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MSc Economics & Business
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Are Convertibles a Proxy for Firms' Uncertainty and Investors' Disagreement?

Abstract

This paper tests the theoretical explanation that firms issue convertible bonds according to the uncertainty of their company risk. According to the theory, firms with high and indeterminate risk are more likely to issue convertible bonds compared to straight debt and seasoned equity. Consistent with the theory of Brennan & Schwartz (1988), firms with higher stock volatility prefer to issue convertibles over straight debt. The disagreement among investors has a significantly positive effect on the choice of finance between convertibles and straight debt as well. However, riskier firms that are characterized by a large dispersion of opinions among investors do not have a preference between convertible bonds and seasoned equity. The variation in announcement returns is primarily caused by a negative effect of stock volatility, which is inconsistent with the prediction; investors' disagreement also has a negative impact, to a smaller degree. The variation in the convertibles' discount offered by companies is primarily caused by a positive effect of stock volatility, and is affected by the disagreement among investors as well.

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Finish date:	14-11-2018

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1 Introduction

The practitioners of finance and their corporate clients used to believe in the misconception that convertibles are a cheap source of capital. The hybrid instruments carry coupon rates below the market rates of interest on straight and preferred debt. Furthermore, they allow companies to sell stock at a premium over the current price. The argument is based on fallacious reasoning and their narrowed view on only the favorable circumstances of the debt and equity components of the instrument (Brennan & Schwartz, 1988). The convertible debt is only compared to straight debt when the company performs poorly and to common stock when the firm performs well. In these situations, the convertibles will always result in a relatively cheap source of financing. On the other hand, convertibles will turn out to be more expensive than common stock, if the company does poorly, because the debt will still have to be serviced. If the company does very well the convertible will be more expensive than straight debt, because investors will then participate in the stockholders' profits. The lower coupons on convertible bonds compared to straight debt thus arise from the convertibility option.

Assume that at present, financial practitioners do not fall for this former misconception of convertibles, which is concluded in the paper of Dong, Dutordoir and Veld (2011). What is the incentive for firms to issue convertibles instead of equity or bond offerings? Brennan & Schwartz (1988) argue that the most plausible rationale for the continuing popularity of convertibles lies in their insensitivity to company risk. The required interest rate for the issue of convertible debt follows a different pattern relative to straight debt according to the companies' risk levels. Furthermore, Stein (1992) argues that the use of convertible bonds is a solution for firms that have to issue an equity-type security instead of straight debt because of prohibitively high financial distress costs and firms that simultaneously want to avoid some of the adverse selection costs that would be associated with common equity financing. Brennan & Schwartz (1988) allocate the adverse selection costs to the uncertainty about the company risk. This paper follows the framework of Brennan & Schwartz (1988) and studies whether the uncertainty of the company risk has the largest impact on a firm's convertible debt issue decisions. The variables that are examined as proxies of uncertainty and as the main determinants are stock volatility and disagreement among investors.

According to Diether, Malloy & Scherbina (2002) the dispersion in analysts' earnings per share forecasts can be viewed as a proxy for differences of opinion among investors. Disagreement is calculated as the standard deviation of earnings per share divided by the absolute mean value of earnings per share forecasted by analysts. Diether, Malloy & Scherbina (2002) show that disagreement is positively related to earnings variability, standard deviation in returns, and market beta. However, they strongly reject the interpretation of dispersion in analysts' forecasts as a measure of the volatility of equity risk. Gragg and Malkiel (1982) report a positive relation between dispersion in forecasts and

future returns. Hence, this can be seen as a risk premium factor within the risk-based framework. Investors' disagreement might increase adverse selection costs for both straight debt and equity issuances. Convertible bonds could serve as a solution for the associated costs of debt and equity. This paper wants to test the effect of disagreement on the choice of finance and other characteristics of convertible debt offerings, such as the announcement effect and the offering discount.

First, the decision between convertible, equity, and straight debt offerings is tested with various multinomial logistic models including stock volatility, disagreement, and other control variables. From here on, one can conclude whether stock volatility and disagreement among investors play a significant role in the choice of financing. The second part tests the effect of the two main variables on the variation of announcement returns of convertible offerings. The third test is about the effect of the uncertainty about the company risk and investors' disagreement on the discount of convertible offerings for the firms. The results show whether the market's uncertainty about the company risk is the primary determinant for managers to decide between convertible debt and other financing offerings, and whether it has a significant effect on the variation of the announcement returns and the discount of convertible offerings.

The first regression reports that firms with higher uncertainty about the company risk, in terms of stock volatility, significantly prefer convertible bonds. This is consistent with theoretical predictions of the choice between convertibles and straight debt offerings (Green, 1984; Brennan & Kraus, 1987; Brennan & Schwartz, 1988; Mayers, 1998). They all imply that convertibles are capable of mitigating risk-related financing costs. It is also consistent with most findings of quantitative studies on the choice between convertibles and straight debt offerings (Lewis, Rogalski & Seward, (1999); Chang, Chen & Liu, 2003; Dutordoir & Van De Gucht, 2006). They conclude that stock volatility and uncertainty about the company risk drives convertible bond issuances. In addition, the findings of the qualitative studies of Bancel & Mittoo (2004) and Dong, Dutordoir & Veld (2011) conclude that convertible bonds are chosen when stock volatility is high and therefore give advantageous terms compared to straight debt bonds. Investors' disagreement has a significantly positive effect on the probability of choosing convertibles over straight debt, which is empirical evidence for the theories about uncertainty. In other words, the proxy for disagreement among investors can be seen as an uncertainty factor about the company risk as well.

However, the results are inconsistent with the theoretical prediction on the preference between convertible debt and equity issues argued by Stein (1992), which states that convertibles are issued as 'delayed-equity' to mitigate adverse selection costs. Stock volatility and disagreement among investors are proxies for the adverse selection costs of equity issuances. The proxies do not significantly affect the decision-making process between convertible and equity issuances. This is consistent with the findings of Dutordoir & Van De Gucht (2006), but inconsistent with the findings of Lewis, Rogalski & Seward

(1999) and Bancel & Mittoo (2004). The firm's leverage and illiquidity ratio are the largest significant determinants.

The second test shows that stock volatility is the primary determinant in the variation of announcement returns of convertible bonds. It has a significantly negative effect. This is consistent with the results of Lewis, Rogalski & Seward (1999), who find that stock volatility is the largest negative determinant of convertible debt announcement returns. In addition, the results are also partly consistent with the findings of Duca, Dutordoir, Veld & Verwijmeren (2012). They find that stock volatility has a negative effect, but it is not the primary determinant. In contrast, Chang, Chen & Liu (2004) conclude that the convertible debt announcement returns are more favorable for focused, and hence more volatile, firms. This means that stock volatility positively affects the convertible debt announcement returns.

Disagreement among investors appears to be a determinant as well, but less impactful. Previous literature does not include an additional proxy for differences of opinions of investors besides stock volatility. The results of this paper can provide more robustness to the negative effect of the uncertainty factors on the convertible debt announcement returns. Firm size, the relative issue size to market capitalization, and the illiquidity ratio are other variables that have a significant effect on the announcement returns. The low R-squared indicates that the total variation of the announcement returns of convertible bonds cannot be explained well by company financials alone. It appears that convertibles are generally interpreted and evaluated as negative by the market, which is consistent with the conclusion of Dann & Mikkelson (1984).

The third test reports stock volatility as the primary determinant of the variation in the discount of convertible bonds. The uncertainty about the company risk has a significantly positive effect on the discount offered by companies. Firms with high and indeterminate risk have weaker negotiation power and hence are required to offer discount to attract potential buyers. This is consistent with the findings of King (1986) and Kang & Lee (1996). The same applies to disagreement among investors, but to a much smaller extent. Hence, investors' disagreement is also a determinant for the discount rate offered by issuers. Other determinants for higher discount offers are research and development intensity, relative issue size to market capitalization, and illiquidity ratio of stocks. The stock-runup strengthens the negotiation power and decreases the discount offered by firms.

The remainder of this paper is structured as follows. The next section provides an overview of the literature and in addition the hypotheses are formed. Section 3 describes the methodology and data selection. Section 4 documents the results of the regressions, and compares the findings with those obtained by other studies on the motivations and predictions for convertible debt offerings. Section 5 concludes the paper. Section 6 provides a discussion about the limitations of this study and proposes suggestions for future studies.

2 Literature background and hypotheses

2.1 Theoretical and empirical papers on convertible debt issuer motivations

Many theoretical studies form predictions on why firms have an incentive to issue convertible debt instead of traditional straight debt. Green (1984), Brennan and Kraus (1987), Brennan and Schwartz (1988), and Mayers (1998) argue that firms characterized by higher straight debt financing costs (e.g. financial distress) and high equity-related financing costs (e.g. asymmetric information) that prevent them from issuing equity, prefer to issue convertible debt.

The first motive mentioned is the asset substitution problem by Green (1984). The problem arises when a company's management willingly deceives another by replacing higher quality assets or projects with lower quality assets or projects, after a credit analysis has already been performed. If the risky project is successful, most of the benefits are for the equity shareholders because creditors' returns are fixed at the original low-risk rate. However, if the project is a failure, the bondholders take a loss. Green (1984) argues that convertible bonds are appropriate instruments for firms that want to mitigate these asset substitution costs arising from the presence of risky debt. By adding a conversion option to their bond issues, firms allow bondholders to participate in the upside potential of their stock. Convertibles thus reduce the value of the stockholders' residual claim, thereby weakening the stockholders' tendency to engage in more risky projects.

Brennan & Kraus (1987) and Brennan & Schwartz (1988) argue about the association between the uncertainty of the company risk and convertible debt. Adverse selection costs could arise for issuing companies of high and indeterminate risk. New bondholders will require an additional premium over the interest rate that they would demand under perfect information on firm risk. Companies can reduce this problem and the additional costs by issuing convertibles of straight bonds. The reason is that the negative impact of an increase in firm risk on the bond component of convertibles will be partly offset by the positive impact of an increase in firm risk on their equity component, so that the total value of convertible issues will be less affected by the issuing company's risk than the total value of straight bonds. Riskier firms could benefit from these advantageous terms of issuing convertible debt compared to straight debt.

Mayers (1998) demonstrates a model that, unlike the previous three models, relies on the critical assumption that convertibles are callable. This means that firms are able to force a conversion of the convertible debt into equity. He advances the sequential-financing hypothesis and argues that convertible debt is more suitable for financing a sequence of investment options of uncertain value than either short- or long-term bonds. Convertibles economize on the issuing costs that would be associated with multiple short-term debt offerings, since conversion retains funds inside the firm. Convertibles also

control for the stockholders' tendency to overinvest in projects with a negative NPV by returning the funds to bondholders through redemption when the investment option has no value.

Stein (1992) models convertible debt as a suitable financing instrument for firms that have to issue an equity-type security instead of straight debt because of prohibitively high financial distress costs, but that want to avoid some of the adverse selection costs that would be associated with common equity financing. Since convertibles have a smaller equity component than shares, convertible issuance is less likely to be perceived as a signal of firm overvaluation, thus induces smaller adverse selection costs. Corresponding to Mayers (1998), the model assumes that a call provision is available for the issuer and obligates the bondholders to convert the debt into shares. Firms can obtain delayed equity financing by calling their outstanding convertibles closely after the issue.

The key elements of the theoretical papers are thus centered around adverse selection costs (e.g. underpricing of equity and interest rate premium), moral hazard (e.g. overinvestment in risky and/or below zero NPV projects), and financial distress costs. The subsequent paragraphs consist of an overview of quantitative and qualitative studies about the choice of finance in order to compare the theoretical predictions stated above with our results.

Lewis, Rogalski & Seward (1999) were the first ones to do a quantitative study on the choice of financing with an extended security choice model in their paper: *"Is Convertible Debt a Substitute for Straight Debt or for Common Equity?"*. This differs from Bayless & Chaplinsky (1991) and Jung, Kim & Stulz (1996), who limit their security choice model between straight debt and common equity. Lewis, Rogalski & Seward (1999) examine the ability of the risk-shifting hypothesis and the backdoor-equity hypothesis to explain firms' decisions to issue convertible debt. They find convincing empirical evidence in support of both hypotheses and thus for most theoretical papers. Hence, managers use convertible bond issues to reduce agency costs associated with the asset substitution problem and to mitigate the adverse selection costs of a seasoned equity offers.

Bancel & Mittoo (2004) did a survey on a sample of 229 firms that issued convertible debt. They document a large cross-sectional variation of reasons across firms for issuing convertibles and find mixed support for most theoretical models. The most common motivations behind convertible bond issues are: firms use it as "delayed equity" financing, firms are expecting that the debt would be converted, convertibles are less expensive than debt, convertibles provide a good signal to the market about the future growth opportunities, and the stock market volatility was high. The popularity of convertible bonds is primarily driven by the flexibility of their design to fit the financing needs of individual firms.

Chang, Chen & Liu (2003) find support for the sequential-financing hypothesis, advanced by Mayers (1998), doing a quantitative study. The hypothesis suggests that convertibles are more useful in reducing security issue costs and controlling the overinvestment problem when values of the initial

project and the future investment option have a strong positive correlation, a feature generally found in firms with focused activities. Focused activities are less diversified and hence more volatile, which increases the uncertainty about the current and future equity risk of the firm.

Dutordoir & Van De Gucht (2006) examine European convertible debt issuer motivations by estimating a security choice model incorporating convertibles, straight debt, and equity. They find that European convertibles are used as sweetened debt, not as delayed equity. This finding is consistent with the rationales of Green (1984), Brennan & Kraus (1987), and Brennan & Schwartz (1988), and thus not with the rationale of Stein (1992). They also find that companies substitute debt-like convertible debt for straight debt during periods with a high economy-wide level of debt-related financing costs. Thus, debt-like convertibles are not only used to alleviate high firm-specific debt related costs, but also to sweeten high economy-wide debt-related costs.

Dong, Dutordoir & Veld (2011) did a qualitative study by interviewing managers who have issued convertible debt. It shows managers are very well aware of the pitfalls of using convertible bonds. They realize that the lower coupons compared to straight debt arise from the convertibility option. Furthermore, the study finds little support for the academic motives for the issuance of convertible bonds, with the exception of the theory of Brennan & Schwartz (1988) which implies that companies issue convertibles when management and investors have different opinions about the firm's risk. In contrast, there is a strong support for more general security issuance theories such as pecking order and market timing. Firms choose convertible bonds over straight debt to reduce the cost of financing in terms of interest payment or debt covenants, and choose convertibles over equity because of perceived share undervaluation and share dilution.

Dutordoir et al. (2014) review the literature on the issuance motives design of convertible bonds in their paper: *"What we do and do not know about convertible bond financing".* They conclude that there is virtually no empirical evidence on the validity of convertible bond rationales other than the "Big Four", which are Green (1984), Brennan and Kraus (1987) and Brennan and Schwartz (1988), Stein (1992), and Mayers (1998). Financial firms are often excluded from research samples, which is another limitation of empirical studies. Financials account for a substantial portion of U.S. hybrid securities issuance: 15.5% of all issues over the period from 1990 to 2009 were done by firms with a main SIC code ranging from 6000 to 6999. They argue that regulatory concerns could merely drive the choice for convertible securities, which should be tested in the future.

The empirical findings for Green (1984), Brennan and Kraus (1987), Brennan and Schwartz (1988), Mayers (1998) and Stein (1992) are thus mixed. Most papers find support for the rationales of Brennan and Schwartz (1988). This paper will focus on their theory and develop hypotheses accordingly. Their main conclusion is that riskier firms could benefit from advantageous terms. This is due to the

insensitivity to the uncertainty about the company risk of issuing convertible debt compared to straight debt. This theory is evaluated by testing the following hypothesis:

Hypothesis H1a: *Stock volatility has a significantly positive effect on the probability to decide for convertible debt relative to straight debt financing.*

This study tests the determinants of the choice between convertible debt and seasoned equity financing as well. The theory of Stein (1992) is combined with the theory of Brennan & Schwartz (1998). Stein (1992) argues that convertible debt is the solution for firms with high financial distress that have to issue equity, but want to avoid adverse selection costs associated with common equity financing. Brennan & Schwartz (1988) allocate the adverse selection costs to the uncertainty about the company risk. This results into testing the following hypothesis:

Hypothesis H1b: *Stock volatility has a significantly positive effect on the probability to decide for convertible debt relative to seasoned equity financing.*

One should take into consideration that all hypotheses are not only reflected against the choice of one type of financing, but both straight debt and seasoned equity in the same model.

Another variable that this paper aims to shed more light on is the disagreement among investors and whether it has a significant effect on the decision making of managers for a specific type of financing. According to Diether, Malloy & Scherbina (2002) the dispersion in analysts' earnings per share forecasts can be viewed as a proxy for differences of opinion among investors. Disagreement is calculated as the standard deviation of earnings per share divided by the absolute mean value of earnings per share forecasted by analysts, and is controlled for the number of unique analysts prior to the issue date. The evidence for disagreement among investors as a risk factor is mixed.

Diether, Malloy & Scherbina (2002) show that disagreement is positively related to earnings variability, standard deviation in returns, and market beta. However, they strongly reject the interpretation of dispersion in analysts' forecasts as a measure of risk. Gragg & Malkiel (1982) report a positive relation between dispersion in forecasts and future returns, which can be seen as a risk premium factor within the risk-based framework. Carlin, Longstaff & Matoba (2014) find that increased disagreement is associated with higher expected returns, higher return volatility, and larger trading volume. Their results imply that there is a positive risk premium for disagreement in asset prices. This paper predicts that disagreement among investors increases the adverse selection costs because of the increased uncertainty of the company risk. New bondholders demand an additional premium and seasoned equity becomes even more expensive due to asymmetric information. Additionally, we predict

that large dispersion among the opinions of investors might lead to overinvestment problems, in which convertible debt could lead to a consensus between investors. These predictions are evaluated by testing the following hypotheses:

Hypothesis H1c: *Disagreement among investors has a significantly positive effect on deciding for convertible debt relative to straight debt financing.*

Hypothesis H1d: *Disagreement among investors has a significantly positive effect on deciding for convertible debt relative to seasoned equity financing.*

2.2 Previous literature on the announcement returns of convertible debt offerings

Further analysis of the convertible bonds is about their announcement returns. Hitherto, many studies have tried to find general explanations of cross-sectional variations in the cumulative abnormal returns around the announcement date of convertible debt offerings. Several originally potential explanations of the price response that are suggested are: announcement of a leverage decrease conveys unfavorable information about the firm, financing new investment by issuing securities conveys unfavorable information about the firm, and original issue underpricing transfers wealth from current securityholders to buyers of the underpriced security.

Dann & Mikkelson (1984) provide evidence on the valuation effects of convertible debt issuance. Common stockholders earn significantly negative abnormal returns at the initial announcement of a convertible debt offering, and at the date of issuance. In contrast, they find that the average valuation effect on common stock at the announcement of non-convertible debt offerings is only marginally negative, and zero at the date of issue. Their results are inconsistent with the evidence from other recent studies documenting common stock price effects of the same sign as the change in leverage. The hypothesis, which implies that obtaining new funds externally reveals unfavorable news about the firm, is supported. However, the stock price response is the same for firms refinancing existing debt as for firms using the proceeds for new investment, which means it is doubtful that the new financing-related information hypothesis can fully explain the common stock price behavior associated with the announcement of new debt offerings. In conclusion, their evidence suggests that convertible debt offerings convey unfavorable information about the issuing firms, but the specific nature of such information remains unidentified.

Eckbo (1986) finds a two-day negative cumulated average abnormal return of 1,25% relative to the announcement of the convertible bond offerings of firms listed on the Standard & Poor's index. The author explains his findings based on theory of asymmetric information and that the announcement should lead to a negative effect since the news of external financing will lead unformed investors to

demand a discount as a hedge if the firm is overvalued. The negative effect of convertible bond announcements is likely to reflect the equity feature of convertible bonds, since there is evidence of the negative announcement effect of equity. Cross-sectional regressions reveal no relation between offer-induced price effects and offering size, rating, post-offer changes in abnormal earnings or debt-related tax shields. The evidence is inconsistent with theories predicting that the price effects of changes in capital structure in the direction of the leverage change as in the work of Dann & Mikkelson (1984).

In contrast to the previous two papers, Chang, Chen & Liu (2004) report that announcements of convertible debt offerings by Taiwanese firms are, on average, associated with significantly positive abnormal returns. These results are similar to those for Japan (e.g. see Kang & Stulz, 1996), but hence different from those for the US and UK which show a significantly negative stock market reaction to announcements of convertibles. They find that the stock market responds more favorably to the announcements of convertible offerings by focused firms than to those by diversified firms. This could be explained by the control of overinvestment by more focused firms as argued by Mayers (1998), and higher volatility by Brennan & Schwartz (1988).

Eckbo, Masulis & Norli (2007) report in their corporate finance overview that the stock returns around convertible debt announcements are negative and intermediate in size between the announcement effects associated with seasoned equity and straight debt offerings, consistent with the hybrid debt-equity nature of convertible debt. Importantly, the finding of a negative announcement effect does not hold for all countries, as stated in the work of Chang, Chen & Liu (2004).

De Jong, Dutordoir & Verwijmeren (2011) find that issue-date abnormal stock returns for uncombined offerings are significantly negative, while issue-date abnormal stock returns for combined offerings are close to zero. Furthermore, Duca, Dutordoir, Veld & Verwijmeren (2012) find for U.S firms that announced convertible offerings between 1984 and 1999 have an average abnormal stock return of -1.69% around the announcement date, and convertibles announced in the period 2000–2008 are associated with average negative abnormal stock returns that are more than twice as large (-4.59%). Stock volatility also has a negative effect on the convertible debt announcement returns. They have tested and found evidence for their key prediction: the observed highly negative announcement effects of recent convertible bond issues may partly reflect temporary price pressure associated with arbitrage-induced short selling upon convertible bond issuance.

The papers that studied U.S. firms agree on the statistically significant negative cumulative abnormal returns around the announcement date of convertible debt offerings. Duca, Dutordoir, Veld & Verwijmeren (2012) find that stock volatility has a significantly negative effect on the convertible debt announcement returns. Furthermore, Chang, Chen & Liu (2004) concluded that focused firms, which could implement higher volatility of equity risk, have more favorable reactions by the market than diversified firms. This paper tests whether the variation of the assumed negative announcement returns

of U.S. firms are primarily caused by the stock volatility of firms. In other words, do investors evaluate the announcement returns as more favorable when firms issue convertible bonds because of their insensitivity characteristic to the uncertainty of present and future company risk? Furthermore, do investors evaluate a company as more favorable when they issue convertible bonds to mitigate higher adverse selection costs associated with higher disagreement among investors? To estimate this effect of stock volatility and disagreement, the following hypotheses will be tested:

Hypothesis H2a: *Stock volatility has a significantly positive effect on the announcement returns of convertible debt offerings.*

Hypothesis H2b: *Disagreement among investors has a significantly positive effect on the announcement returns of convertible debt offerings.*

2.3 Previous literature on the offering discount of convertible debt offerings

This paper also aims to test the effect of the uncertainty about the company risk and disagreement among investors on the offering discount of convertible bonds. Many papers have already done research on this subject (Kang & Lee (1996); Ammann, Kind & Wilde (2003); Loncarski, ter Horst & Veld (2009); De Jong, Dutordoir & Verwijmeren (2011)) and find significant underpricing of the convertible debt offerings. The offering discount for a convertible debt offering is as follows: (Theoretical Price – Offer Price) / Theoretical Price.

Most of the studies test the effect of values that are needed to compute the theoretical bond price such as the bond contractual specifications, the underlying stock price, a schedule of conversion prices, interest rates, and estimates of dividend yield and volatility.

Kang & Lee (1996) use a sample of 91 convertible debt offerings from the 1988-92 period. They report an average initial excess return of 1.11%. Their analysis shows that risk associated with convertible debt offerings plays an important role in explaining the initial return. The initial underpricing is most striking for the convertible bonds issued by firms with high equity beta above 1. King (1986) also finds issuers with higher volatility of stock returns (riskier companies) to be associated with a higher underpricing. Ammann, Kind & Wilde (2003) find that theoretical values for the analysed convertible bonds are on average more than three percent higher than the observed market prices. Accordingly, Loncarski, ter Horst & Veld (2009) find that convertible bonds are underpriced at the issuance dates with an average of 3.24%. De Jong, Dutordoir & Verwijmeren (2011) explore the motivations for combining a convertible bond issue with a share repurchase. They predict that combined offerings should exhibit lower offering discount than uncombined convertibles, because issuers offer a short

position to arbitrageurs and thus obtain a stronger bargaining position. They find evidence for this prediction; convertibles combined with a stock repurchase are associated with lower offering discounts.

This paper wants to focus on whether stock volatility and disagreement among investors have a significant effect on the offering discount of convertible debt offerings. Kang and Lee (1996) have already found that underpricing is most striking for firms with higher equity betas. Further research of the effect of company financials on the offering discount should elaborate more about this subject. We also predict that higher disagreement among investors and thus higher adverse selection costs should result in higher offering discounts because firms have weaker negotiation power and they have to offer larger discounts to attract investors. To evaluate these predictions, we test the following hypotheses:

Hypothesis H3a: *Stock volatility has a significantly positive effect on the offering discount of convertible debt offerings.*

Hypothesis H3b: *Disagreement among investors has a significantly positive effect on the offering discount of convertible debt offerings.*

2.4 Explanatory variables

This section provides the main explanatory and control variables that are predicted by the theory and empirical findings. Stock volatility and disagreement are the main variables in the models. Riskier firms should have an incentive to issue convertible bond instead of straight debt and seasoned equity, because of the interest rate insensitivity, financial distress and adverse selections costs. Dispersion in opinions of investors could create adverse selection costs because there is more uncertainty about the company risk. New bondholders will require an additional premium over the interest rate that they would demand under perfect information on firm risk, and equity financing is associated with the highest adverse selection costs according to the pecking-order theory introduced by Myers & Majluf (1984). This paper predicts that firms prefer convertible bonds as a middle way because of high asymmetric information. This investors' disagreement is always controlled by the number of analysts that made a forecast in the year before the issue date.

To control the robustness of the coefficients' values of the main variables in the regressions, we add other specific company variables. The firm size is associated with company risk. In general, higher firm size equals lower risk. This variable is measured by the logarithm of the total value of assets. Higher leverage in combination with a company's characteristics increase the financial distress because of the debt obligations. Therefore, we add these variables which could affect the uncertainty about the risk of a firm. Bancel and Mittoo (2004) conclude that convertible issues are used to signal future growth opportunities to the market. The market-to-book ratio is included to test this effect. Firms that pay

dividend tend to be less risky and stable in the market. The models include a dummy variable whether a firm pays dividend or not. Information asymmetries could arise from equity issues between stockholders and agents. Brennan & Schwartz (1988) also argue that adverse selection costs could arise in straight debt issues. New bondholders require an additional premium over the interest rate. The variables that measure the effect of information asymmetries besides disagreement are tangibility and R&D intensity.

The return volatility of the issuer's stock is measured from -240 to -40 trading days relative to the announcement date; the disagreement is calculated as the standard deviation of earnings per share divided by the absolute mean value of earnings per share as forecasted by financial analysts retrieved from the I/B/E/S database; number of analysts is the count of the unique analysts that forecasted one year prior to the issue date; the likelihood of financial distress is measured by a firm's Altman Z-score (Z-scores are higher for firms with a lower chance of bankruptcy); firm size is measured by the logarithm of the total value of assets; tangibility is calculated as the ratio of tangible assets over total assets; the R&D dummy takes the value unity for firms that report R&D expenses; R&D intensity is measured as R&D expenses over total sales; market-to-book ratio is measured as the market value of equity divided by the total book assets of a firm; a dummy that takes the value unity when the bond is issued by a dividend-paying company. In section 4.2 and 4.3 the following variables are included: the percentage institutional ownership of the firm's stock, the Amihud liquidity measure (a high Amihud-score denotes illiquidity), and the stock run-up as the stock return over trading days −76 to −2 relative to announcement date.

3   Methodology and data selection

3.1 Methodology

This paper uses two methods to test the hypotheses. The first method examines the choice of financing. This is a categorical data analysis with a dummy variable as the dependent variable. This dependent variable is equal to zero for seasoned equity, one for convertible debt and two for straight debt offerings. We set convertibles as the baseline outcome. The output of the multinomial logit analysis therefore consists of two pairwise analyses: one analysing the choice between convertibles and straight bonds, and one analysing the choice between convertibles and seasoned equity. A positive (negative) coefficient sign reflects a higher (lower) probability of choosing straight debt and equity over convertibles.

The second and third hypotheses are tested with the simple ordinary least squares regressions with several sets of control variables, industry and year fixed effects. The second hypothesis aims to measure the effect of the uncertainty about the company risk, as in stock volatility and disagreement among investors, on the announcement returns. To measure the effects, we estimate the following regressions:

$$CAR_{it} = \alpha + \beta_1 Volatility_i + \beta_i X_i + v_t + w_t + \varepsilon_{it,} \tag{1}$$

$$CAR_{it} = \alpha + \beta_1 Disagreement_i + \beta_2 Number\ of\ Analysts_i + \beta_i X_i + v_t + w_t + \varepsilon_{it,} \tag{2}$$

where i indexes firms; t indexes years; X is a set of control variables; $Volatility_i$ is the firm i's stock volatility; $Disagreement_i$ is the firm i's disagreement among investors; $Number\ of\ Analysts_i$ is the firm i's number of analysts that forecasted the earnings per share values; v is a fixed year effect; w is a fixed industry effect according to the Fama and French 12-industries classification; ε is the random error term robust to both clustering (i.e., dependence) at the firm level and heteroscedasticity; CAR defines the cumulative abnormal returns with an event window of [-1,1]. The coefficient β_1 provides statistical information about the (significant) effect of stock volatility and disagreement. β_2 $Number\ of\ Analysts_i$ needs to be added in the equation to produce more robust outcomes for the disagreement variable, which is the logical mechanism of controlling the forecasts by the number of unique forecasters.

The third hypothesis follows the same framework of methodology as the previously mentioned regressions. However, the dependent variable is now the discount of convertibles offered by issuing firms. To estimate the effect of the risk measure variables, we estimate the following regressions:

$$Discount_{it} = \alpha + \beta_1 Volatility_i + \beta_i X_i + v_t + w_t + \varepsilon_{it,} \tag{3}$$

$$Discount_{it} = \alpha + \beta_1 Disagreement_i + \beta_2 Number\ of\ Analysts_i + \beta_i X_i + v_t + w_t + \varepsilon_{it,} \tag{4}$$

where *i* indexes firms; *t* indexes years; *X* is a set of control variables; *Volatility$_i$* is the firm *i*'s stock volatility; *Disagreement$_i$* is the firm *i*'s disagreement among investors; *Number of Analysts$_i$* is the firm *i*'s number of analysts who forecasted the earnings per share values; *v* is a fixed year effect; *w* is a fixed industry effect according to the Fama and French 12-industries classification; *ε* is the random error term robust to both clustering (i.e., dependence) at the firm level and heteroscedasticity; *Discount* is the percentage reduction of convertibles for issuing firms.

3.2 Data

The complete dataset consists of the announced public offerings of convertible debt, equity, and straight debt issues made by firms from the United States during the period from 2000 to 2014. The issues are retrieved from the Thomson One database. The company financials are retrieved from Compustat North America. Financial and utility companies (SIC codes between 6000 and 6999 and between 4899 and 4999, respectively) are excluded from the dataset because of their unique capital structure characteristics. Missing values for the total assets, volatility and disagreement are dropped. The value for the calculation of disagreement among investors and its number of analysts is retrieved from the I/B/E/S database. The leverage and the amount of issue proceeds divided by market capitalization are restricted to the closed unit interval of [0;1]. The dataset contains 1,127 convertible debt offerings, 3,763 equity offerings, and 3,103 bond offerings. Table 1 reports the convertible debt, equity and straight debt samples sorted by the year of issuance.

Table 1

Temporal dispersion of the convertible debt, equity and straight debt offerings. N denotes the number of observations and % the percentage of the security type by each issue year.

Issue calendar year	Convertible debt offerings		Equity offerings		Straight debt offerings	
	N	%	N	%	N	%
2000	52	4.61%	161	4.28%	168	5.41%
2001	96	8.52%	305	8.11%	271	8.73%
2002	58	5.15%	286	7.60%	266	8.57%
2003	163	14.46%	324	8.61%	216	6.96%
2004	141	12.51%	390	10.36%	168	5.41%
2005	78	6.92%	300	7.97%	138	4.45%
2006	96	8.52%	280	7.44%	149	4.80%
2007	104	9.23%	397	7.89%	163	5.25%
2008	48	4.26%	162	4.31%	137	4.42%
2009	49	4.35%	271	7.20%	217	6.99%
2010	43	3.82%	205	5.45%	235	7.57%
2011	45	3.99%	165	4.38%	206	6.99%
2012	39	3.46%	164	4.36%	292	9.41%
2013	64	5.68%	231	6.14%	250	8.06%
2014	51	4.53%	222	5.90%	227	7.32%
Total	1,127	100%	3,763	100%	3,103	100%

Table 1 shows substantial temporal fluctuations in equity and convertible debt offering volumes. This is in line with previous studies of Choe et al. (1993) and Bayless & Chaplinsky (1996). They both conclude that common stock issues are substantially higher in expansionary phases of the business cycle. Additionally, Choe et al. (1993) find support for the prediction that firm announcements of equity issues convey less adverse information about equity values in such periods. Bayless and Chaplinsky (1996) provide evidence that windows of opportunity exist when otherwise identical firms receive favorable prices for new seasoned equity. They find that the average price reaction in hot markets is significantly less negative while the price reaction in cold markets is significantly more negative than at other times. The security volume fluctuations might reflect changes in aggregate levels of equity- and debt-related financing costs over time. There is also considerable time variation in the number of straight debt offerings.

Table 2 reports the summary statistics of the subsamples convertible debt, equity and straight debt offerings. The volatility is measured as the daily stock return volatility over trading days [-240, -40] relative to the issue date and is retrieved from the CRSP database. The relative size of the proceeds of the issues to the market value of equity and the leverage must be in the closed unit interval of [0;1]. The Altman Z-score of the financial distress is also winsorized to values between -100 and 100. Missing values of total assets, volatility, and disagreement are dropped. All variables are winsorized at the upper and lower 0.5-percentiles to avoid large outliers.

Table 2

Summary statistics of the convertible debt, equity and straight debt offerings. All variables are trimmed at the upper and lower 0.5-percentiles. Large values are rounded to full numbers. Other values are rounded to two decimals. Variable descriptions can be found in the appendix. SD is the abbreviation of standard deviation. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Variables	Convertible debt offerings		Equity offerings		Straight debt offerings		Convertibles vs. Equity	Convertibles vs. Straight debt
	Mean [Median]	(SD)	Mean [Median]	(SD)	Mean [Median]	(SD)	t-stat. for pairwise differences in mean values	
Total assets	2978 [810]	(8571)	1785 [358]	(6072)	17349 [7032]	(27826)	3.99***	-25.79***
Market capitalization	3358 [976]	(8882)	1865 [459]	(5964)	21109 [6495]	(35166)	5.29***	-25.82***
Stock volatility	0.04 [0.03]	(0.02)	0.04 [0.03]	(0.02)	0.02 [0.02]	(0.01)	-5.11***	24.16***
Disagreement	0.30 [0.09]	(0.67)	0.24 [0.08]	(0.56)	0.16 [0.04]	(0.47)	2.66***	6.41***
Proceeds	262 [173]	(300)	138 [59]	(255)	597 [364]	(695.86)	12.58***	-21.83***
Proceeds / market equity	0.18 [0.16]	(0.13)	0.18 [0.13]	(0.16)	0.12 [0.07]	(0.14)	1.39	14.01***
Financial distress (Z-score)	8.68 [4.00]	(13.77)	10.03 [3.80]	(16.17)	5.64 [4.12]	(6.59)	-2.47**	6.37***
Leverage	0.25 [0.24]	(0.20)	0.27 [0.24]	(0.20)	0.31 [0.29]	(0.15)	-1.98**	-8.74***
Market-to-book	2.49 [1.80]	(1.99)	2.53 [1.86]	(1.92)	1.94 [1.61]	(1.04)	-0.60	8.77***
Tangibility	0.42 [0.31]	(0.35)	0.45 [0.32]	(0.38)	0.66 [0.59]	(0.40)	-2.13**	-18.21***
Illiquidity	0.12 [0.04]	(0.29)	0.30 [0.10]	(0.53)	0.05 [0.01]	(0.20)	-14.71***	6.98***
R&D intensity	0.68 [0.03]	(3.90)	1.24 [0.02]	(5.46)	0.02 [0]	(0.07)	-3.79***	5.67***
R&D dummy	0.73 [1]	(0.44)	0.67 [1]	(0.47)	0.57 [1]	(0.50)	3.54***	10.25***
Stock run-up	0.16 [0.13]	(0.31)	0.17 [0.14]	(0.33)	0.06 [0.06]	(0.19)	-1.08	9.57***
Number of analysts	8.70 [7]	(6.47)	6.17 [5]	(5.27)	12.45 [12]	(6.98)	12.00***	-16.27***
Dividend payer	0.19 [0]	(0.39)	0.16 [0]	(0.37)	0.71 [1]	(0.45)	1.97**	-36.71***
Discount	0.14 [0.13]	(0.18)						
Obs.	1,127		3,763		3,103			

Table 2 shows that firms issuing convertible bonds have significantly higher stock volatility than straight debt issuers, which is 4% compared to 2%. The disagreement among investors is significantly higher as well, 30% to 16%. The differences between convertible debt and equity offerings are smaller. Firms that issue equity offerings have significantly higher stock volatility relative to convertible issuers. The t-statistic provides support, because both are 4% in table 2. The disagreement is significantly higher for convertible bond issuers. The proceeds of the offerings are significantly the highest for straight debt issues, which is 597 million relative to 262 million for convertible bonds, and 138 million for equity offerings. However, this is not consistent with the relative issued amount to total market capitalization. Both convertible bond and equity offerings have a relative issued amount of 18% that do not significantly differ from each other, but are significantly larger than the 12% of straight debt offerings.

The variables that measure the effect of information asymmetries besides stock volatility and disagreement among investors are tangibility and research & development intensity. One can see that the straight debt issuers have significantly higher tangibility (66% to 42%) and lower R&D intensity (2% to 68%) than convertible bond issuers. These data statistics are in line with the rationale of Brennan & Schwartz (1988).

4 Empirical results

The results section is split up into four subsections. The first one reports univariate analyses of stock volatility and disagreement among investors. The second subsection reports results whether the uncertainty about the company risk, which is denoted as stock volatility, and disagreement among investors have large explanatory power on the firm's financing decision between convertible debt, straight debt, and equity offerings. The third subsection describes results of the effect of stock volatility and disagreement on the announcement returns of convertible debt. The last subsection reports the effect of stock volatility and disagreement on the offering discount of issuing companies. Eventually, the tests conclude whether the uncertainty about the company risk and disagreement among investors of firms: (1) are the largest significant determinants to issue convertible debt relative to other types of financing; (2) are amplifying factors in the evaluation by investors on the stock price; or (3) have an effect on the discount of convertibles for issuing firms.

4.1 Univariate analyses

This research starts with the univariate analyses of stock volatility and investors' disagreement. Table 3a displays the count of observations of each issue type (convertibles, equity, and straight debt offerings) for the quantiles of stock volatility. Table 3b lists the count of observations of each issue type for the quantiles of disagreement among investors. One can see an upward trend of convertible and equity offerings and a downward trend of straight debt issues from the 1st to the 4th quantile of stock volatility. The upward and partly the downward trend can be found from the 1st to the 4th quantiles of disagreement as well.

Table 3a. Quantiles of stock volatility.

Issue type	1st quantile	2nd quantile	3rd quantile	4th quantile
Convertibles	141	291	317	378
Equity	415	808	1,147	1,393
Straight debt	1,443	899	534	227

Table 3b. Quantiles of disagreement among investors.

Issue type	1st quantile	2nd quantile	3rd quantile	4th quantile
Convertibles	197	262	291	377
Equity	943	702	1,002	1,116
Straight debt	859	1,035	704	505

Figures 1a and 1b display a clearer view of the trends with the percentages of each issue type in the quantiles of the stock volatility and disagreement among investors.

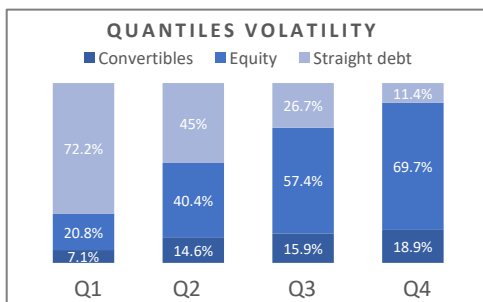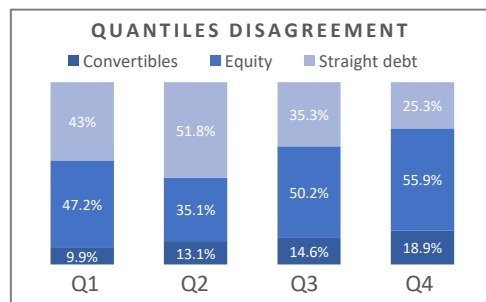**Figure 1a.** Quantiles of stock volatility.

Figure 1b. Quantiles of disagreement among investors.

The relative number of straight issues are significantly lower in the 4th quantile relative to the 1st quantile, which is 11.4% to 72.2% for stock volatility and 25.3% to 43% for disagreement among

investors. The relative number of convertibles are significantly higher in the 4th quantile compared to the 1st quantile, which is 7.1% to 18.9% for stock volatility and 9.9% to 18.9% for investors' disagreement.

4.2 Stock Volatility and Investors' Disagreement on the Convertible Debt Choice

This section studies whether stock volatility, disagreement among investors and other control variables are determinants of the choice between convertible debt and equity or straight debt. Table 4 reports the results of the multinomial logit regressions. Convertible debt is the baseline outcome. A positive (negative) coefficient sign reflects a lower (higher) probability of choosing convertibles over straight debt and equity. First, the models are calculated with only the stock volatility and disagreement among investors. The only control variable included is the number of analysts that executed a forecast. This provides a more robust outcome of the proxy for investors' disagreement.

One can see that the stock volatility and disagreement among investors have a significantly negative coefficient in the models presented in columns 1 and 2. The coefficient remains significantly negative when other control variables are added to the models, which are presented in columns 3 and 4. Although the regression models include only firm-specific explanatory variables, the pseudo-R^2 (27% and 30%) is very high for both. In line with hypotheses H1a and H1c, the results show that firms with high stock volatility and large dispersion of opinions among investors are significantly more likely to issue convertible bonds than to issue straight debt bonds. These findings are consistent with the theories of Green (1984), Brennan & Kraus (1987), and Brennan & Schwartz (1988), which all imply that convertibles are capable of mitigating risk-related financing costs. It is consistent with the sequential-financing rationale of Mayers (1998) as well, if stock volatility is also taken as a proxy for the level of uncertainty regarding the value of future investment options. The findings are also consistent with the survey of Bancel & Mittoo (2004) in which convertibles were preferred in high volatile stock markets, as well as the empirical finding of Chang, Chen & Liu (2003) that concludes more focused firms issue relative more convertible bonds. Focused firms are less diversified and hence more volatile, which increases the uncertainty about the present and future risk of the firm. Furthermore, Dutordoir & Van De Gucht (2006) have very similar results, even when they include macroeconomic and country-specific variables.

The models presented in columns 5 and 6 show significant effects of stock volatility and investors' disagreement on the choice between convertibles and equity financing when other control variables besides the number of analysts are not included. However, the significance disappears in the extended models presented in columns 7 and 8. Stock volatility and investors' disagreement are thus not determinants of the choice between convertible debt and equity. Hypotheses H1b and H1d are

Table 4
The Effect of Stock Volatility and Investors' Disagreement on the Choice between Convertible, Straight Debt, and Equity Offerings

This table reports results of a multinomial logistic analyses of firms' choice between convertibles, straight bonds, and seasoned equity. The sample consists of 1,127 convertible debt offerings, 3,103 straight bond offerings, and 3,763 seasoned equity offerings made by U.S. firms, or 7,993 security offerings in total. Regressions 1 until 4 are the results of straight debt versus convertibles, and regressions 5 until 8 are the results of equity offerings versus convertibles. Convertible debt is the baseline outcome. A positive (negative) coefficient sign reflects a higher (lower) probability of choosing equity and straight debt over convertibles. Independent variables are defined in the Appendix. The robust Wald-statistics are displayed between parentheses. *, ** and *** indicate significance at less than the 10%, 5% and 1% levels.

	The Choice between Convertible debt, Equity and Straight Debt Offerings							
	Straight debt versus Convertibles				Equity versus Convertibles			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Volatility	-74.39***		-36.04***	-24.82***	8.82***		-2.19	-1.94
	(-23.04)		(-11.20)	(-7.00)	(4.88)		(-0.93)	(-0.74)
Disagreement		-0.49***	-0.19**	-0.20**		-0.11**	-0.10	-0.10
		(-5.83)	(-2.23)	(-2.32)		(-2.50)	(-1.64)	(-1.54)
Number of analysts		0.08***	-0.04***	-0.02**		-0.09***	-0.02***	-0.02**
		(13.54)	(-4.49)	(-2.44)		(-13.01)	(-3.13)	(-2.35)
Firm size			0.79***	0.70***			-0.26***	-0.21***
			(22.63)	(16.24)			(-7.63)	(-5.05)
Financial distress (Z-score)			0.26	0.01			0.87**	0.01***
			(0.48)	(1.05)			(2.26)	(2.70)
Leverage			0.78**	0.83**			1.06***	1.14***
			(2.48)	(2.52)			(3.83)	(3.94)
Market-to-Book			-0.08**	0.05			-0.09***	-0.04
			(-2.24)	(1.11)			(-3.25)	(-1.30)
Tangibility				0.83***				0.14
				(6.16)				(1.24)
Illiquidity				1.16***				1.03***
				(3.81)				(3.50)
R&D dummy				-0.10				-0.36***
				(-0.92)				(-3.83)
R&D intensity				-4.71***				0.00
				(-6.07)				(0.30)
Stock run-up				-0.64***				0.02
				(-3.39)				(0.39)
Dividend-paying				0.99***				0.26**
				(8.99)				(2.33)
Constant	0.73***	0.29***	-3.75***	-4.42***	0.88***	1.86***	3.05***	2.47***
	(4.16)	(29.40)	(-12.39)	(-11.72)	(11.81)	(29.57)	(11.79)	(7.33)
Pseudo R^2	0.12	0.10	0.27	0.30	0.12	0.10	0.27	0.30
Obs.	7,993	7,963	6,976	6,815	7,993	7,963	6,976	6,815

rejected. These results are inconsistent with the theoretical explanation argued by Stein (1992). He argues that firms issue convertibles as 'delayed-equity'. Although the coefficients of stock volatility and disagreement among investors are negative, they are not significant. This means that convertible bond issuances are not used as backdoor equity. Dutordoir & Van De Gucht (2006) find similar results; convertibles are used as sweetened debt and not as 'delayed-equity'. However, the results in model 8 are inconsistent with the quantitative study of Lewis, Rogalski and Seward (1999) and the qualitative study of Bancel and Mittoo (2004). They both find support for the 'delayed-equity' hypothesis. It is difficult to conclude whether the theory of Stein (1992) is the most plausible reason for managers to decide between convertibles and equity, due to the mixed evidence.

Other control variables that have a significant effect on the choice between convertible debt and straight debt are consistent with the predictions. Larger companies prefer to issue straight debt; firms with high leverage prefer to issue straight debt; the two asymmetric information proxies tangibility and R&D intensity are consistent with each other: firms with more tangible assets have less asymmetric information and therefore prefer straight debt; firms with higher research and development intensity have more asymmetric information and therefore prefer to issue convertibles; firms with illiquid stocks

prefer straight debt; firms' stocks with a large return prior to the issue prefer convertibles because stocks are more expensive; firms that pay dividend are characterized by being more stable, and prefer to issue straight debt bonds.

Control variables that do have a significant effect and thus are determinants of the choice between convertible debt and seasoned equity are the size of the firm, the financial distress of a firm, the leverage ratio, the illiquidity of stocks, whether a firm reports the research and development costs publicly (R&D dummy) and whether a firm pays dividend. Larger firms prefer convertibles likely because of the tax-shield benefits; firms with lower chance of bankruptcy (higher Z-scores) prefer to issue seasoned equity, although this effect is nihil (0.01); highly leveraged firms prefer to issue seasoned equity; firms that have more illiquid stocks prefer seasoned equity, which is inconsistent with the prediction of Bharath, Pasquariello and Wu (2008) who attribute equity illiquidity to exogenous information asymmetry and hence larger use of debt; however, it can be explained by the results of Yu (2009) that using debt itself causes the lower liquidity of equity and that the companies tend to use equity financing when the stock liquidity is low; firms that report their research and development costs publicly prefer convertibles, which is inconsistent with the prediction of asymmetric information as well; dividend-paying firms are often stable and larger firms that prefer seasoned equity.

4.3 Stock Volatility and Investors' Disagreement on the Announcement Returns of Convertible Issues

Table 5 reports the cumulative abnormal returns around the dates of the convertible debt, equity and straight debt issues with an estimation window of [-1;1]. One can see that the announcement returns of all issue types are negative in this sample. Investors evaluate and react significantly the worst to convertible bond announcements, which is on average -3.26%.

Table 5. Cumulative abnormal returns around the issue date with an estimation window of [-1;1].

Issue type	CAR [1;1]	Convertibles vs. Equity	Convertibles vs. Straight Debt	Equity vs. Straight Debt
Convertibles	-3.26%			
Equity	-1.67%	-6.47***	-14.37***	-12.46***
Straight debt	-0.04%			

Table 6 reports the effect of the stock volatility and disagreement among investors on the cumulative abnormal returns of the convertible announcements. Model 1 displays the simple OLS regression with stock volatility as the independent variable on the announcement returns with event window [-1;1]. Stock volatility without control variables has a significantly negative effect on the abnormal returns of convertible bond offerings. An increase of 1% in stock volatility decreases the cumulative abnormal returns on average by 0.56% around the issue date. The R-squared is 0.02 which means that the stock volatility on its own is a bad predictor of future announcement returns of

convertible bonds. However, the low P-value still indicates a true relationship; investors evaluate riskier firms that issue convertible debt even worse.

Models 3 and 4 are extended with various control variables including fixed year and industry effects, to check for robustness of the stock volatility effect. The fixed year and industry effects are added to observe whether they capture the variation in data caused by falling or rising trends in the announcement returns of convertibles issues, stock volatility, disagreement and other control variables and to check if time-invariant unobservable industry factors affect the announcement returns. The effect of the stock volatility remains significant and negative, but has dropped to 0.41% in model 3 and 0.42% in model 4 on average, ceteris paribus. These results are not in line with hypothesis H2a. Stock volatility does not have a significantly positive effect on the announcement returns. Announcements of convertible bonds issued by riskier firms are evaluated more unfavorably by investors.

Table 6
The Effect of Stock Volatility and Investors' Disagreement on the Announcement Returns of Convertibles Issues

The sample consists of the convertibles issues of firms from the United States between 2000 until 2014. This table presents the results of OLS regression models estimating the relation between the announcement returns of convertibles and the characteristics of firms. The dependent variable in models 1, 2, 3 and 4 is the cumulative abnormal returns at the issue date with an estimation window of [-1;1]. All variables are trimmed at the upper and lower 0.5-percentiles. Variable definitions are provided in the Appendix. The variable fixed year effects denotes whether fiscal year fixed effects are included in the specification. Fixed industry effects, according to the Fame-French 12 industries code, denote whether fixed industry effects are included in the specification. The *t*-statistics are displayed between parentheses. *, ** and *** indicate significance at less than the 10%, 5% and 1% levels. The *t*-statistics are computed using standard errors robust to both clustering (i.e., dependence) at the firm level and heteroscedasticity.

Convertible Issues and Announcement Returns				
Variables	(1)	(2)	(3)	(4)
Volatility	-0.56***		-0.41**	-0.42**
	(-3.95)		(-2.10)	(-1.98)
Disagreement		-0.01***	-0.01**	-0.01**
		(-3.41)	(-2.05)	(-1.96)
Number of analysts		0.00***	0.00	0.00
		(3.19)	(1.36)	(0.65)
Firm size			0.00	0.01*
			(0.49)	(1.72)
Financial distress (Z-score)			0.00	0.00
			(0.98)	(1.15)
Leverage			0.03	0.01
			(0.03)	(0.34)
Market-to-Book			-0.00	0.00
			(-0.19)	(0.22)
Tangibility				0.00
				(0.28)
R&D dummy				0.01
				(0.99)
R&D intensity				-0.00
				(-0.35)
Stock run-up				0.01
				(0.55)
Institutional ownership				-0.01
				(-0.68)
Relative size: Proceeds ÷ market value of equity				-0.06**
				(-2.21)
Illiquidity				0.04***
				(3.40)
Dividend-paying				0.00
				(0.25)
Constant	-0.01***	-0.04***	-0.08***	-0.10**
	(-2.62)	(-10.07)	(-2.17)	(-2.22)
Fixed year effects	No	No	Yes	Yes
Fixed industry effects	No	No	Yes	Yes
Adj. R²	0.02	0.00	0.08	0.12
Obs.	1,106	1,103	866	787

Subsequently, the effect of disagreement among investors on the cumulative abnormal announcement returns of convertible bonds is examined. Model 2, that includes the investors' disagreement and the number of analysts as a control variable, reports a significantly negative effect. The number of analysts needs to be added in the model to provide a more robust effect of the disagreement proxy which is derived from the forecasts of those financial analysts. The coefficient shows a small significantly negative effect of -0.01 on the announcement returns. This means that an increase of 1% in the dispersion of opinions between investors, decreases the abnormal announcement returns with 0.01%. This effect remains significant and keeps the same absolute rounded value as the coefficient. The very low R-squared of 0.00 means that the disagreement among investors on its own is a bad predictor of future announcement returns of convertible bonds. However, the low P-value still indicates a true relationship. These results are not in line with hypothesis H2b. Investors' disagreement does not have a significantly positive effect on the announcement returns. Announcements of convertible bonds issued by firms that have larger disagreement among investors are evaluated more unfavorably.

The results of stock volatility are consistent with the papers of Lewis, Rogalski & Seward (1999) and Duca, Dutordoir, Veld & Verwijmeren (2012). However, the firm's individual stock volatility is not the primary firm-specific variable in the work of Duca, Dutordoir, Veld & Verwijmeren (2012). The financial slack of a firm, which is not included in this model, is the largest determinant. Furthermore, the firm's size and the total amount of proceeds are not significant in their model. They include macroeconomic variables that appear to be determinants as well. The interest rate, the term spread, and the market volatility have significant effects on the convertible debt announcement returns. The results in table 6 are also inconsistent with the findings of Chang, Chen & Liu (2004). They find that the stock market responds more favorably, instead of less favorably, to the announcements of convertible offerings by focused and hence more volatile firms than to those by diversified firms.

The other variables that have a significant effect on the cumulative announcement returns of convertible bonds in model 4 are the relative firm size, the relative size of the issue to market value of equity, and the illiquidity of the firm's stock. The relative firm size has a positive effect of 0.01 at the 10% significance level, which means that larger firms have less negative returns. An increase of 1% in relative market capitalization, increases the return 0.01% on average, ceteris paribus. Larger firms tend to be less risky, which could explain the less severe reaction of the market. The relative size of the convertible bond issue has a negative effect of -0.06 at a 5% significance level. An increase of 1% of the relative size, decreases the announcement returns with 0.06% on average, ceteris paribus. The general negative market reaction of convertible bonds' announcements is thus amplified by its size.

The R-squared of model 4, which includes control variables, is still not very convincing; it has only 12% explanatory power of the variability of the cumulative announcement returns. Since the

announcement returns of convertible debt offerings are statistically significant and negative, these results are consistent with the conclusion of Dann & Mikkelson (1984). Convertible debt offerings convey unfavorable information about the issuing firms, but the specific nature of such information remains unidentified and there are not yet models available with large explanatory power. However, we can conclude that the uncertainty about the company risk, as in stock volatility, is the primary determinant of the variation in convertible offering returns. Disagreement among investors does not explain much.

4.4 Stock Volatility and Investors' Disagreement on the Discount of Convertible Bond Issues

Firms with weaker negotiation power have to offer a discount to attract potential buyers, so the discount would be larger. With a stronger negotiation power, the discount would be lower. The lower the discount, the better the financing is for the firm. In table 2, one can see that the average discount rate is 14% for the total convertible bonds sample. We predict that firms with higher uncertainty about the company risk and larger dispersion among investors have weaker negotiation power. Table 7 reports the effect of stock volatility and disagreement among investors on the discount rates of convertible bonds. Model 1 shows that stock volatility is significantly positive when isolated from control variables. An increase of 1% in stock volatility results in a 4.79% higher discount rate of convertible bond issues on average. The R-squared (16%) is relatively high for a model that only includes one variable. On first sight, stock volatility seems to have a large effect and explains much of the variance of the discount rates of convertibles. Model 2 reports a significantly positive effect of investors' disagreement on the discount rates of convertibles. If the disagreement among investors is 1% larger, the given discount rate is on average 0.04% higher. This minor model, with only disagreement among investors and number of analysts as variables, has lower explanation power than stock volatility does. In an economic context, the R-squared of 7% is not very low for a model that excludes many control variables.

To find the most robust effects of stock volatility and disagreement on the discount rates of convertible bonds, we add more firm-specific and fixed effects control variables. One can see in model 4 that the effects are still significant and positive. The coefficient of stock volatility increased to 5.50 and the coefficient of investors' disagreement decreased to 0.02. The final interpretation is as follows: an increase of 1% of stock volatility and disagreement among investors results on average in a 5.5% and 0.02% increase of the discount rates of convertible bonds, all else equal. Model 4 has an R-squared of 42%, which is very high for a model that only includes firm-specific variables, and thus not macro variables. Firm-specific variables can explain the variation in discount rates well. These results are in line with both hypotheses H3a and H3b; stock volatility and investors' disagreement do have a significantly positive effect on the discount rate of convertible bonds and thus the negotiation power of firms. The

Table 7

The Effect of Stock Volatility and Investors' Disagreement on the Discount Rates of Convertible Bonds

The sample consists of the convertibles issues of firms from the United States between 2000 until 2014 denoted in fiscal years. This table presents the results of OLS regression models estimating the relation between the firm's discount of convertibles and its characteristics. The dependent variable in all models is the discount of convertibles for the issuing company. All variables are trimmed at the upper and lower 0.5-percentiles. Variable definitions are provided in the Appendix. Fixed year effects denote whether fiscal year fixed effects are included in the specification. Fixed industry effects, according to the Fame-French 12 industries code, denote whether fixed industry effects are included in the specification. The *t*-statistics are displayed between parentheses. *, ** and *** indicate the significance at less than the 10%, 5% and 1% levels. The *t*-statistics are computed using standard errors robust to both clustering (i.e., dependence) at the firm level and heteroscedasticity.

Variables	Discount of Convertibles			
	(1)	(2)	(3)	(4)
Volatility	4.79***		5.58***	5.50***
	(10.51)		(8.20)	(6.90)
Disagreement		0.04***	0.02***	0.02**
		(4.56)	(2.65)	(2.34)
Number of analysts		-0.01***	-0.00	-0.00
		(-5.60)	(-1.20)	(-1.50)
Firm size			-0.03***	-0.01
			(-3.78)	(-1.49)
Financial distress (Z-score)			0.00	0.00
			(0.91)	(1.11)
Leverage			0.02	0.05
			(0.39)	(0.71)
Market-to-Book			-0.01	0.00
			(-1.38)	(0.19)
Stock run-up				-0.09***
				(-3.27)
Tangibility				0.03
				(1.27)
R&D dummy				0.00
				(0.22)
R&D intensity				0.00**
				(2.47)
Institutional ownership				-0.05
				(-1.11)
Relative size: Proceeds ÷ market value of equity				0.16*
				(1.80)
Illiquidity				0.12*
				(1.95)
Dividend-paying				-0.01
				(-0.41)
Constant	-0.02	0.19***	0.37***	0.26*
	(-1.33)	(15.06)	(3.20)	(1.78)
Fixed year effects	No	No	Yes	Yes
Fixed industry effects	No	No	Yes	Yes
Adj. R²	0.16	0.07	0.39	0.42
Obs.	598	595	487	444

findings of King (1986) and Kang & Lee (1996), who conclude that underpricing is most striking for firms with higher equity betas, are consistent with these results.

Other significant variables are stock run-up prior to the issue date, research and development intensity of the firm, relative size of the convertible issue, and the illiquidity ratio of the firm's stocks. The following effects consider all other variables to be equal in the model. An increase of 1% of the stock run-up 76 trading days prior to the announcement date strengthens the negotiation power of firms with a 0.09% decrease on average of the discount rate. The research and development intensity, which is the total amount of expenditures of research and development divided by the total sales, has a significantly positive percentage effect of less than two decimals on the discount rate, which is almost nihil. The relative convertible issue size of the bond to the firm's market capitalization is the second largest determinant in this specific model. The larger the issue size, the weaker the negotiation power becomes for the issuing firms. An increase of 1% of the relative issue size, increases the discount rate by 0.16%

on average. The final significant variable is the Amihud illiquidity ratio. An increase of 1% of illiquidity, on average increases the discount of convertible bonds by 0.12%, which is in line with Lhabitant (2002). The most likely reason is that convertible bond buyers require an additional liquidity premium if the conversion leads to less liquid stocks than the general market. Illiquidity lowers the negotiation power of issuing firms and therefore these firms have to provide higher discounts.

The primary determinant for the discount rate is stock volatility. The effect is very large relative to the average of 14% in the convertibles sample; an increase of 1% in stock volatility results into discount rates that are 5.5% higher.

5   Conclusion

The goal of this study is to shed light on the effect of the uncertainty about the company risk, as in stock volatility, and the disagreement among investors on the choice for convertible bonds compared to straight debt bonds and equity. Additionally, it examines the effect of stock volatility and investors' disagreement on the announcement returns and the discount rate of convertibles. Existing literature predicts that convertible bonds are preferred over straight bonds if a firm has high and indeterminate risk. This is explained by the interest rate insensitivity of convertible bonds. The results are consistent with this prediction. Firms with higher stock volatility prefer convertibles relative to straight debt bonds. Besides the stock volatility, the prediction is that the disagreement among investors might lead to overinvestment problems by stockholders, and may be associated with increased uncertainty. Firms with larger investors' disagreement do prefer to issue convertible bonds relative to straight debt bonds, which also is in compliance with the prediction.

Adverse selection costs could arise for issuing firms with uncertainty about their company risk. The prediction is that firms associated with high adverse selection costs prefer convertible debt as 'delayed equity' financing with the assumption that there is a call option. The firm could call the bondholders to convert the total debt into shares. The results are inconsistent with this prediction. Riskier firms do not have a significant preference between convertible bonds and seasoned equity issues. The same reasoning is also associated with disagreement among investors, which is inconsistent with the prediction as well.

Further analysis is done on the variation of announcement returns of convertible bonds. Existing literature provides evidence for both positive and negative abnormal returns. However, the abnormal announcement returns for U.S. firms are generally negative. Stock volatility is the primary determinant of an investor's evaluation of the announcement of convertibles. It has a significantly negative effect. Disagreement among investors is also a determinant for the announcement returns of convertible debt offerings, but has much smaller impact than the stock volatility and other variables like the relative issue size to market capitalization and illiquidity of the stocks. Information asymmetries proxies, like tangibility and R&D intensity, are not found to be determinants.

The final result is that stock volatility is the main determinant of the discount rate value of a convertible bond. Riskier firms are less attracted by bondholders that require a return for the extra risk they have to bear. The discount provides this additional return. Disagreement among investors does influence the discount rate as well, but significantly less than stock volatility. The prediction was a positive effect because firms have weaker negotiation power if the dispersion of opinions between investors is large. Other determinants for the discount of convertibles are the stock run-up, the R&D intensity, the relative issue size to market capitalization, and the Amihud illiquidity ratio of stocks.

6   Discussion

Finally, this paper is confined by its temporal scope and thus has a few caveats. This paper only includes micro variables, particularly company financials. This is a limitation to the robustness of the results. Future studies could pay more attention to the macro determinants of the choice of financing, announcement returns, and the discount on convertible bonds. Trends in interest rate could affect the financing climate of firms, especially for straight debt. In this paper and other studies, hot and cold convertible bond markets are observed, which could possibly be better explained by macro variables. The effects of the variables might change when macro variables are included in the regressions. Furthermore, other proxies of investors' disagreement could be used to check for similar results; qualitative data selection, which is time-consuming, might be a better approach.

Lastly, the results could be specific for certain countries and economic markets. This study only contains American firms. Managers of companies in developed markets located in other areas e.g., Europe could have other significant motivations than the uncertainty of their firm's risk to issue convertible bonds. The characteristics of emerging markets could also limit the ability to issue convertibles for such firms. It is often difficult to obtain information on companies listed on their stock markets. Furthermore, it may not be easy to sell debt, such as corporate bonds, on the secondary market. All these components raise the risk. This could either strengthen or weaken the motivations for such companies to issue convertibles.

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Appendix

Variable descriptions

Volatility

> denotes the standard deviation of the daily stock returns estimated over trading days -240 to -40 relative to the announcement date.

Disagreement

> is the analyst forecast of the standard deviation of the earnings per share divided by the absolute mean value of earnings per share retrieved from the I/B/E/S database.

Number of analysts

> is the number of unique analysts that did a forecast prior to the issue date in the same year.

Firm size

> is the logarithm of the total assets.

Financial distress (Z-score)

> is calculated according to the Altman z-score. The Altman Z-score is an estimate of the probability of a firm's bankruptcy and is calculated as 1.2 (Working capital / Total assets) + 1.4 (Retained earnings / Total assets) + 3.3 (EBIT / Total assets) + 0.6 (Market value of equity / Book value of liabilities) + (Sales / Total assets).

Proceeds ÷ market value of equity

> is the issue size; value of the issue divided by the market value of equity.

Leverage

> is the total debt divided by the total assets.

Market-to-book

> is the market value of equity divided by the total assets.

Tangibility

> is the total tangible assets divided by the total assets.

R&D dummy

> states whether a firm publish the research and development costs publicly.

R&D intensity

> is defined as expenditures by a firm on its research and development (R&D) divided by the firm's sales.

Discount

> is the difference of the theoretical convertible price minus the offer price divided by the theoretical price. The discount is for the issuer.

Dividend payer

> denoted whether a firm pays dividend.

Institutional ownership

> is the percentage of convertibles owned by the institutions.

Illiquidity

> is calculated according to illiquidity measure of Amihud.

Stock run-up

> is calculated as the stock return over trading days −76 to −2 relative to announcement date.