it is used to produce and/or reveal information (Baron, 1982; Chemmanur, 1993). More specifically, bookbuilding models that focus on the information hurdles faced by underwriters when pricing a new issue have been considered by Benveniste and Spindt (1989) and Benveniste et al (1996). The empirical support for the bookbuilding models has been positive (Lee et al, 1999; Cornelli and Goldreich, 2001; Cornelli and Goldreich, 2003).

Previous studies have also confirmed that underpricing is related to the ex-ante uncertainty among investors regarding the aftermarket equilibrium price (Beatty and Ritter, 1986; Miller and Reilly, 1987; Corwin, 2003). Moreover, research has also established that equity underpricing is related to the price setting behavior by underwriters, as underwriters have an incentive for reputational or strategic reasons to maintain underpricing to attract investors and issuers (Beatty and Ritter, 1986; Loughran and Ritter, 2004). Empirical evidence has also suggested that equity underpricing is related to underwriters' pricing conventions and practices (such as price rounding and pricing relative to the bid quote) (Lee et al, 1996; Mola and Loughran, 2004; Corwin, 2003). Furthermore, the relation between underpricing and the level of prestige of underwriters have also been examined, where prestige has been argued to be a sort of signaling of risk (Logue, 1973; Hammond and Neuberger, 1974; Block and Stanley, 1980; Chapelle and Neuberger, 1983; Johnson and Miller, 1988; Michaely and Shaw, 1994).

Using a sample of firms who have raised capital through corporate bonds before entering the equity market, Cai et al (2004) found that underpricing for such firms is much lower than for firms that have not issued public debt before, which can be attributed to information asymmetry problems. Similarly, Glushkov et al (2014) examined equity underpricing for firms with public debt and showed empirically that firms who have public debt when issuing equity were likely to have less information asymmetry problems and face lower underpricing.

3.4 Contribution to the existing literature

To our knowledge, except for two earlier studies⁶, underpricing in corporate bond issues has been examined exclusively using data on US corporate bonds. This study uses a dataset comprised only of corporate bonds issued by firms domiciled and incorporated in Sweden. Consequently, this study represents the first of its kind on the Swedish market as well as the first on the European market in over two decades. Thus, not only do we provide academia and market practitioners with a more recent estimate of underpricing but also extend existing research by analyzing the level of underpricing and its determinants using observations from the Swedish corporate bond market where the institutional trading characteristics and regulations are different from the US. Conversations with market practitioners indicate that the Swedish corporate bond market is underdeveloped in comparison to the US market in terms of transparency, liquidity and standardization.

Furthermore, unlike older studies we measure underpricing similar to the most current research on this field (e.g. Hale and Santos, 2006; Cai et al, 2007) and include both IPO bonds and seasoned offers which allows us to test a broad set of hypotheses. Moreover, our study uses trader quotes similar to studies by Fung and Rudd (1986) and Helwege and Kleiman (1998), which could be considered a more reliable source of bond prices as these reflect the activity in the dealer market where most of the corporate bond trading occurs.

Lastly, an aspect that differentiates this study from previous ones is that we use an underpricing measure based on clean rather than dirty prices, which we argue is more accurate. While the direct implication of this is that our results are not directly comparable in absolute terms to previous findings (although our results should not be substantially different), the underpricing links and relationships that we find are comparable.

4 Theory and Hypotheses

4.1 Theories on underpricing in corporate bonds

The existing literature on corporate bond underpricing generally tends to refer to information problems as the main source of underpricing⁷, where the greater the

⁶Wasserfallen and Wydler (1988) and McKenzie and Takaoka (2009) used data on Swiss and Japanese corporate bonds, respectively.

⁷See for instance Datta et al (1997), Helwege and Kleiman (1998), Welch (2000), Cai et al (2007).

information problems associated with a firm, the more the underpricing. Generally, previous research recognizes three main theories in information problems: (i) the winner's curse theory, (ii) information acquisition theory and (iii) asymmetric information theory.

The winner's curse theory suggests that underpricing solves asymmetric information between informed and uninformed investors. The winner's curse arises when informed investors avoid offerings by bad firms and only request allocations in fairly valued or undervalued offerings, thereby leaving the uninformed investors with the overvalued offerings. Thus, in order to make sure that uninformed investors participate so that an issue is fully sold, the offeror will underprice the issue to compensate the uninformed investors for the risk of the winner's curse.

The information acquisition theory suggests that underpricing solves asymmetric information between underwriters and investors and refers to the information hurdles faced by underwriters when pricing a new issue. The theory implies that underwriters use underpricing as an economic motivation to investors for truthfully reveal their demand in offerings. Should underpricing not exist investors would have an incentive to understate their demand in offerings hoping they can purchase the stocks or bonds at a lower price.

The asymmetric information theory refers to a lemons problem where there is asymmetric information between managers and investors. The theory implies that underpricing solves asymmetric information problems by functioning as a signal of a firm's quality where a good firm can afford to underprice offerings more than a bad firm is able to do. Theoretically, once a good firm has distinguished itself from a bad firm (and consequently reduced asymmetric information problems) it is able to underprice less, which suggests that a firm could sell a smaller amount at a large underprice in a first offering and then recoup this underpricing amount in seasoned offerings.

4.2 Hypotheses

First, we test if Swedish corporate bond issues are underpriced (the first hypothesis). Second, we test if underpricing is related to information problems (the second and third hypotheses). Third, we apply an approach similar to Cai et al (2007) and test which specific information problem that underpricing solves by testing

the underpricing theories described above⁸ (the fourth, fifth and sixth hypotheses). For each hypothesis, we begin by describing the expected outcome after which we state the hypothesis.

Based on conversations with market practitioners and results in previous studies on underpricing in corporate bonds by, for instance, Wasserfallen and Wydler (1988), Datta et al (1997), Helwege and Kleiman (1998), Welch (2000), Cai et al (2007), we expect offerings to be underpriced on average.

I: Corporate bond offerings are underpriced on average.

If information problems drive underpricing, we would expect it to be related to whether issuers are first-time or seasoned issuers. For instance, consider a firm that has previously issued a corporate bond and subsequently issues a new bond. In such situation, investors who wish to purchase the new bond might have already analyzed and invested in the previous bond issued by the firm and is able to view the issuer's track record – something which is not possible for a first-time corporate bond issuer. Thus, we would expect a first-time issuer to be more likely to experience information problems than a seasoned issuer and should consequently experience more underpricing as a result of these information uncertainties. This hypothesis has been supported by empirical findings by Hale and Santos (2006) and Cai et al (2007).

II: First-time issuers experience larger underpricing than seasoned issuers.

On a similar note, if information problems drive underpricing we would also expect it to be related to whether issuers have public equity outstanding when issuing a corporate bond or not. For instance, consider a firm that has public equity outstanding when issuing a corporate bond. In such situation, investors who wish to purchase the bond might have already analyzed and invested in the firm's equity and is able to use the already existing information that has been provided over time since the equity listing (e.g. IPO prospectus, regular reporting, CMD-presentations) to gain additional knowledge on the firm. Thus, we would expect a

⁸Cai et al (2007) found empirical support for the information acquisition theory and the asymmetric information theory but did not find evidence in support of the winner's curse theory. However, Welch (2000) did find support for the winner's curse theory.

firm with public equity at the time of issuing a corporate bond to be more likely to experience less information problems than a firm without public equity and should consequently experience less underpricing. This hypothesis has been found to hold in a study by Cai et al (2007) although Helwege and Kleiman (1998) found empirical results contrary to this hypothesis.

III: Private firms experience larger underpricing than public firms.

In order to test if underpricing can be explained by the winner's curse theory, we must make assumptions on the existence of informed and uninformed investors. Market practitioners generally regard investors in the corporate bond markets as informed since investors are primarily institutional investors⁹. Thus, we would expect there to be a high degree of informational homogeneity these across investors¹⁰. Obviously, there is no definitive way to identify informed and uninformed investors, nevertheless, based on conversations with market practitioners, we could to some extent assume that the existence of uninformed investors might be higher if the corporate bond is listed¹¹. Thus, if the winner's curse theory is an important determinant for underpricing, we would expect greater underpricing for corporate bonds that are listed. However, market practitioners suggest that investor bases across Swedish corporate bonds are largely similar irrespective of whether a bond is listed or not and we therefore do realize that this proxy is arguably rather weak.

IV: Corporate bonds that are listed will experience larger underpricing than those who are not.

To test if underpricing can be explained by the information acquisition theory, we must make assumptions on the degree of information about the demand for cor-

⁹The market is mainly characterized by larger, long-term investors (Bonthron, 2014).

¹⁰Datta et al (1997) found empirically that there is little underpricing when investors are homogeneous (as expected of the winner's curse theory).

¹¹The Nasdaq OMX Stockholm offers issuers listing of corporate bonds in one of three separate lists (the retail bond list, the corporate bond list and the benchmark bond list), where the retail bond list is intended primarily for smaller/medium sized investors, while the corporate and benchmark bond lists are intended for more professional investors. These listing differences could function as an indication of the investor composition and allow us to test the winner's curse theory. However, only a handful bonds were listed on the retail bond list, which makes any attempts to achieve statistical significance futile.

porate bond offerings that underwriters have when pricing an issue. For instance, consider a firm that issues a corporate bond after having recently undertaken another public capital raising. In such a situation, we would expect underwriters to have a relatively better knowledge on the potential demand for the corporate bond offering as a result of the previous capital raising. If the information acquisition theory is an important determinant of underpricing and if underpricing is a motivational tool for extracting information on demand from investors, we would expect underpricing to be lower in such situations. We will consider both debt and equity offerings that have been recently undertaken since both provide underwriters with information on the potential investor demand. However, whether firms have issued bonds or equity will be treated separately as they are different events, where we believe that recent bond issue activity will be more relevant than recent equity activity.

V: Firms that have recently raised capital through a debt or equity offering will experience less underpricing.

In order to test if underpricing can be explained by the asymmetric information theory, we must make assumptions on firm quality. If the theory is an important explanation of underpricing, we would expect good firms to underprice more than bad firms in order to signal their quality. Cai et al (2007) used future rating downgrades as a proxy for firm quality where the firms with the highest incidence of downgrades were considered bad firms. Unfortunately, this is not a viable proxy in our study¹². Another method of testing the theory could focus on how underpricing changes between first-time issues and subsequent offerings as the theory suggests that a firm could sell a smaller amount at a large underprice in a first offering to signal its quality and then recoup the underpricing in seasoned offerings. This has been supported empirically by Hale and Santos (2006) who found that underpricing is lower for the second bond that a first-time issuer issues. However, the number of firms in the sample that fulfill this requirement are too few, which makes statistical inference futile.

On the other hand, once a good firm has distinguished itself from bad firms, the asymmetric information problems are reduced. Hence, we would expect firms

¹²Our dataset only includes corporate bonds that are currently active and outstanding, which means that some bonds in the sample have only recently been issued. Thus, we cannot use this proxy as some bonds might not yet have had the time to become up- or downgraded.

that have conveyed to investors that they are good to be able to underprice less. Asymmetric information issues between investors and managers can be mitigated by an issuer's reputation, as suggested by Chemmanur and Paeglis (2005), where the number of years an issuer has issued bonds in the market can proxy for reputation, as suggested by Diamond (1989). Thus, we will use reputation as measured by the number of years a firm has been issuing bonds in the market, where we expect a firm that has been issuing bonds for a long time to have better reputation among investors. Hence, such firms should have fewer asymmetric information problems and therefore be able to underprice less.

VI: Firms with better reputation will experience less underpricing.

5 Methodology and Data

5.1 Methodology

The methodologies used in previous studies have shifted and developed over time. The first approach to examining underpricing in corporate bond issues was to treat the yield to maturity¹³ of bonds as the dependent variable¹⁴. This yield approximates the expected return to investors who purchase the bond at issue and hold it until maturity. However, for investors with shorter investment horizons, holding period returns constitute a better proxy of the expected return. Consequently, Weinstein (1978) argued for using a holding period return methodology based on bonds' trading prices as the dependent variable and claimed that although the yield to maturity and holding period return use the same underlying data (i.e. bond prices), and therefore produce similar results, the holding period return is superior. More specifically, Weinstein (1978) emphasized two main advantages: (i) the holding period return methodology makes it easier to relate empirical results in the bond market to those in the equity market and (ii) the statistical properties of returns are more amenable to analysis and aggregation than yields. This methodology has been further used in recent studies by Fung and Rudd (1986), Wasserfallen and Wydler (1988), Datta et al (1997), Welch (2000) and Cai et al (2007) and currently represents the primary method of examining underpricing in

¹³A bond's price can naturally be expressed both in terms of the actual trading price or yield to maturity as they depend upon and determine each other.

¹⁴See for instance Brimmer (1960), Ederington (1974), Lindvall (1977) and Sorensen (1982).

corporate bonds.

As for all tradable instruments, corporate bond price movements are dependent on both systematic and idiosyncratic risk. In order to isolate the effect of systematic price movements, returns on individual corporate bonds must be adjusted for market-wide movements. Researchers have adjusted returns using different market proxies throughout the decades. Yet, the empirical results have been largely consistent regardless of the approach used, which suggests that the market adjustment technique is less important. Datta et al (1997) matched their sample of corporate bond returns to returns on treasury bonds according to maturities and coupon rates¹⁵. This approach was also employed by Fung and Rudd (1986). In contrast, Weinstein (1978), Wasserfallen and Wydler (1988) and Helwege and Kleiman (1998), matched their sample of corporate bond issues with already outstanding bonds with similar characteristics (e.g. maturity, coupon rates and credit ratings). However, in studies by Sorensen (1982), Welch (2000) and Cai et al (2007), returns on corporate bonds were matched against corporate bond indexes depending on rating class and maturity.

Consistent with the most current research, we calculate holding returns to investors assuming that the corporate bonds were purchased at issue and realized at current market prices (Equation 1). We adjust for market movements by matching each corporate bond with a comparable corporate bond index based on ratings class and maturity and subtracting the index returns¹⁶ (Equation 3). This method ensures that a consistent measure of market-wide movements is used.

$$R_{i,n}^{Bond} = \frac{P_{t+n}^{Bond} - P_t^{Bond}}{P_t^{Bond}} \quad (1)$$

$$R_{i,n}^{Index} = \frac{P_{t+n}^{Index} - P_t^{Index}}{P_t^{Index}} \quad (2)$$

$$R_{i,n}^{Excess} = R_{i,n}^{Bond} - R_{i,n}^{Index} \quad (3)$$

The prices used to compute the bond and index returns are based on clean prices, which means that price effect of interest accrual and payment is not included. In

¹⁵Fridson and Garman (1996) showed that the correlation between high yield bond returns and ten-year treasury bond returns is only 0.4, which implies that treasury bonds might not be the appropriate benchmark for evaluating returns on high yield bond offerings.

¹⁶We also run regressions on excess returns based on treasury returns (similar to Datta et al, 1997) and find that our results do not become materially different.

theory, prices move in either direction, while the accumulated interest (coupon payments) only adds positively (negatively) to the total return. Thus, we believe that by using clean prices we are able to disregard the positive effect that comes from interest accrual in the first few days after the bond issue and therefore examine underpricing in a more clean and accurate way.

Technically, issue of the corporate bond is identified as day 0, while the following trading days are identified as day 1, 2 and onwards. All trading prices after the issue date are compared to the issue price on day 0, such that the 1-day return is expressed as the trading price on day 1 divided by the issue price on day 0, the 2-day return is the price on day 2 divided by the price on day 0, and so on.

The trading activity among the bonds in the sample differs, where some bonds are more traded than others. Since these instruments are traded OTC, trading can be both infrequent and uneven within different time periods. Therefore, price data is generally not available for all trading days subsequent to an issue. As a result, for some bonds the 1-day return, 2-day return and onwards can be calculated while for some bonds (for example) only 1-day and 3-day returns and onwards can be calculated¹⁷. As argued in previous research (e.g. Helwege and Kleiman, 1998), the most reliable and commonly used measure of underpricing is 1-day excess returns¹⁸. Theoretically, a longer time period could lead to less exact estimates of underpricing as the time period in such case would likely be distorted by more noise. Nonetheless, Helwege and Kleiman (1998) pointed out that the length of the time period (up to around a month) is less important when examining underpricing because trading subsequent to an offering does not significantly offset the initial return¹⁹. Similarly, Datta et al (1997) showed that returns in the days following corporate bond issues are low, which support the notion that excess returns over a period up to a month reflects the initially observed underpricing.

¹⁷In some previous studies, average daily returns have been computed to make up for the fact that daily price data is unavailable for some bonds. For instance, Helwege and Kleiman (1998) and Cai et al (2007) used an average of several days in order to increase sample size. However, we prefer to base the 1-day return on the price on day 1, the 2-day return on the price on day 2 and so on.

¹⁸While we note that underpricing remains when examining a period up to one week after issue we do note that underpricing is decreasing over time.

¹⁹Drawing upon results from the equity markets, Helwege and Kleiman (1998) argued that the effects of stabilization of equity IPOs in the first ten days and the price changes in the remainder of the month is only slightly below the initial return, which implies that 1-day returns could be similar to returns observed in periods as long as a month.

5.2 Comparable corporate bond indexes

The indexes are provided by Bank of America Merrill Lynch and separated in terms of rating class (investment grade vs. high yield). The investment grade indexes are further divided into maturity: 1-3 years, 3-5 years, 5-7 years, 7-10 years and +10 years. These index characteristics allow us to match the corporate bond issues in our sample closely to each respective index, thus enabling a good indication of the excess return. The corporate bonds included in the indexes are Euro-denominated and have at least 18 months to final maturity at issuance and at least 1 year remaining to final maturity. The indexes only include corporate bonds whose coupon schedules are fixed and have a minimum of EUR 250 million outstanding for investment grade bonds and 100 million for high yield bonds (we realize that these bonds are slightly larger than the ones in our sample but see no reason to believe that this will have a substantial effect on the results). The indexes track the performance of Euro-denominated corporate bonds issued in the Euro domestic or Eurobond markets.

Ideally, the corporate bonds in the sample would be matched to an index comprised only of issuers domiciled in Sweden. However, as no such relevant index exists²⁰ (to our knowledge) we believe that these indexes constitute the best available alternative and have no obvious reason to believe that the bonds in the indexes and our sample would have substantially different risk characteristics that would affect the price returns in separate ways. Furthermore, the indexes do not include financial institutions and therefore both the index and sample firm composition match. Moreover, the selected indexes have price data available dating back to 1996 for the investment grade indexes and 1998 for the high yield index, which offers significant consistency to our study as the indexes are calculated according to the same methodology and by the same financial institute.

²⁰An index comprising only investment grade corporate bonds issued in SEK exists from 2011 and onwards. This index would naturally be suitable for the investment grade bonds in our sample but as no corresponding high yield index exists (to our knowledge) we believe the above mentioned indexes are more suitable. Another methodology would be to create our own indexes consisting of corporate bonds that match those in our sample. However, this would require price data on all corporate bonds at all times throughout the study period - a requirement which cannot be met due to lack of reliable historical price data for matured bonds (please refer to our discussion on the availability of price data).

5.3 Price data source and collection methodology

We use price information from Bloomberg exclusively. Only using one source for price information might seem limited given that the corporate bond trading takes place OTC and no centralized price information exists. However, since actual transaction data is unavailable and investors primarily use Bloomberg for trading (also when corporate bonds are exchange-listed), we argue that this is by far the most relevant and reliable source for price information.

Previous studies have mainly used actual transaction data by relying on transaction information from the National Association of Insurance Commissioners, which is a database that includes purchases and sales of publicly traded US bonds by insurance companies since 1995. Such database is (to our knowledge) not available for the Swedish corporate bond market and therefore trader quotes represent the only available source for establishing price levels at which bonds trade²¹.

Studies conducted on corporate bond markets outside the US have also used trader quotes. For instance, Wasserfallen and Wydler (1988) used Swiss trader quotes and McKenzie and Takaoka (2009) used reference prices as provided by major Japanese financial institutions. However, a few studies on US corporate bonds have also used trader quotes (e.g. Fung and Rudd, 1986; Helwege and Kleiman, 1998).

Naturally, we do realize that trader quotes are inferior to actual transaction data and can only be seen as estimates of their true values. A specific problem with trader quotes is that they may not necessarily reflect true values as quotes do not represent actual commitments from financial institutions to trade but rather indicates the true values based on valuation models. Another problem is that the models that are used to produce trader quotes might not necessarily always be up-to-date and reflect the latest market information. Furthermore, another aspect that differs from actual transaction data is the informational value of trader quotes. As trader quotes do not take into account volumes, one could argue that the informational value is lower than if actual transaction data had been used.

Conversations with market practitioners indicate that there might be some level of price stabilization in the market by underwriters after a corporate bond has been issued, which could potentially influence the underpricing measure. However, by using a large sample of bonds and quotes from a combination of different

²¹Bonthron (2014) argued that trader quotes are the only trustworthy source of price information for Swedish corporate bonds, although it is primarily an indicator of the real price.

financial institutions, we believe that this will not bias our findings.

The method of obtaining price quotes from Bloomberg is rather complex and manual. Having obtained a list of relevant corporate bonds, we first check which financial institutions contribute price information to each corporate bond in the sample. The reason for doing so is that Bloomberg requires terminal-users to specify which price contributors that information should be retrieved from. In its data systems, Bloomberg has access to several thousand contributors and constructing a file that would retrieve price information for each price contributor would be too complex (confirmed by Bloomberg). Second, we construct a spreadsheet which lets us manually download price quotes (when available) for each relevant price contributor for each bond. In addition to the price quotes provided by the contributing financial institutions, we also retrieve price quotes based on Bloomberg’s proprietary pricing service when available. These price quotes are partly based on other available price quotes for the same bond and other information that Bloomberg finds relevant (e.g. historical correlations and yield curves). Both the price quotes provided by contributing financial institutions and Bloomberg’s proprietary pricing service²² are used in the study.

5.4 Overview of the dataset

Using Bloomberg, we retrieved lists comprising all active and matured bonds issued by firms domiciled and incorporated in Sweden since the mid-1900s. These lists cover all corporate bond offerings and include static information, such as announcement date, issue date, pricing date, maturity date, issue price, issue amount, issue currency, coupon rate, coupon type, credit ratings, Bloomberg ID, ISIN and CUSIP.

We apply several constraints when deriving our final sample of corporate bond issues. First, we restrict our sample to only include firms domiciled and incorporated in Sweden²³. Second, we restrict our sample to only include issues of corporate bonds that are currently active and outstanding as of February 4, 2015. Another method would be to include all bonds issued within a specific time period rather than those bonds that were active and outstanding at a specific date since this restriction could potentially lead to a biased sample selection. However, this restriction was necessary as the price data source used in this study did not reliably

²²Robustness tests indicate that inclusion of these quotes do not yield materially different results.

²³Swedish companies constitute c. 75% of the issues on the Swedish market (Bonthron, 2014).

provide historical price data for matured bonds²⁴. Given the lower level of reliability in the historical price data information on matured bonds, we believe that the most suitable way to undertake a study on corporate bonds in the Swedish context is by looking at active bonds, which offers a higher degree of reliability. However, it should be noted that unlike equities where a risk of survivorship bias exists, bonds mature naturally as a result of their structural composition and as Swedish corporate bonds default relatively seldom, we believe that the risk of survivorship bias in our sample is low. Third, similar to Hale and Santos (2006), we exclude financial firms, government-extensions and quasi-government firms as these firms typically have very different leverage and risk profiles compared to ordinary firms.

Following the restrictions above, our sample consists of 719 corporate bonds that are relevant for further examination. Out of these bonds, 84 bonds are missing price observations and are thus omitted from the sample (resulting in a dataset comprising 635 bonds). Announcement date and issue date are available for all bonds in the sample. However, pricing date is missing for 97 bonds. When a pricing date is available, the bond is assumed to be available for trading from this date and onwards (as it is from this date that price quotes exist generally). When a pricing date is unavailable, the bond is assumed to be available for trading from the issue date and onwards²⁵. When an issue price is available, this price is assumed to constitute the starting price. Of the remaining 635 bonds, 202 bonds do not have a readily available issue price. When an issue price is unavailable, the first price observation is assumed to constitute the starting price provided that the first price observation is obtained within five days of the pricing or issue date²⁶. This assumption reduces the dataset by an additional 38 bonds (resulting in a

²⁴Bloomberg does not provide terminal-users with price contributor information for matured bonds (unlike active bonds), which requires us to either (i) guess which financial institutions contributed trader quotes when the matured corporate bonds were active or (ii) download price quote data for all price contributors that Bloomberg has access to (several thousands). The first method is, in our opinion, not reliable enough, while the second is also not reliable enough as well as too complex. Furthermore, conversations with Bloomberg has indicated that some price contributors remove the price information they have provided historically when bonds mature, which makes price information on matured bonds less reliable.

²⁵In some cases we have noted that there are a few errors in the date information provided by Bloomberg, which we have adjusted manually. Furthermore, in certain cases we have noted that price observations exist prior to the pricing date and/or issue date. In such instances, it is assumed that trading began at this earlier observed date.

²⁶We realize that this assumption might produce lower estimates since underpricing for these bonds might not be captured by our estimation window. To test robustness of this assumption, we exclude issues without issue price and find that this assumption produces slightly lower estimates, although our findings remain largely robust.

dataset comprising 597 bonds).

We eliminated 22 bonds with non-standard characteristics (e.g. 144A bonds²⁷ and perpetual maturity) and 10 bonds that were believed to have faulty price observations. This provides us with a final sample of 565 bonds. However, it should be noted there are not as many excess return observations as there are bonds in the sample since 1-day returns, 2-day returns and onwards cannot always be calculated for all bonds – for instance, of the full sample, only 457 bonds have price data which allows us to calculate 1-day excess returns.

A detailed summary of the final sample is provided in Table 1. The oldest bond included in the sample was issued in June 2003 and the most recent was issued in February 2015, although the majority of bonds have been issued in the most recent years (Table B12). The smallest bond issue amounts to EUR 8 million and the largest to EUR 1,135 million, where the majority of bonds are less than EUR 100 million (c. 67%), although bonds issued by public firms and seasoned bonds are slightly larger. The shortest bond maturity is 1 year while the longest is 63 years, where the distribution of maturities in the sample is skewed towards short and medium maturities. Interestingly, seasoned issues and issues by public firms tend to be more long-term than first-time issues and issues by private firms.

Rated bonds included in the sample vary between AA–/Aa3 to CCC–/Caa3, where the distribution is skewed towards investment grade bonds (c. 55%), although a significant portion are unrated (c. 38%). We note that first-time issues tend to be unrated while seasoned issues tend to be investment grade.

There are slightly more issues by firms with publicly traded equity compared to issues by private firms (58% vs. 42%). This relation holds for seasoned issuers (62% vs. 38%), although for first-time issuers it is reversed (31% vs. 69%).

The number of issues by seasoned issuers clearly outweigh the number of issues by first-time issuers (86% vs. 14%). A majority of the bond issues are subsequently listed post-issue whereas a small amount of issues remain unlisted (91% vs. 9%).

Interestingly, almost all seasoned issuers in the sample (c. 91%) have been preceded by another bond offering within the last two years before the bond issue. This suggests that some of the seasoned issues might be bonds that have been issued under a program, such as an MTN program (firms that frequently tap the debt markets often set up bond programs, which is a framework that stipulates standardized terms and conditions as well as maximum outstanding issue amount

²⁷144A bonds are excluded as those can only be marketed to/purchased by certain US investors.

Table 1: Summary statistics.

	Number	Percent
All corporate bonds	565	100.0
Firm status		
<i>Private firms</i>	239	42.3
<i>Public firms</i>	326	57.7
Issuer status		
<i>First-time issuer</i>	78	13.8
<i>Seasoned issuer</i>	487	86.2
Listing status of corporate bond		
<i>Listed</i>	516	91.3
<i>Unlisted</i>	49	8.7
Rating		
<i>Investment grade</i>	312	55.2
<i>High yield</i>	39	6.9
<i>Unrated</i>	214	37.9
Issue size		
<i>Less than EUR 100 million</i>	377	66.7
<i>EUR 100-250 million</i>	105	18.6
<i>More than EUR 250 million</i>	83	14.7
Maturity		
<i>Short (less than 5 years)</i>	214	37.9
<i>Medium (5-10 years)</i>	274	48.5
<i>Long (more than 10 years)</i>	77	13.6
Bond issue activity		
<i>Issued another bond within last 2 years</i>	444	78.6
Equity issue activity		
<i>Offered equity within the last 2 years</i>	63	11.2
Number of years since first bond issue		
<i><5 years of issue activity</i>	163	28.8
<i>5-10 years of issue activity</i>	45	8.0
<i>>10 years of issue activity</i>	279	49.4

The table displays the the full bond issue sample, split by relevant metrics. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

through which bonds can be issued continuously and more quickly to the market).

In addition, c. 11% of the bond issues in the sample have been preceded by equity market activity within the last two years before bond issue. Furthermore, in more than half of the seasoned issues the issuer has been active in the bond market for more than 10 years.

In order to match the corporate bonds in the sample to its relevant index, we categorize the bonds as investment grade or high yield. When doing so the highest

of the available credit ratings at the time of the issue for each bond has been used. Thus, if S&P rates a bond "BBB—" (investment grade) but Moody's rates the same bond as "Ba1" (high yield), the bond will be categorized as investment grade in our study. When credit ratings from the time of the issue are unavailable, the current bond rating is used as a proxy. When current bond ratings are unavailable, the issuer's current credit rating is used as a proxy²⁸. All bonds are matched to their rating-equivalent index although bonds that have no rating whatsoever are matched against the high yield index (an approach similar to Goldstein and Hotchkiss, 2007).

From Bloomberg, lists comprising all publicly traded equity instruments issued by firms domiciled and incorporated in Sweden were retrieved. The lists contain all primary and secondary tickers, regardless of their current status (e.g. active, delisted and acquired) as well as the date the instrument was first offered to the public (these dates were also manually verified using secondary sources). The lists were then matched to our sample of corporate bonds to establish which bonds had public equity outstanding at the time of the bond issue.

In order to determine whether a bond issue in our sample is a first-time or seasoned offering, each corporate bond issue in the sample was matched against the list comprising all active and matured bonds issued by firms domiciled and incorporated in Sweden since the mid-1900s. Only the first bond issued by each firm is classified as a first-time offering while the following bonds are considered seasoned offerings²⁹.

5.5 Explanatory variables

To test our hypotheses that underpricing is related to information problems, we create three indicator variables: (i) one variable that takes the value of one for firms that are first-time issuers, (ii) one variable that takes the value of one for firms that are private at the time of issuing a bond and (iii) one interaction variable

²⁸One corporate issuer without credit ratings has manually been categorized as investment grade on the basis of NASDAQ and SEB which classify the firm as investment grade.

²⁹This matching does not take into account potential acquisitions or spin-offs. Also, this approach does not take into account the domicile and incorporation history of issuers and subsequently disregards if an issuer has issued bonds while domiciled and incorporated in another country. Moreover, the lists obtained from Bloomberg only takes into account where the issuing entity is located. For instance, consider a Dutch firm that has previously issued a corporate bond in the Dutch market who decides to establish a subsidiary that is domiciled and incorporated in Sweden. If that subsidiary undertakes a bond issue then that issue will be considered a first time issue regardless of the parent company status.

between the former two.

To test our hypothesis that underpricing is related to the winner's curse theory, we create an indicator variable that takes the value of one if the corporate bonds is listed on an exchange.

To test our hypothesis that underpricing is related to the information acquisition theory, we create two indicator variables: (i) one variable that takes the value of one for firms that have issued another bond within the previous two years and (ii) one variable that takes the value of one for firms that have completed any type of equity offering within the previous two years (thus this variable accounts for both IPO and follow-on offerings).

To test our hypothesis that underpricing is related to the asymmetric information theory, we create one variable that takes the number of years a firm has been issuing since its first bond offering as its value³⁰.

5.6 Control variables

To control for factors that could have an influence on the explanatory variables we also include variables related to issue size, maturity and credit rating³¹. The issue size might matter because a large offering may be underpriced less on a percentage basis compared to a smaller offering since a large offering would mean that a great sum in absolute terms is "left on the table". Also, a larger issue could perhaps be followed more closely and by a greater number of research analysts and investors, which might reduce information problems and subsequently underpricing. On the other hand, one could also argue that a smaller issue is easier to market to investors whereas a larger issue might require more underpricing to attract a sufficient number of investors so that the issue becomes fully subscribed. Moreover, within the sample it seems like issue sizes differ for issuer and firm status, which suggests that issue size should be controlled for. Thus, we create one indicator variable that takes the value of one for corporate bond issues that are smaller

³⁰Similar to Cai et al (2007), we could also have included a variable that takes the squared value of the number of years a firm has been issuing in order to capture the concave relationship as firms with decades of issuance history are unlikely to have much more reputation than one that has issued for 10 years. However, statistical analysis indicates that the two variables would be highly collinear and therefore make the regressions subject to multicollinearity.

³¹Statistical omitted variable bias tests indicate that there is no omitted variable bias when we control for issue size, maturity and ratings class. These variables also correspond to those used by Cai et al (2007).

than the median (EUR 59.6 million) of the sample³².

Furthermore, the maturity might also matter because different maturities could potentially be more attractive to different investor groups and therefore generate different interest and price movements before and after the issue. Moreover, within the sample it seems like maturity differs for issuer and firm status, which suggests that maturity should also be controlled for. Therefore, we create indicator variables and split the maturities into three brackets; less than 5 years, 5-10 years and more than 10 years³³.

Also, the ratings class could be important since the ratings class of a bond (investment grade vs. high yield) will likely attract different investor groups and, similar to maturities and issue currencies, therefore generate different interest and price movements before and after the issue. As pointed out by Datta et al (1997), investment grade and high yield bonds differ in terms of marketing to investors and one could argue that riskier bonds might have more information problems as there is little value of additional information for bonds that are completely safe. Moreover, conversations with market practitioners indicate that even though a corporate bond is unrated, investors generally have an opinion regarding which ratings class such bond belongs to (for instance, one of the major Swedish bond issuers is generally considered investment grade although the firm's bonds are all unrated). As almost 40% of the bonds in our sample are unrated, we realize that the large portion of unrated bonds could potentially make controlling for ratings class less exact as these unrated bonds are not be captured by such control variable³⁴. Hence, we report regression results both with and without controls for ratings class.

However, other issuer and bond characteristics could also be relevant. For instance, issue currency could matter as some issue currencies are potentially more attractive to different investor groups and consequently therefore generate different interest and price movements before and after the issue. However, statistical analysis reveals that controlling for the issue currency does not yield substantially different results (likely due to the high concentration of SEK-denominated bonds

³²We also create several different indicator variables based on different ranges of issue sizes (e.g. EUR 0-100 million, 100-200 million and so on) and find that the method of splitting the issue sizes does not yield substantially different results.

³³We also try different splits (e.g. 0-3 years, 3-7 years and so on) and find that the method of splitting the maturity does not yield substantially different results.

³⁴The proportion of unrated corporate bonds has increased in recent years, where c. 21% of newly issued bonds in 2011 were unrated while the corresponding figure was c. 53% in 2014 (Bonthron, 2014).

in the sample).

The liquidity of a corporate bond after the issue could also be an important control variable. In the current setup, the observed underpricing is completely unaffected by the trading volumes post-offering and price quotes can therefore affect the results even though no trading actually occurred. Unfortunately, the liquidity of the bonds cannot be assessed as this information is not available in the Swedish market. However, an earlier study (Cai et al, 2007) found that underpricing was unrelated to liquidity.

As earlier mentioned, it is likely that many of the seasoned bond issues in the sample have been issued under a bond program and it would indeed be interesting to control for whether bonds are issued under such programs or not. However, we do not have information on which bonds that have been issued under such programs and cannot control for this (although the issue size and maturity controls should capture these bonds as they tend to be smaller and of shorter maturity). Nevertheless, when Cai et al (2007) exclude MTNs in their multivariate regressions their results do not become substantially different.

6 Empirical Results and Discussion

We present empirical results together with discussion for our hypotheses using both univariate and multivariate analyses. The univariate analyses provide indicative results and highlights relationships, while the multivariate analyses provide us with an understanding of these relationships and links. Together, these analyses not only provide us with a greater understanding but also let us test a broader set of hypotheses. The univariate and multivariate analyses evaluate hypotheses I–IV and hypotheses II–VI, respectively. Empirically, we are able to confirm hypothesis I, II and V in the univariate analysis and hypothesis II and V in the multivariate analysis. The dependent variables (1-day excess returns) have been winsorized by 2% to disregard outliers³⁵. In the univariate analyses in Table 3 and 4, we also perform two-sample t-tests to test if the mean 1-day excess returns within different subsamples are statistically different from each other. The multivariate analysis relies on linear OLS regressions³⁶ corrected for heteroscedasticity using Huber-White sandwich estimators (robust), which has also been applied in

³⁵Robustness tests indicate that our main findings are largely robust also without winsorizing.

³⁶Graphical analysis has been used to verify that regressions residuals are approximately normally distributed.

previous studies (e.g. Wasserfallen and Wydler, 1988; Cai et al, 2007)³⁷.

6.1 Univariate analysis

Univariate analysis in Table 2 indicates that our sample is on average underpriced by c. 0.21%. Irrespective of which subsample we investigate, the corporate bonds are on average consistently underpriced with statistical significance and thus confirm the first hypothesis. Hence, we confirm earlier findings by Wasserfallen and Wydler (1988), Datta et al (1997), Helwege and Kleiman (1998), Welch (2000) and Cai et al (2007).

As anticipated by the second hypothesis, the univariate analysis indicates that underpricing in first-time issues is more than twice as high as in seasoned issues (0.45% vs. 0.17%), which is a similar pattern found by Cai et al (2007). Moreover, when we split the underpricing analysis by issuer status (Table 3), we note that this difference in underpricing is statistically significant and that underpricing is larger for first-time issues across almost all subsamples and that several differences across subsamples are statistically significant. This pattern suggests that the issuer status is an important explanation of the level of underpricing. Interestingly, underpricing for private firms differs significantly for first-time and seasoned issues, where private first-time issues experience almost five times as much underpricing than private seasoned issues (0.53% vs. 0.11%). This significant difference is most likely because first-time issues by private firms represents the first offering ever made to the public and consequently represents a situation where information problems are likely to be significant. On a similar note, as many of the seasoned issuers are also active issuers and have issued another bond within the last two years, underpricing need not be as high because information problems have been mitigated through previous issues. These initial findings suggest that underpricing is related to information problems and confirm the second hypothesis.

Next, the univariate analysis suggests that public firms have slightly more underpricing than private firms (0.22% vs. 0.20%), which contradicts our a priori expectations and in particular the third hypothesis. Even though the level of underpricing for public and private firms is very similar, both results are statistically significant. However, when we split the underpricing analysis by firm status (Table 4), we note that differences in underpricing between private and public firms

³⁷The Breusch-Pagan (1979) test and the more general White (1980) test indicated a certain level of heteroscedasticity in the dataset.

Table 2: Univariate analysis of underpricing as measured by 1-day excess returns.

	1-day excess return		
	Mean	t-Stat	Obs.
All corporate bonds	0.212***	7.42	457
Firm status			
<i>Private firms</i>	0.204***	4.44	198
<i>Public firms</i>	0.218***	6.02	259
Issuer status			
<i>First-time issuer</i>	0.451***	5.37	65
<i>Seasoned issuer</i>	0.172***	5.78	392
Listing status of corporate bond			
<i>Listed</i>	0.219***	7.34	426
<i>Unlisted</i>	0.119	1.23	31
Rating			
<i>Investment grade</i>	0.149***	4.06	253
<i>High yield</i>	0.619***	4.05	35
<i>Unrated</i>	0.222***	5.31	169
Issue size			
<i>Less than EUR 100 million</i>	0.161***	5.16	289
<i>EUR 100-250 million</i>	0.206***	2.89	86
<i>More than EUR 250 million</i>	0.398***	4.68	82
Maturity			
<i>Short (less than 5 years)</i>	0.095***	2.87	185
<i>Medium (5-10 years)</i>	0.265***	6.06	214
<i>Long (more than 10 years)</i>	0.390***	3.52	58
Bond issue activity			
<i>Issued another bond within last 2 years</i>	0.146***	4.94	359
Equity issue activity			
<i>Offered equity within the last 2 years</i>	0.470***	4.14	49
Number of years since first bond issue			
<i><5 years of issue activity</i>	0.156***	3.19	131
<i>5-10 years of issue activity</i>	0.114*	1.92	36
<i>>10 years of issue activity</i>	0.191***	4.50	225

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns are winsorized by 2% and expressed in %. ***/**/* denotes statistical significance at 1%/5%/10%. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

are not statistically significant across most subsamples. This could indicate that firm status has a lower explanatory effect of underpricing and that firm status is potentially less related to information problems, which suggests that information problems might not necessarily be larger in issues by private firms compared to

Table 3: Univariate analysis of underpricing as measured by 1-day excess returns, split by issuer status.

	1-day excess return						
	First-time issuers			Seasoned issuers			Mean diff.
	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.	t-Stat
All corporate bonds	0.451***	5.37	65	0.172***	5.78	392	3.45
Firm status							
<i>Private firms</i>	0.527***	4.73	46	0.106**	2.27	152	4.03
<i>Public firms</i>	0.267***	2.94	19	0.215***	5.57	240	0.38
Listing status of corp. bond							
<i>Listed</i>	0.475***	5.59	63	0.174***	5.59	363	3.63
<i>Unlisted</i>	-0.391		2	0.148	1.46	29	N.a.
Rating							
<i>Investment grade</i>	0.431	1.50	9	0.139***	3.80	244	1.48
<i>High yield</i>	0.500	1.21	6	0.644***	3.86	29	-0.35
<i>Unrated</i>	0.449***	5.20	50	0.127***	2.86	119	3.65
Issue size							
<i>Less than EUR 100 million</i>	0.476***	4.92	46	0.101***	3.27	243	4.54
<i>EUR 100-250 million</i>	0.164	1.80	9	0.211***	2.67	77	-0.20
<i>More than EUR 250 million</i>	0.595*	1.95	10	0.371***	4.24	72	0.86
Maturity							
<i>Short (less than 5 years)</i>	0.492***	4.41	26	0.030	0.96	159	5.19
<i>Medium (5-10 years)</i>	0.424***	3.54	39	0.230***	4.98	175	1.72
<i>Long (more than 10 years)</i>	N.a.		0	0.390***	3.52	58	0.00
Bond issue activity							
<i>Issued bond w/i last 2 years</i>	N.a.		0	0.146***	4.94	359	N.a.
Equity issue activity							
<i>Offered equity w/i last 2 years</i>	0.311**	2.45	7	0.496***	3.80	42	-0.57
No. of years since first issue							
<i><5 years of issue activity</i>	N.a.		0	0.156***	3.19	131	N.a.
<i>5-10 years of issue activity</i>	N.a.		0	0.114*	1.92	36	N.a.
<i>>10 years of issue activity</i>	N.a.		0	0.191***	4.50	225	N.a.

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns are winsorized by 2% and expressed in %. Difference in mean are based on two-sample t-tests. ***/**/* denotes statistical significance at 1%/5%/10%. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

public firms in the Swedish corporate bond market. This notion is consistent with Helwege and Kleiman (1998) who found that underpricing was lower for private firms and argued that firm status could potentially be somewhat less related to information problems. A possible explanation of our finding could be that the level of financial information available to investors is fairly similar irrespective of whether a firm is private or public, which could be reasonable to assume considering that accounts are to a great extent public in Sweden. On the other hand, one could also argue that the observed results might be due to the fact that sufficient information is provided through issue prospectuses or that underwriters "educate" investors

Table 4: Univariate analysis of underpricing as measured by 1-day excess returns, split by firm status.

	1-day excess return						
	Private firms			Public firms			Mean diff.
	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.	t-Stat
All corporate bonds	0.204***	4.44	198	0.218***	6.02	259	-0.25
Issuer status							
<i>First-time issuer</i>	0.527***	4.73	46	0.267***	2.94	19	1.42
<i>Seasoned issuer</i>	0.106**	2.27	152	0.215***	5.57	240	-1.78
Listing status of corp. bond							
<i>Listed</i>	0.221***	4.32	174	0.217***	6.02	252	0.07
<i>Unlisted</i>	0.076	1.10	24	0.266	0.71	7	-0.82
Rating							
<i>Investment grade</i>	0.015	0.35	115	0.261***	4.69	138	-3.40
<i>High yield</i>	0.795***	4.00	22	0.322	1.44	13	1.52
<i>Unrated</i>	0.346***	4.02	61	0.152***	3.56	108	2.26
Issue size							
<i>Less than EUR 100 million</i>	0.135***	2.92	138	0.184***	4.36	151	-0.78
<i>EUR 100-250 million</i>	0.155	1.60	31	0.235**	2.40	55	-0.54
<i>More than EUR 250 million</i>	0.581***	3.13	29	0.298***	3.62	53	1.60
Maturity							
<i>Short (less than 5 years)</i>	0.102*	1.88	91	0.087**	2.27	94	0.22
<i>Medium (5-10 years)</i>	0.296***	4.15	95	0.241***	4.42	119	0.62
<i>Long (more than 10 years)</i>	0.245	0.85	12	0.428***	3.58	46	-0.67
Bond issue activity							
<i>Issued bond w/i last 2 years</i>	0.078*	1.68	146	0.193***	5.05	213	-1.91
Equity issue activity							
<i>Offered equity w/i last 2 years</i>	N.a.		0	0.470***	4.14	49	N.a.
No. of years since first issue							
<i><5 years of issue activity</i>	0.193***	2.77	79	0.1	1.58	52	0.93
<i>5-10 years of issue activity</i>	0.116	1.09	13	0.112	1.55	23	0.03
<i>>10 years of issue activity</i>	-0.011	(0.16)	60	0.265***	5.19	165	-2.92

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns are winsorized by 2% and expressed in %. Difference in mean are based on two-sample t-tests. ***/**/* denotes statistical significance at 1%/5%/10%. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

sufficiently so that information problems are mitigated. However, robustness tests indicate that outliers might affect the results for the observed underpricing for the firm status variable, which makes interpretation of these results less interesting, and consequently, we cannot confirm the third hypothesis.

In addition, while the univariate analysis in Table 2 suggests that bonds that are listed on an exchange experience higher underpricing than those that are not (0.22% vs. 0.12%), the estimate for unlisted bonds is insignificant (likely due to the smaller sample of unlisted bonds). Splitting the analysis into issuer status (Table 3), we also note that underpricing for listed bond issues by first-time issuers is

significantly higher than those by seasoned issuers, although this observed difference is likely because those bonds are first-time issues rather than seasoned issues. While these findings are in line with our fourth hypothesis we cannot statistically confirm the notion that issues which target a higher degree of uninformed investors are subject to larger underpricing as expected by the winner's curse theory.

Moreover, Table 2 suggests that underpricing is related to credit ratings, where high yield issues seem to experience significantly higher underpricing than investment grade offerings (almost four times as much underpricing). This relation also holds when splitting the analysis by issuer and firm status (Table 3 and 4). These results are in line with findings by Welch (2000) and Cai et al (2007) but partially contrasts findings by Datta et al (1997).

Further analyzing Table 2, we also note that underpricing is positively related to the issue size, where the larger the issue size the larger is the underpricing. This pattern also holds when splitting the underpricing analysis by firm status (Table 4). However, for first-time issues, underpricing displays a puzzling pattern (Table 3), although this is most likely due to a lack of medium-sized issues in the sample.

Similarly, underpricing is positively related to maturity, where the longer the maturity the larger is the underpricing. For first-time issues, a pattern similar to the one observed for issue size can be seen for maturity (Table 3), where underpricing for first-time issues displays an opposite pattern than for the sample as a whole, although this is likely due to the lack of long-term issues in the sample.

Table 2 also suggests that issues that have been preceded by another bond issue within the last two years experience lower underpricing than what is observed on average. In such issues, one can reasonably assume that underwriters already have a good view on the investor demand through recent bond issues and therefore do not need to use underpricing to extract information from investors. This finding is consequently consistent with our expectation that underpricing is an economic motivation to investors to truthfully reveal their demand. However, a possible explanation for the lower underpricing for these bonds could be that many of these have been issued under a standardized bond issue program³⁸. Also, what contributes to the lower observed underpricing could also be that many firms probably use the same underwriters when undertaking frequent issues who then

³⁸This is supported by results presented by Cai et al (2007) who found that underpricing for MTN bonds was significantly lower than for non-MTN bonds.

develop substantial insight into the investor demand by having already undertaken bond issues with that same firm. In contrast, issues that have been preceded by some sort of equity offering within the last two years seem to experience underpricing that is higher than on average. This contradicts our a priori expectations and suggests that it would be more costly for firms to undertake bond issues when such are preceded by equity market activity. In light of the information acquisition theory, these results would suggest that underwriters do not gain ample knowledge on the investor demand for bond issues through equity offering processes. Admittedly, one could likely argue that bond and equity offerings are quite different events, which suggests that information on the investor demand might not be transferable across these types of offerings, where a possible justification for this is that bonds and equities issued by a firm are not necessarily held by the same investors. However, explaining why underpricing is higher for issues that follow recent equity market activity poses slight of a challenge. An imagineable explanation could be that bond investors in such situations expect a larger underpricing than what is usually offered because an underpricing was recently offered to the equity investors in the firm. However, splitting the analysis by issue status (Table 3) displays a puzzling relation, which indicates that the higher underpricing comes from seasoned rather first-time issues. We can think of no rational explanation for this unexpected result and realize that this might be affected by outliers (as is suggested by robustness tests) as a result of the small sample of issues that follow recent equity market activity, which makes interpretation of these results less accurate. While these findings are mixed, based on the findings for recent bond market activity, we argue that underpricing can be explained by the information acquisition theory and thus supports our fifth hypothesis.

Table 2 also suggests that underpricing is unrelated to the number of years a firm has been issuing bonds in the market since the observed underpricing is relatively similar irrespective of number of years. Our a priori expectation was that firms with a long history would be characterized by fewer asymmetric information problems and thus the observed underpricing should be lower. However, our results do not support this idea. This could either suggest that underpricing does not solve asymmetric information or simply that the number of years that a firm has been active in the market is a poor proxy for asymmetric information, which is a more likely explanation. Hence, the sixth hypothesis cannot be confirmed.

6.2 Multivariate analysis

The multivariate analysis in Table 5 tests how issuer and firm status relate to underpricing. Similar to results posted in the univariate analysis, first-time issues are subject to more underpricing than seasoned issues, although this relation is only statistically significant in model (1) and (3) when there are no or few other explanatory variables. Interestingly, statistical significance and coefficient size for the issuer status variable are remarkably reduced when introducing the interaction variable in model (4), which is because the issuer status variable only captures the effect of public first-time issuers when the interaction variable is included rather than both private and public first-time issuers. Furthermore, the interaction variable displays with statistical significance that first-time issuers who are private experience more underpricing, which is robust when controlling for issue size, maturity and ratings class. Thus, these results present additional evidence that underpricing is related to information problems (and consequently our second hypothesis) and confirm previous findings by Hale and Santos (2006) and Cai et al (2007).

As previously argued, firm status could have a lower explanatory effect of underpricing. This notion is supported by the poor statistical significance of the firm status variable in model (2) and (3). On the other hand, when we introduce the interaction variable in model (4), the firm status variable indeed becomes statistically significant, although this significance disappears when including control variables. However, one should keep in mind that the meaning of the firm status variable changes from covering all private firms to only covering private seasoned issues when the interaction variable is included in model. Hence, the firm status variable in model (4) captures the effect of seasoned issues by private firms and indicates that for such firms underpricing is substantially lower, which corresponds to the results in the univariate analysis in Table 2 where it is apparent that such firms have lower underpricing. Based on these findings, we argue that underpricing seems more related to the issuer status rather than whether the firm is private or public. Subsequently, we cannot confirm our third hypothesis, contrary to findings by Cai et al (2007).

While the bond listing coefficient in Table 6 (and A9) is slightly positive in model (1) and consequently in line with our fourth hypothesis, it is both statistically insignificant and negligible in size. We therefore present additional evidence that the fourth hypothesis cannot be confirmed. However, as mentioned, we do re-

Table 5: Multivariate analysis of underpricing as measured by 1-day excess returns.

Model specification	(1)	(2)	(3)	(4)	(5)	(6)
First-time issuer	0.279*** (0.089)		0.299*** (0.089)	0.052 (0.097)	0.119 (0.105)	0.077 (0.116)
Private at issue		-0.015 (0.058)	-0.062 (0.056)	-0.109* (0.061)	-0.059 (0.064)	-0.088 (0.065)
First-time * Private				0.369** (0.154)	0.288* (0.167)	0.325* (0.170)
Short maturity					-0.141** (0.056)	-0.118** (0.054)
Long maturity					0.159 (0.121)	0.183 (0.121)
Small issue					-0.065 (0.062)	-0.017 (0.059)
Investment grade						-0.042 (0.060)
High yield						0.376** (0.166)
Constant	0.172*** (0.030)	0.218*** (0.036)	0.196*** (0.038)	0.215*** (0.039)	0.258*** (0.053)	0.234*** (0.057)
Observations	457	457	457	457	457	457
R-squared	0.025	0.000	0.028	0.037	0.069	0.099

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

alize that this proxy is arguably weak as investor bases across Swedish corporate bonds are largely similar irrespective of whether a bond is listed or not, which makes us unable to fully investigate the notion that underpricing solves asymmetric information between informed and uninformed investors as explained by the winner's curse theory. Realizing that some recently issued bonds in our sample might not have had the time to become listed yet, we also run the regressions where we exclude bonds issued within the last six months and find that the results do not differ substantially. Nonetheless, in line with results by Cai et al (2007) but in contrast to findings based on ownership rationing by Welch (2000), we find

no support for the winner's curse theory.

In Table 6 (and A10) we also include separate variables for whether an issue has been preceded by other bond or equity market activity within the last two years and note that results for these variables are both statistically significant and robust when controlling for issue size, maturity and ratings class. As expected based on evidence in the univariate analysis, bonds that follow recent bond market activity experience lower underpricing than on average while, puzzlingly, bonds that follow recent equity market activity experience more underpricing. Interestingly, Cai et al (2007) also found a positive (albeit smaller) coefficient for their equity market variable, which they argued was because these firms could be considered similar to private firms in terms of information asymmetries since they were private up until recently. Based on results for recent bond market activity, we therefore provide additional evidence that underpricing is used to extract information from investors and functions as an economic motivation to investors to truthfully reveal their demand as explained by the information acquisition theory, thereby further supporting our fifth hypothesis. Consequently, we present evidence that support the findings by Cai et al (2007). Interestingly, we note that the coefficient for the issuer status variable is drastically reduced (even negative) when bond and equity market activity variables are included, where inclusion of the bond market variable seems to have the largest confounding effect on the issuer status variable. This is most probably because a majority of the seasoned bonds instead are explained by that particular variable rather than the issuer status variable.

Table 6 (and A11) suggests that the number of years that a firm has been active in the market has no significant relation to underpricing since the coefficient is not only statistically insignificant but also negligible in size. Similar to the univariate analysis, we can either conclude that underpricing does not solve asymmetric information or, more likely, that the number of years a firm has been active in the market is a poor proxy for asymmetric information as it is not obvious that firms with a long history have fewer asymmetric information problems between investors and managers. This is contrary to Cai et al (2007) who used a similar proxy and found with statistical significance that underpricing was inversely related to years in the market, which suggests years in the market and asymmetric information might not be related in the Swedish corporate bond market. Thus, realizing that our proxy might be weak we are unable to fully investigate the relation between asymmetric information and underpricing and provide additional evidence

Table 6: Multivariate analysis of underpricing as measured by 1-day excess returns.

Model specification	(1)	(2)	(3)
First-time issuer	-0.228 (0.176)	-0.202 (0.179)	-0.159 (0.181)
Private at issue	-0.004 (0.066)	0.015 (0.066)	-0.008 (0.078)
First-time * Private	0.386** (0.163)	0.325* (0.172)	0.362** (0.177)
Listed bond	0.009 (0.106)	-0.003 (0.108)	-0.028 (0.111)
Another bond issued within last 2 years	-0.300** (0.140)	-0.293** (0.139)	-0.226* (0.134)
Equity issued within last 2 years	0.329*** (0.124)	0.309*** (0.117)	0.323*** (0.115)
Years since first bond issue	0.004 (0.004)	0.000 (0.004)	0.002 (0.005)
Short maturity		-0.149*** (0.056)	-0.128** (0.054)
Long maturity		0.119 (0.113)	0.127 (0.112)
Small issue		-0.070 (0.060)	-0.021 (0.057)
Investment grade			-0.033 (0.081)
High yield			0.361** (0.166)
Constant	0.365** (0.178)	0.477*** (0.183)	0.385** (0.184)
Observations	457	457	457
R-squared	0.077	0.105	0.130

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

that the sixth hypothesis cannot be confirmed. Consequently, in contrast to Hale and Santos (2006) and Cai et al (2007) we find no support for the asymmetric information theory.

6.3 Robustness tests

The dependent variables have been winsorized by 2%. Hence, we also present univariate and multivariate results in Table B13 and B14 using non-winsorized data. The analyses suggest our findings are largely robust, nevertheless, we do note a few differences. In the univariate analysis, firm status displays the reversed results, where private firms seem to underprice slightly more than public firms, which contrasts our findings in Table 2. While this is in line with our a priori expectations, these contrasting results suggest that findings for the firm status variable are sensitive to winsorizing and that the results might either be affected by outliers or that firm status has lower explanatory effect on underpricing. Moreover, underpricing for issues that follow recent equity activity is even higher, which suggests that there may be outliers that affect the observed results for this variable and that the underlying sample might be slightly skewed due to the smaller number of firms fulfilling this requirement. The multivariate analysis indicates that the variable that considers recent bond market activity loses statistical significance, which suggests that this variable is sensitive to winsorizing.

The price quotes used in the study relies both on those by contributing financial institutions and Bloomberg’s proprietary pricing service. Univariate and multivariate analysis where quotes provided by Bloomberg’s pricing service have been disregarded are reported in Table B13 and B15. The univariate analysis suggests a relatively similar underpricing pattern as in Table 2 (albeit slightly lower for the sample as a whole) and suggests that inclusion of the price quotes do not yield substantially different results. However, we note that firm status displays the reversed relationship, where private firms underprice more than public firms, which contrasts previous findings. As with non-winsorized data, this findings provide further evidence that results for firm status might either be affected by outliers or that the variable has a lower explanatory effect. Interestingly, we note that underpricing for issues that follow recent equity activity is significantly lower (almost halved), which further supports our belief that outliers might affect results for this variable and that the underlying sample might be skewed due to the smaller sample of firms fulfilling this requirement. However, multivariate

analysis suggests that the bond listing variable is statistically significant, although this significance disappears when using controls.

Furthermore, we use the first trading observation as a proxy for the issue price when issue prices are unavailable. Regressions where bond issues without issue prices have been excluded are presented in Table B13 and B16 and suggest our findings are relatively robust. Univariate analysis suggests higher underpricing for the sample as whole but displays a relatively similar pattern as previously observed. Also, as with non-winsorized data, the univariate analysis suggests that private firms underprice more than public firms, further supporting our belief that firm status might either be affected by outliers or have lower explanatory effect as the observed effect seems to fluctuate depending on how the dataset is split. Multivariate analysis indicates that the variable that considers recent equity market activity loses statistical significance (likely caused by the smaller sample size) and that the bond listing variable becomes statistically significant regardless of controls (also likely caused by the smaller sample size).

We also conduct univariate (Table B17) and multivariate analysis (not reported) on excess returns for longer periods to test other combinations of bond issues in the sample (return variables were unavailable for some bonds on certain days due to lack of trader quotes). We notice that underpricing remains in the days following the issue (albeit slightly decreasing over time) and that our findings are robust when using a longer study period. However, as with non-winsorized data, the univariate analysis provides further evidence that firm status might either be affected by outliers or that the variable has a lower explanatory effect.

Similar to Wasserfallen and Wydler (1988), we report underpricing split by issue year (Table B18) and notice that statistical significance for underpricing can only be achieved during 2011 to 2014. In light of this, we re-run our regressions using year-controls and find that the results do not change materially (Table B19).

Similar to Glushkov et al (2014), we report underpricing split by sectors (Table B18). As a result of this, we also run our regressions using sector-controls and note that the results do not change substantially (Table B19).

Since error terms may be correlated within issuers we also report multivariate regressions using clustered (by issuer) standard errors in Table B20 and find that our main findings are robust and (depending on which control variables are being used) remain statistically significant.

Acknowledging the risk of unobservable fixed effects, we realize that issuer

fixed effects regressions that control for immeasurable issuer-specific characteristics could be interesting to employ. But, in order to achieve statistically viable results in fixed effects regressions, one would need repeated observations for issuers and a reasonable amount of variation within each issuer. As our sample includes 59 firms with only one observation, 52 firms with two observations and 45 firms with three observations, we argue that a fixed effects regression setup is not appropriate.

Furthermore, we perform VIF tests to test statistically for multicollinearity among the explanatory and control variables. The tolerance values are reported in Table B21 and suggest low multicollinearity (also supported by the correlation matrix reported in Table B22).

7 Limitations and Future Research

We acknowledge that our study may be subject to limitations on which future research could elaborate. For instance, the use of trader quotes rather than actual transaction data could produce biased estimates since these do not represent actual trades. Another shortcoming of our pricing source is that we could only reliably include active bonds, which reduced sample size and consequently made statistical significance more difficult to achieve as well as increased the risk of biased estimates. Thus, the ongoing transparency initiatives in the Swedish corporate bond market should allow for an interesting opportunity to undertake a similar study in future years to confirm and expand our findings using trading data on prices and volumes for bonds within a specific time period rather as of a specific date.

Naturally, our findings have implications for several stakeholders, such as issuers, underwriters and investors, where a natural expansion of this study would be to analyze how investors might benefit from underpricing and propose an investment strategy. Further analysis into the underpricing pattern of frequent issuers and bonds that are issued under programs could provide more evidence on how the information acquisition theory relates to underpricing. Also, examination of how issuers can take advantage of the fact that subsequent bonds could be subject to lower underpricing (as suggested by our results) could also prove interesting in terms of achieving an optimal capital structure.

Underpricing is presumably also affected by factors other than we have included in this study. For instance, as the Swedish corporate bond market is somewhat

confined to a smaller number of stakeholders, an explorative study on the informal channels (such as network effects and relationships) between participating actors (e.g. investors, issuers, underwriters) could be valuable in explaining underpricing in addition to the theories put forward in this study.

Lastly, further development and examination into our finding that suggests that bond issues that follow recent equity market activity experience more underpricing than bonds on average (as was also indicated by Cai et al, 2007) presents a topic that remains to be explained and represents an interesting area of future study.

8 Conclusion

This thesis has investigated corporate bond underpricing in the context of the Swedish corporate bond market and examined how underpricing relates to information problems.

Using 1-day excess return observations from 457 bond issues on the Swedish corporate bond market ranging from June 2003 to February 2015, we confirm findings by Wasserfallen and Wydler (1988), Datta et al (1997), Helwege and Kleiman (1998), Welch (2000) and Cai et al (2007) and show that corporate bond issues are on average underpriced by c. 0.21%. Furthermore, we find that underpricing is related to information problems, thereby confirming findings by Welch (2000), Hale and Santos (2006) and Cai et al (2007).

Specifically, we demonstrate that underpricing is strongly related to the issuer status, where underpricing in first-time issues is more than twice as high as in seasoned issues (0.45% vs. 0.17%). We are, however, unable to fully investigate how the firm status (private vs. public) affects underpricing, as robustness tests suggest that outliers might affect the observed underpricing results for the firm status variable. Yet, we show that first-time issuers who are private underprice the most (c. 0.53%).

Similar to Cai et al (2007), we find no support for the winner's curse theory and the notion that issues which target a higher degree of uninformed investors are subject to larger underpricing. Although, we do note that this finding is based on an arguably weak proxy, which implies that this result is potentially less robust. Moreover, realizing that the proxy for asymmetric information might be weak, which makes us unable to fully investigate the relation between asymmetric

information and underpricing, we do not find support for the asymmetric information theory. However, we do find evidence that underpricing is related to the information acquisition theory and is used to extract information from investors, which confirms findings by Cai et al (2007).

These findings have implications not only for issuing firms but also for other stakeholders, such as underwriters, debt investors and shareholders in the issuing firms themselves. Arguably, an awareness of the underpricing drivers and its pattern may assist stakeholders involved in price setting and assessment of corporate bond issues. In particular, our results suggest that firms that choose to rely on the corporate bond market as a funding source should consider whether they are able commit to that funding source and issue bonds more than once so that the initial large underpricing can be compensated by lower underpricing in subsequent offerings. Also, based on our results for the information acquisition theory, it could be appropriate for issuers to issue smaller bonds regularly rather than larger bonds infrequently since the latter type is subject to more underpricing on average. Lastly, short-term investors seeking to benefit from underpricing could choose to commit resources to those issues where underpricing has been shown to be the largest.

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Appendix A

Table A7: Summary statistics, split by issuer status.

	First-time issuers		Seasoned issuers	
	Number	Percent	Number	Percent
All corporate bonds	78	100.0	487	100.0
Firm status				
<i>Private firms</i>	54	69.2	185	38.0
<i>Public firms</i>	24	30.8	302	62.0
Issuer status				
<i>First-time issuer</i>	78	100.0	0	0.0
<i>Seasoned issuer</i>	0	0.0	487	100.0
Listing status of corporate bond				
<i>Listed</i>	75	96.2	441	90.6
<i>Unlisted</i>	3	3.8	46	9.4
Rating				
<i>Investment grade</i>	10	12.8	302	62.0
<i>High yield</i>	6	7.7	33	6.8
<i>Unrated</i>	62	79.5	152	31.2
Issue size				
<i>Less than EUR 100 million</i>	57	73.1	320	65.7
<i>EUR 100-250 million</i>	11	14.1	94	19.3
<i>More than EUR 250 million</i>	10	12.8	73	15.0
Maturity				
<i>Short (less than 5 years)</i>	29	37.2	185	38.0
<i>Medium (5-10 years)</i>	48	61.5	226	46.4
<i>Long (more than 10 years)</i>	1	1.3	76	15.6
Bond issue activity				
<i>Issued another bond w/i last 2 yrs</i>	0	0.0	444	91.2
Equity issue activity				
<i>Offered equity w/i last 2 yrs</i>	9	11.5	54	11.1
Number of years since first bond issue				
<i><5 years of issue activity</i>	0	0.0	163	33.5
<i>5-10 years of issue activity</i>	0	0.0	45	9.2
<i>>10 years of issue activity</i>	0	0.0	279	57.3

The table displays the the full bond issue sample, split by relevant metrics. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

Table A8: Summary statistics, split by firm status.

	Private firms		Public firms	
	Number	Percent	Number	Percent
All corporate bonds	239	100.0	326	100.0
Firm status				
<i>Private firms</i>	239	100.0	0	0.0
<i>Public firms</i>	0	0.0	326	100.0
Issuer status				
<i>First-time issuer</i>	54	22.6	24	7.4
<i>Seasoned issuer</i>	185	77.4	302	92.6
Listing status of corporate bond				
<i>Listed</i>	207	86.6	309	94.8
<i>Unlisted</i>	32	13.4	17	5.2
Rating				
<i>Investment grade</i>	133	55.6	179	54.9
<i>High yield</i>	25	10.5	14	4.3
<i>Unrated</i>	81	33.9	133	40.8
Issue size				
<i>Less than EUR 100 million</i>	171	71.5	206	63.2
<i>EUR 100-250 million</i>	39	16.3	66	20.2
<i>More than EUR 250 million</i>	29	12.1	54	16.6
Maturity				
<i>Short (less than 5 years)</i>	103	43.1	111	34.0
<i>Medium (5-10 years)</i>	122	51.0	152	46.6
<i>Long (more than 10 years)</i>	14	5.9	63	19.3
Bond issue activity				
<i>Issued another bond w/i last 2 yrs</i>	176	73.6	268	82.2
Equity issue activity				
<i>Offered equity w/i last 2 yrs</i>	0	0.0	63	19.3
Number of years since first bond issue				
<i><5 years of issue activity</i>	102	42.7	61	18.7
<i>5-10 years of issue activity</i>	16	6.7	29	8.9
<i>>10 years of issue activity</i>	67	28.0	212	65.0

The table displays the the full bond issue sample, split by relevant metrics. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

Table A9: Multivariate analysis of underpricing as measured by 1-day excess returns.

Model specification	(1)	(2)	(3)
First-time issuer	0.053 (0.096)	0.119 (0.105)	0.076 (0.116)
Private at issue	-0.105 (0.066)	-0.058 (0.068)	-0.090 (0.068)
First-time * Private	0.364** (0.156)	0.287* (0.168)	0.327* (0.171)
Listed bond	0.030 (0.111)	0.008 (0.113)	-0.021 (0.114)
Short maturity		-0.141** (0.056)	-0.117** (0.054)
Long maturity		0.159 (0.121)	0.184 (0.121)
Small issue		-0.064 (0.061)	-0.019 (0.058)
Investment grade			-0.044 (0.058)
High yield			0.376** (0.166)
Constant	0.185 (0.119)	0.250* (0.129)	0.255** (0.129)
Observations	457	457	457
R-squared	0.037	0.069	0.099

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Table A10: Multivariate analysis of underpricing as measured by 1-day excess returns.

Model specification	(1)	(2)	(3)
First-time issuer	-0.273 (0.172)	-0.205 (0.176)	-0.175 (0.179)
Private at issue	-0.031 (0.058)	0.014 (0.061)	-0.023 (0.061)
First-time * Private	0.408** (0.160)	0.326* (0.171)	0.368** (0.174)
Another bond issued within last 2 years	-0.298** (0.141)	-0.293** (0.139)	-0.228* (0.134)
Equity issued within last 2 years	0.316*** (0.121)	0.308*** (0.113)	0.316*** (0.112)
Short maturity		-0.149*** (0.056)	-0.127** (0.054)
Long maturity		0.121 (0.114)	0.134 (0.114)
Small issue		-0.071 (0.060)	-0.022 (0.057)
Investment grade			-0.010 (0.060)
High yield			0.372** (0.162)
Constant	0.424*** (0.139)	0.477*** (0.145)	0.377** (0.146)
Observations	457	457	457
R-squared	0.075	0.105	0.129

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Table A11: Multivariate analysis of underpricing as measured by 1-day excess returns.

Model specification	(1)	(2)	(3)
First-time issuer	0.073 (0.108)	0.091 (0.114)	0.075 (0.120)
Private at issue	-0.099 (0.064)	-0.072 (0.065)	-0.090 (0.079)
First-time * Private	0.359** (0.156)	0.299* (0.167)	0.326* (0.173)
Years since first bond issue	0.002 (0.004)	-0.002 (0.004)	-0.000 (0.005)
Short maturity		-0.140** (0.056)	-0.118** (0.054)
Long maturity		0.173 (0.121)	0.184 (0.120)
Small issue		-0.071 (0.063)	-0.017 (0.059)
Investment grade			-0.041 (0.083)
High yield			0.377** (0.170)
Constant	0.194*** (0.061)	0.291*** (0.072)	0.235*** (0.065)
Observations	457	457	457
R-squared	0.038	0.070	0.099

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Appendix B

Table B12: Summary statistics, split by issue year and sector.

	Number	Percent
All corporate bonds	565	100.0
Issue year		
<i>2004 and before</i>	3	0.5
<i>2005</i>	7	1.2
<i>2006</i>	2	0.4
<i>2007</i>	8	1.4
<i>2008</i>	2	0.4
<i>2009</i>	10	1.8
<i>2010</i>	18	3.2
<i>2011</i>	31	5.5
<i>2012</i>	122	21.6
<i>2013</i>	153	27.1
<i>2014</i>	199	35.2
<i>2015</i>	10	1.8
Industries		
<i>Communications</i>	48	8.5
<i>Financials</i>	36	6.4
<i>Materials</i>	25	4.4
<i>Industrials</i>	6	1.1
<i>Utilities</i>	234	41.4
<i>Health Care</i>	15	2.7
<i>Energy</i>	146	25.8
<i>Consumer Discretionary</i>	34	6.0
<i>Consumer Staples</i>	2	0.4
<i>Technology</i>	19	3.4

The firms included in "Financials" include largely real estate firms and certain firms whose operations target customers in the financial sector.

Table B13: Univariate analysis of underpricing as measured by 1-day excess returns.

	1-day excess return						Excl. issues w/o issue price		
	Non-winsorized			Excl. Bloomberg pricing			Mean	t-Stat	Obs.
	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.
All corporate bonds	0.227***	3.82	457	0.176***	6.48	368	0.316***	8.05	300
Firm status									
<i>Private firms</i>	0.291***	3.19	198	0.199***	4.31	157	0.398***	5.23	99
<i>Public firms</i>	0.178**	2.28	259	0.159***	4.86	211	0.276***	6.14	201
Issuer status									
<i>First-time issuer</i>	0.541***	3.55	65	0.425***	5.10	63	0.513***	5.33	50
<i>Seasoned issuer</i>	0.175***	2.73	392	0.124***	4.60	305	0.277***	6.49	250
Listing status of corporate bond									
<i>Listed</i>	0.232***	3.74	426	0.186***	6.52	348	0.318***	7.97	289
<i>Unlisted</i>	0.161	0.81	31	-0.002	(0.05)	20	0.276	1.16	11
Rating									
<i>Investment grade</i>	0.083	1.07	253	0.090***	2.69	178	0.242***	4.67	167
<i>High yield</i>	0.704***	3.35	35	0.539***	3.48	31	0.688***	4.07	31
<i>Unrated</i>	0.344***	3.44	169	0.201***	5.28	159	0.325***	5.79	102
Issue size									
<i>Less than EUR 100 million</i>	0.218***	3.58	289	0.128***	4.44	222	0.279***	6.03	160
<i>EUR 100-250 million</i>	0.299**	2.28	86	0.165***	2.98	72	0.289***	2.94	61
<i>More than EUR 250 million</i>	0.187	0.88	82	0.331***	3.80	74	0.413***	4.69	79
Maturity									
<i>Short (less than 5 years)</i>	0.118**	2.42	185	0.103***	3.04	155	0.213***	3.96	101
<i>Medium (5-10 years)</i>	0.266**	2.36	214	0.231***	5.37	177	0.351***	6.17	145
<i>Long (more than 10 years)</i>	0.436***	2.88	58	0.217**	2.14	36	0.416***	3.53	54
Bond issue activity									
<i>Issued another bond within last 2 years</i>	0.155**	2.51	359	0.088***	3.56	273	0.240***	5.59	225
Equity issue activity									
<i>Offered equity within the last 2 years</i>	0.536***	3.62	49	0.257***	2.80	39	0.569***	4.27	40
Number of years since first bond issue									
<i><5 years of issue activity</i>	0.246**	2.29	131	0.126***	2.88	115	0.329***	3.62	59
<i>5-10 years of issue activity</i>	0.068	0.75	36	0.094*	1.75	32	0.199**	2.71	24
<i>>10 years of issue activity</i>	0.151	1.65	225	0.130***	3.24	158	0.269***	4.96	167

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The table displays underpricing for the sample, split by relevant metrics. The 1-day excess returns are winsorized by 2% and expressed in %. ***/**/* denotes statistical significance at 1%/5%/10%. Non-winsorized indicates that the excess returns have not been winsorized. Excl. Bloomberg pricing indicates that price quotes from Bloomberg's pricing service has been excluded when computing excess returns. Excl. issues w/o issue price indicates that issues without issue prices have been excluded. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

Table B14: Multivariate analysis of underpricing as measured by non-winsorized 1-day excess returns.

Model specification	(1)	(2)	(3)
First-time issuer	-0.231 (0.382)	-0.226 (0.383)	-0.143 (0.386)
Private at issue	0.104 (0.117)	0.111 (0.115)	0.182 (0.154)
First-time * Private	0.445* (0.265)	0.436 (0.287)	0.445 (0.290)
Listed bond	0.039 (0.226)	0.051 (0.228)	-0.073 (0.221)
Another bond issued within last 2 years	-0.256 (0.361)	-0.247 (0.365)	-0.108 (0.376)
Equity issued within last 2 years	0.442** (0.174)	0.401** (0.168)	0.433** (0.168)
Years since first bond issue	-0.001 (0.008)	-0.005 (0.008)	0.008 (0.009)
Short maturity		-0.153 (0.130)	-0.136 (0.131)
Long maturity		0.237 (0.202)	0.276 (0.205)
Small issue		0.042 (0.118)	0.086 (0.113)
Investment grade			-0.319* (0.177)
High yield			0.303 (0.265)
Constant	0.298 (0.434)	0.328 (0.462)	0.293 (0.460)
Observations	457	457	457
R-squared	0.026	0.034	0.051

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Table B15: Multivariate analysis of underpricing as measured by 1-day excess returns excl. Bloomberg pricing.

Model specification	(1)	(2)	(3)
First-time issuer	-0.206 (0.166)	-0.166 (0.172)	-0.140 (0.173)
Private at issue	-0.007 (0.062)	0.001 (0.061)	-0.031 (0.071)
First-time * Private	0.281* (0.155)	0.202 (0.161)	0.246 (0.165)
Listed bond	0.123* (0.071)	0.086 (0.074)	0.076 (0.091)
Another bond issued within last 2 years	-0.334** (0.139)	-0.322** (0.140)	-0.276** (0.134)
Equity issued within last 2 years	0.112 (0.104)	0.101 (0.101)	0.113 (0.099)
Years since first bond issue	-0.001 (0.004)	-0.004 (0.004)	-0.004 (0.005)
Short maturity		-0.072 (0.054)	-0.052 (0.053)
Long maturity		0.028 (0.108)	0.025 (0.108)
Small issue		-0.154*** (0.055)	-0.113** (0.052)
Investment grade			0.000 (0.086)
High yield			0.298* (0.165)
Constant	0.308** (0.157)	0.460*** (0.164)	0.381** (0.169)
Observations	368	368	368
R-squared	0.097	0.126	0.148

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) exclude price quotes from Bloomberg's pricing service and are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Table B16: Multivariate analysis of underpricing as measured by 1-day excess returns excl. issues without issue price.

Model specification	(1)	(2)	(3)
First-time issuer	-0.381* (0.213)	-0.291 (0.222)	-0.260 (0.222)
Private at issue	-0.000 (0.100)	-0.002 (0.096)	-0.053 (0.106)
First-time * Private	0.350* (0.199)	0.252 (0.206)	0.329 (0.211)
Listed bond	0.488*** (0.116)	0.468*** (0.137)	0.477*** (0.178)
Another bond issued within last 2 years	-0.440** (0.175)	-0.416** (0.182)	-0.362** (0.174)
Equity issued within last 2 years	0.138 (0.131)	0.121 (0.129)	0.136 (0.126)
Years since first bond issue	-0.006 (0.005)	-0.008 (0.005)	-0.006 (0.007)
Short maturity		-0.070 (0.081)	-0.047 (0.081)
Long maturity		-0.017 (0.121)	-0.003 (0.123)
Small issue		-0.158** (0.077)	-0.116 (0.076)
Investment grade			-0.024 (0.130)
High yield			0.271 (0.190)
Constant	0.167 (0.212)	0.268 (0.230)	0.156 (0.263)
Observations	246	246	246
R-squared	0.127	0.147	0.165

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) exclude issues without issue prices and are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues.

Table B17: Univariate analysis of underpricing as measured by excess returns up to 5 days.

	2-day excess return			3-day excess return			4-day excess return			5-day excess return		
	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.	Mean	t-Stat	Obs.
All corporate bonds	0.173***	5.67	473	0.151***	4.72	485	0.155***	4.74	502	0.136***	3.96	505
Firm status												
Private firms	0.180***	3.54	209	0.164***	3.10	213	0.174***	3.28	222	0.184***	3.39	226
Public firms	0.168***	4.51	264	0.140***	3.58	272	0.140***	3.42	280	0.096**	2.21	279
Issuer status												
First-time issuer	0.484***	4.91	66	0.453***	4.11	65	0.461***	4.27	69	0.437***	4.04	72
Seasoned issuer	0.123***	3.96	407	0.104***	3.23	420	0.106***	3.20	433	0.086**	2.43	433
Listing status of corporate bond												
Listed	0.183***	5.68	436	0.160***	4.75	447	0.167***	4.85	463	0.148***	4.13	467
Unlisted	0.059	0.65	37	0.044	0.45	38	0.015	0.14	39	-0.02	(0.18)	38
Rating												
Investment grade	0.073**	2.12	262	0.070*	1.88	269	0.073*	1.84	274	0.039	0.96	274
High yield	0.629***	3.48	37	0.542***	2.86	38	0.544***	2.82	38	0.482**	2.25	38
Unrated	0.227***	4.63	174	0.189***	3.72	178	0.196***	3.90	190	0.205***	3.89	193
Issue size												
Less than EUR 100 million	0.112***	3.37	301	0.086**	2.42	311	0.105***	2.83	320	0.079**	2.06	322
EUR 100-250 million	0.166**	2.14	90	0.131	1.64	93	0.13	1.59	100	0.13	1.51	102
More than EUR 250 million	0.404***	4.47	82	0.420***	4.56	81	0.382***	4.07	82	0.369***	3.66	81
Maturity												
Short (less than 5 years)	0.057	1.61	197	0.024	0.67	198	0.041	1.04	202	0.036	0.89	203
Medium (5-10 years)	0.261***	5.36	223	0.230***	4.65	235	0.238***	4.69	246	0.204***	3.73	248
Long (more than 10 years)	0.233**	2.01	53	0.272**	2.05	52	0.206	1.59	54	0.199	1.54	54
Bond issue activity												
Issued another bond within last 2 years	0.091***	2.91	375	0.072**	2.23	386	0.069**	2.06	398	0.058	1.64	398
Equity issue activity												
Offered equity within the last 2 years	0.345***	3.33	48	0.314***	2.99	49	0.359***	3.38	54	0.343***	3.09	56
Number of years since first bond issue												
<5 years of issue activity	0.145**	2.54	138	0.098*	1.72	144	0.098*	1.71	153	0.102	1.60	152
5-10 years of issue activity	0.081	1.29	36	0.073	1.12	39	0.106	1.49	38	0.081	1.03	38
>10 years of issue activity	0.116***	2.81	233	0.112**	2.55	237	0.112**	2.43	242	0.076	1.62	243

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The table displays underpricing for the sample, split by relevant metrics. The n-day excess returns are winsorized by 2% and expressed in %. ***/**/* denotes statistical significance at 1%/5%/10%. Non-winsorized indicates that the excess returns have not been winsorized. Excl. Bloomberg pricing indicates that price quotes from Bloomberg's pricing service has been excluded when computing excess returns. Excl. issues w/o issue price indicates that issues without issue prices have been excluded. Firm status refers to whether the issuer has private or public equity. Issuer status refers to whether the bond issuer has made previous bond offerings at the time of the bond issue. Listing status refers to whether the issued bond has been listed at an exchange or not.

Table B18: Univariate analysis of underpricing as measured by 1-day excess returns.

	1-day excess return		
	Mean	t-Stat	Obs.
All corporate bonds	0.212***	7.42	457
Issue year			
<i>2004 and before</i>	-0.159	(0.81)	3
<i>2005</i>	0.325	1.18	4
<i>2006</i>	N.a.		1
<i>2007</i>	0.135	1.77	5
<i>2008</i>	0.829	0.51	2
<i>2009</i>	0.421	1.32	9
<i>2010</i>	0.43	1.33	9
<i>2011</i>	0.428**	2.42	20
<i>2012</i>	0.204***	3.22	100
<i>2013</i>	0.373***	6.16	113
<i>2014</i>	0.082**	2.35	182
<i>2015</i>	-0.022	(0.23)	9
Sectors			
<i>Communications</i>	0.588***	4.33	40
<i>Financials</i>	0.095***	2.63	198
<i>Materials</i>	0.261**	2.47	29
<i>Industrials</i>	0.175***	3.73	102
<i>Utilities</i>	0.051	0.24	18
<i>Health Care</i>	0.471**	2.27	11
<i>Energy</i>	0.379	1.34	5
<i>Consumer Discretionary</i>	0.483***	3.68	35
<i>Consumer Staples</i>	0.19	1.42	17
<i>Technology</i>	0.513	2.77	2

The table displays underpricing for the sample, split by relevant metrics. The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns are winsorized by 2% and expressed in %. ***/**/* denotes statistical significance at 1%/5%/10%. The firms included in "Financials" include largely real estate firms and certain firms whose operations target customers in the financial sector.

Table B19: Multivariate analysis of underpricing as measured by 1-day excess returns with year and sector controls.

Model specification	(1)	(2)	(3)	(4)
First-time issuer	-0.159 (0.181)	-0.201 (0.176)	-0.143 (0.168)	-0.202 (0.164)
Private at issue	-0.008 (0.078)	0.003 (0.077)	0.062 (0.087)	0.051 (0.090)
First-time * Private	0.362** (0.177)	0.372** (0.172)	0.316* (0.182)	0.346* (0.177)
Listed bond	-0.028 (0.111)	0.055 (0.111)	-0.072 (0.109)	0.004 (0.112)
Another bond issued within last 2 years	-0.226* (0.134)	-0.226* (0.132)	-0.239* (0.130)	-0.238* (0.130)
Equity issued within last 2 years	0.323*** (0.115)	0.320*** (0.113)	0.267** (0.103)	0.266** (0.104)
Years since first bond issue	0.002 (0.005)	0.000 (0.005)	0.003 (0.006)	-0.001 (0.005)
Short maturity	-0.128** (0.054)	-0.126** (0.054)	-0.114* (0.060)	-0.110* (0.060)
Long maturity	0.127 (0.112)	0.142 (0.138)	0.114 (0.113)	0.118 (0.133)
Small issue	-0.021 (0.057)	-0.002 (0.058)	-0.005 (0.057)	0.014 (0.059)
Investment grade	-0.033 (0.081)	-0.026 (0.083)	-0.059 (0.082)	-0.042 (0.084)
High yield	0.361** (0.166)	0.387** (0.166)	0.283 (0.173)	0.332* (0.178)
Constant	0.385** (0.184)	0.263 (0.251)	0.591*** (0.196)	0.874*** (0.337)
Year controls	No	Yes	No	Yes
Sector controls	No	No	Yes	Yes
Observations	457	457	457	457
R-squared	0.130	0.180	0.157	0.208

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield issues. Year (sector) controls refer to year (sector) indicator variables that take the value of one for issues in the corresponding year (sector).

Table B20: Multivariate analysis of underpricing as measured by 1-day excess returns using clustered standard errors.

Model specification	(1)	(2)	(3)
First-time issuer	-0.228 (0.189)	-0.202 (0.189)	-0.159 (0.186)
Private at issue	-0.004 (0.101)	0.015 (0.085)	-0.008 (0.085)
First-time * Private	0.386** (0.184)	0.325* (0.181)	0.362** (0.180)
Listed bond	0.009 (0.112)	-0.003 (0.103)	-0.028 (0.102)
Another bond issued within last 2 years	-0.300** (0.150)	-0.293* (0.149)	-0.226 (0.142)
Equity issued within last 2 years	0.329 (0.208)	0.309* (0.174)	0.323* (0.176)
Years since first bond issue	0.004 (0.005)	0.000 (0.005)	0.002 (0.005)
Short maturity		-0.149** (0.066)	-0.128** (0.063)
Long maturity		0.119 (0.086)	0.127 (0.088)
Small issue		-0.070 (0.080)	-0.021 (0.071)
Investment grade			-0.033 (0.087)
High yield			0.361* (0.206)
Constant	0.365* (0.187)	0.477** (0.188)	0.385** (0.182)
Observations	457	457	457
R-squared	0.077	0.105	0.130

The sample includes observations from 457 bond issues on the Swedish corporate bond market and ranges from June 2003 and February 2015. The 1-day excess returns (dependent variable) are winsorized by 2% and expressed in %. Coefficients are computed using linear OLS regressions. Clustered (by issuer) robust standard errors in parentheses. ***/**/* denotes statistical significance at 1%/5%/10%. First-time issuer takes the value of one for first-time issues. Private at issue takes the value of one private firms. First-time * Private is an interaction variable. Listed bond takes the value one for bonds that are listed. Another bond issued within last 2 years takes the value of one for issues that are preceded by another issue within the previous two years. Equity issued within last 2 years takes the value of one for issues that are preceded by an equity offering within the previous two years. Years since first bond issue takes the number of years since a firm first entered the bond market. Short maturity takes the value of one for maturities <5 years. Long maturity takes the value of one for maturities >10 years. Small issue takes the value of one for issues that are smaller than the median (EUR 59.6 million) of the sample. Investment grade takes the value of one for investment grade issues. High yield takes the value of one for high yield

Table B21: Tolerance levels for multivariate analysis.

	VIF	Tolerance
First-time issuer	5.09	0.196
First-time * Private	3.66	0.273
Another bond issued within last 2 years	2.6	0.385
Private at issue	1.61	0.621
Equity issued within last 2 years	1.14	0.877
Listed bond	1.07	0.935
Mean VIF	2.39	
First-time issuer	5.17	0.193
First-time * Private	3.8	0.263
Another bond issued within last 2 years	2.72	0.368
Years since first bond issue	2.48	0.403
Investment grade	2.2	0.455
Private at issue	1.96	0.510
High yield	1.37	0.730
Long maturity	1.29	0.775
Small issue	1.25	0.800
Equity issued within last 2 years	1.18	0.847
Short maturity	1.17	0.855
Listed bond	1.15	0.870
Mean VIF	2.15	

Table B22: Correlation matrix for explanatory and control variables in multivariate analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	1.00												
(2)	0.16	1.00											
(3)	-0.01	0.23	1.00										
(4)	0.17	0.82	0.38	1.00									
(5)	0.04	0.06	-0.19	0.06	1.00								
(6)	-0.21	-0.78	-0.10	-0.64	-0.10	1.00							
(7)	0.15	0.00	-0.30	-0.12	0.04	-0.01	1.00						
(8)	-0.03	-0.45	-0.41	-0.37	0.13	0.34	-0.03	1.00					
(9)	-0.16	0.00	0.10	-0.01	-0.03	0.02	-0.01	-0.11	1.00				
(10)	0.11	-0.16	-0.17	-0.13	0.05	0.10	0.14	0.34	-0.31	1.00			
(11)	-0.11	0.03	0.14	-0.06	-0.17	0.00	0.01	-0.24	0.22	-0.17	1.00		
(12)	-0.11	-0.34	0.05	-0.24	-0.17	0.38	-0.06	0.53	-0.05	0.24	-0.07	1.00	
(13)	0.19	0.02	0.11	0.04	0.05	-0.11	-0.07	-0.05	-0.14	0.01	-0.23	-0.32	1.00
(1)	1-day excess return			(6)	Another bond issued within last 2 years					(10)	Long maturity		
(2)	First-time issuer			(7)	Equity issued within last 2 years					(11)	Small issue		
(3)	Private at issue			(8)	Years since first bond issue					(12)	Investment grade		
(4)	First-time * Private			(9)	Short maturity					(13)	High yield		