An Investigation of Death Spiral Convertible Bonds

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ABSTRACT

Floating-priced convertibles give buyers a right to convert a bond into equity at a stated discount percentage below market prices, which gives buyers the opportunity to always buy below market, sell at market, and make a profit. However, the conversion dilutes the value of other shareholders and depresses the stock price. This paper tries to find out what type of firms are willing to issue floating-priced convertibles, given their "toxic" nature. Based on a hand-collected data with matching non-issuers, we find young firms with more asymmetric information are more likely to issue floating-priced convertibles. Firms that are illiquid before the first floating or fixed-priced convertible debt issuance are more likely to suffer steeper price declines after issuance. Illiquid firms are subject to more asymmetric information and outside investors tend to react more negatively to unfavorable information on those firms.

Keywords: Floating-priced convertibles, Asymmetric information, Conflict of interest

INTRODUCTION

Floating-priced convertible bonds give the bondholder the right to convert the bond into equity at below market prices. This differs from traditional convertibles because there is no fixed conversion price. Instead, the conversion price automatically resets as a percent of current market price of the stock if the firm's stock price falls below the conversion price at the time of issuance. As the process repeats itself the stock's price spirals downwards. This process benefits the bondholders at the cost of the shareholders.

For example, for fixed-priced convertibles with conversion price of $1, the buyer can convert at the price of $1 regardless of the market price of the stock. On the other hand, if the stock is trading at $1, with floating-priced convertibles of 50 percent discount, the buyers can convert at the price of $0.50. If it's trading at $.01 buyers can convert for $.005, and so on. No matter what price the stock is trading at, the buyer can always "buy low and sell high." This discount can have a negative impact on a company's stock price because the buyers of these bonds can get massive amounts of shares upon conversion. The increase in the number of shares from the conversion causes dilution, which makes other stockholders' shares less valuable because they will own a smaller percentage of the company. The buyers then short sell the company stock and cover their shorts with discounted stock. This short selling can further depress the stock price. The name "death spiral" comes from the decline in stock price and increased dilution among companies that issue floating-priced convertibles.

Floating-priced convertibles fall under the category of structured private investment in public equity (PIPE). It was initially created in the late 1990s and gained renewed attention recently when investors made millions of dollars by financing penny stocks instead of trading them. When markets are efficient, investors have to sustain a given amount of risk for a given return. However, floating-priced convertibles offer a very low risk for investors with high returns.

Given their "toxic" nature, this paper tries to find out what type of firms are willing to issue floating-priced convertibles. This paper also examines what firm characteristics will cause stock price to drop more after issuing floating or fixed-priced convertibles.

Floating-priced convertible bonds are private placements in public equity which makes them unavailable in traditional databases such as Bloomberg Terminal or Mergent. Therefore, we hand-collected data over the period of January 2010 to December 2016 from 10-Ks or 10-Qs in the SEC-Edgar database and websites such as Nasdaq.com, Google Finance, and Yahoo Finance. The final dataset has a total of 396 observations with 326 issues of floating-priced convertible bonds from 30 issuers and 70 issues of fixed-priced convertible bonds from 19 matching non-issuers. Matching non-issuers are fixed-priced convertible bond issuers with matching industry and firm size at the first issuance. It is our control group.

We find floating-priced convertible bond issuers spread over more industries compared to Hillion and Vermaelen (2004). However, biological and technology sectors still represent more issuers. In addition, firms are more aggressive in giving conversion discount now than firms 20 years ago in Hillion and Vermaelen (2004). The prevailing median discount rate is 52 percent now, which is three times more than the 17 percent in Hillion and Vermaelen (2004). Therefore, issuers are giving more profit to attract buyers to finance the firms.

Wilcoxon rank-sum test shows that firms with more debt before the first issuance is more likely to issue floating-priced convertible bonds; however, this is not supported by using the binary logit model. To our surprise, the firm's profitability before the first issuance is not significantly different between issuers and non-issuers, and does not have a significant explanatory power to predict the likelihood of issuing floating-priced convertibles. Younger firms are more likely to issue floating-priced convertible bonds. Less liquid firms do suffer a greater price drop in their equity after the first issuance.

The rest of the paper is organized as follows. Section 2 summarizes the literature review. Section 3 develops the working hypotheses and empirical predictions. Section 4 describes the data. Section 5 demonstrates the methodology and results. Section 6 concludes.

LITERATURE REVIEW

Public firms' choice of financing method is an important area that is being widely researched. Our literature review focuses on three areas from boarder to narrower scope. First, why do public firms choose to use private investment in public equity (PIPE)? Second, among PIPE, why do they choose to use convertible debt? Third, if firms use convertible debt, why do they choose to use floating-priced convertible debt?

Private Investment in Public Equity

An influential seminal work is Myers and Majluf (1984), which states that asymmetric information determines the order of external financing. Public firms, especially firms with severe asymmetric information, follow a pecking order, choosing funds with lower information cost first, such as debt instead of equity. Hertzel and Smith (1993) extend Myers and Majluf (1984) by assuming private investors can obtain firm information through direct negotiations with management. They find undervalued firms with an asymmetric information problem tend to use private placements of equity instead of public issues. By doing that, firms reduce the underinvestment problem in Myers and Majluf (1984) and lower undervaluation loss. They consider the discount that private placement investors get as the compensation to assess firm value and the positive announcement return as the reward to signal favorable inside information that the firm is undervalued.

Gomes and Phillips (2006) argue that in private placements more information can be obtained by the investors during the due diligence process. Thus, the asymmetric information effects can be reduced in the private market. They find firms' likelihood of issuing convertibles and equity increases slightly with more asymmetric information, but the likelihood of issuing debt is reduced. This is opposite of what Myers and Majluf (1984) predicted for the public market. Gomes and Phillips (2006) also find that when the firms have more information asymmetry, they tend to issue in the private market more for all security types, with equity being most sensitive and debt least sensitive. They also find smaller firms with more research and development expense and worse profitability prior to offering are more likely to issue in the private market. Chen, Dai and Schwartzberg (2010) examine firm's choice between seasoned equity offerings and private placements. They show firms with high information asymmetry and weak operating performance are more likely to choose private placements as it may represent the last resort for those firms.

They also show when the general market and firm's stock are performing poorly, firms tend to choose private placements. They also find firms choose private placements as a cheaper way of financing than traditional seasoned equity offerings.

Hertzel, Lemmon, Linck and Rees (2002) investigate 619 public firms that issued private placements of equity from 1980 to 1996 and find a positive reaction to private placements, but a negative reaction to public seasoned equity offerings. However, those private equity placements tend to follow poorer post-issuance performance than public seasoned equity offerings which typically have above average operating performance after issuance. They find the private equity offerings are sold at substantial discounts compared to market value, which reflects the true estimates the private investors place on the firm. Ellis and Twite (2012) propose firms with uncertain growth prospects tend to choose private equity placements. Those firms typically face uncertainty in future cash flows but invest heavily in research and development. Those firms typically have less sales, less profitability but more patents.

Wu (2004) states that asymmetric information and monitoring demand are two potential determinants of financing choice between public offerings and private placements. Wu finds firms with more asymmetric information are more likely to choose private placements. However, no evidence supports a monitoring role related to private placements. Instead, based on the sample of 360 private placements and 728 public offerings by high technology public firms from 1986 to 1997, the firms with private placements are less likely backed by investors with good monitoring ability (venture capitalists or institutional investors). Therefore, public firms' choice of private placements are not motivated by monitoring. Furthermore, Wu finds that when managers' initial ownership is small, they tend to expropriate existing shareholders by converting shares at a larger discount in the private placements. Wu concludes that private placements could be motivated by managers' self-interest rather than better monitoring. Krishnamurthy, Spindt, Subramanian, and Woidtke (2005) find that after controlling for participating investor identity and financial distress, the positive announcement return and long-term negative post issuance abnormal return disappear. When shares are placed with affiliated investors, rather than with unaffiliated investors only, the announcement return and long-term post issuance return are both significantly higher.

Convertible Debt

It is widely acknowledged that there are implausible and plausible motives to issue convertible debt instead of straight bonds or equity (Dutordoir, Seward, & Veld, 2014). The Free-lunch hypothesis is reported as an implausible motive in Ross, Westerfield, and Jaffe (2016). Convertible debt is cheaper than straight debt because it carries a lower coupon rate and is cheaper than equity because it has a higher conversion price than the stock market price at issuance. However, this reasoning ignores the fact that the lower coupon rate of the convertible bonds is to compensate the issuers for giving convertible bond buyers the option of future capital gains. Similarly, conversion prices cannot be compared with current market price at issuance as this is an option with interest, rather than a current sale. Contrary to the free-lunch hypothesis, the plausible motive argues that convertible debt is an alternative financing mechanism for firms when straight debt and equity are too costly to issue.

Green (1984) focuses on the agency problem between debtholders and stockholders. He argues that convertible debt is used as a tool to mitigate the agency cost between

debtholders and stockholders as the convertibility allows debtholders to share any cash flows from risky projects. It limits the asset substitution problem in Jensen and Meckling (1976). Stockholders have less incentive to take risky but negative NPV projects, which lowers the financing cost of the firm. Dorion, Francois, Grass and Jeanneret (2014) develop an economic measure of shareholders' risk-shifting incentive in both Jensen and Meckling (1976) and Green (1984), and document that the propensity to issue convertible debt increases with higher risk-shifting incentive. The stock market also reacts more negatively following the convertible debt issuance announcement when the risk-shifting incentive is higher.

Mayers (1998) considers another agency problem between managers and outside shareholders with multi-stage investment projects. He suggests that issuing convertibles is better than rolling over straight debt, as the convertible debtholders have the option to convert bonds to equity when the investment option works well and to redeem the bonds when over-investment happens and projects are not profitable. The flexibility of the convertibles lowers its financing costs. Lyandres and Zhdanov (2014) state that convertible debt can also mitigate or even potentially eliminate the under-investment problem proposed in the Myers (1977) paper. When equity values are lower, managers tend to increase equity sales to dilute the equity component of the convertible debt and delay the optimal conversion of convertible debt. This increase in investment offsets the under-investment problem resulting from the debt feature of the convertibles.

Another major stream of literature focuses on asymmetric information and adverse selection as incentives for firms to issue convertible debt instead of equity. Stein (1992) builds on Myers and Majluf (1984). Due to asymmetric information about firm value between inside and outside shareholders, outside shareholders view issuing equity as a signal of overvaluation of the firm. This amplifies the cost of issuing equity more than convertible debt because the latter only has a lower equity component and is unlikely to be converted immediately. Therefore, convertible debt reduces adverse selection costs. Nyborg (1995) assumes that calling convertible debt sends a negative signal to the market as issuing callable convertibles and forcing conversion early incurs adverse selection costs twice. Therefore, managers will only try to forcefully call the convertibles early if the outlook of the potential capital gain is good. His model finds that only voluntary conversion of convertibles can retain the benefits of convertibles as delayed equity. Chakraborty and Yilmaz (2011) suggest the adverse selection costs can be avoided by issuing callable convertible debt with call only possible when stock price exceeds a certain level. Managers can only force conversion when sufficient positive information is released to the market that pushes stock price above the triggering call price. Because future favorable information is related to the initial private information, mangers are more likely to call early if their initial private information is more favorable. The authors believe this design of convertible debt can completely solve the asymmetric information from the beginning.

Lewis, Rogalski and Seward (2001) argue that issuance of convertible debt is not motivated by reduction of financing costs of straight debt or equity. Instead, they argue that it is used as a way to ration the participants in the seasoned equity offerings. They find the convertibles do not convey efficient investment incentives, since firms, on average, underperform after issuance of convertible debt. Brown, Grundy, Lewis and Verwijmeren (2012) show firms with high cost in issuing seasoned equity offerings tend to issue convertibles to obtain funds at a lower cost. The convertibles are more likely issued in

private placements to hedge funds when firm characteristics indicate a low cost of short sale.

The empirical studies on motives in issuing convertible debt are mixed. Dutordoir, Lewis, Seward and Veld (2014) summarize very early empirical study in the 1950s and 1960s in the form of survey analysis. The survey finds majority managers use convertibles as backdoor equity. However, Billingsley and Smith (1996) take a new survey and find that managers' incentive change overtime to take advantage of the lower coupon rate of convertibles. Interestingly, Graham and Harvey (2001) survey corporate CFOs and find the responses strongly support the backdoor equity rationale. Dong, Dutordoir and Veld (2013) argue that direct interviews with managers may obtain more accurate results than surveys as the latter are more abstract and concise. Based on their direct interviews, firms with more uncertain future risks tend to issue convertibles. The backdoor equity rationale is also weakly supported. Lewis, Rogalski and Seward (1999) find that some firms use convertible debt to solve the asset substitution problem and some use convertible debt to solve the adverse selection problem. Krishnaswami and Yaman (2008) show that firms with more moral hazard, adverse selection and expected financial distress tend to issue convertible debt instead of straight debt.

Flexible Convertible Debt

There are few studies on the flexible convertible debt, due to the difficulty in getting data. Hillion and Vermaelen (2004) is the only paper that systematically studied this relatively new type of financing method after its creation in the second half of 1990s by US firms. By hand-collecting data from 1994 to 1998, they find flexible convertible debt is used as the last resort financing tool for firms with financial distress that are not able to raise funds through equity or other debt. The conversion discount design of the flexible convertible debt attracts short sales and causes the stock price to plummet after issuance. This is consistent with their faulty contract hypothesis. They also find firms issuing floating-priced convertibles are young, small, risky and mainly in the internet industry. However, over 20 years have passed since the Hillion and Vermaelen sample period. The format and purpose of flexible convertible debt may have changed over time. We are not aware of any study updating how floating-priced convertibles are used by the firms now. Our paper extends the literature by investigating the floating-priced convertibles issued from 2010 to 2016 to detect any developments in the use of floating-priced convertibles in the U.S.

HYPOTHESES

The main purpose of this study is to find out the reason why some firms are willing to issue floating-priced convertible bonds, which is documented in literature and news to have a substantial negative effect on firms' stock price after issuance. Specifically, what kind of firms will choose to issue this particular type of financing? Are there any common characteristics that those firms share? What firm characteristics will result in a deeper price cut after issuing floating or fixed-priced convertibles?

Hypothesis 1: Firms with a higher debt ratio, and thus fewer borrowing options, tend to use floating-priced convertible bonds.

Hillion and Vermaelen (2004) argue that floating-priced convertible bonds serve as the last resort for firms who are financially distressed. Firms with high debt ratios tend to have used up all their borrowing capacity. Therefore, they are more likely to issue floating-priced convertible bonds, as more traditional ways of financing, such as straight debt, fixed-priced convertible debt and equity are just not available to them.

Hypothesis 2: Firms with poorer profitability tend to issue floating-priced convertibles more.

When firms are not as profitable as their industry peers, their borrowing capacity may also be limited. Sometimes, floating-priced convertibles become the only option to help firms to survive difficulty times.

Hypothesis 3: Young firms are more likely to issue floating-priced convertible bonds than matching non-issuers.

Young firms with fewer years of financial data are subject to a more severe asymmetric information problem. Numerous studies (e.g. Myers, & Majluf, 1984, Chen, Dai, & Schatzberg, 2010, and Wu, 2004) find firms with more asymmetric information will choose the financing method with lower information costs. Issuing fixed-priced convertible bonds or even equity may send a negative signal to the market that the firm is overvalued. Therefore, young firms tend to choose floating-priced convertible debt to avoid greater information costs.

Hypothesis 4: Illiquid firms with less trading volume before first issuance of floating or fixed-priced convertibles suffer a greater asymmetric information problem, and thus are more likely to trigger unfavorable market reaction as shown by a stock price drop.

Firms with lower trading volume release less information to the market, therefore are subject to a greater asymmetric information problem. Issuing floating or fixed-priced convertibles may send a more negative signal to the market and result in a greater price decline.

DATA

Floating-priced convertible bonds are private placements in public equity which makes them unavailable in traditional databases such as Bloomberg Terminal or Mergent. Therefore, we hand-collected data over the period of January 2010 to December 2016.

First, we used Google to search for companies issuing floating-priced convertible bonds. By simply typing in different variances of "companies issuing floating-priced convertible bonds" into Google we were able to look through message boards such as Investorhub.com and see if users commented on whether a company was issuing floating-priced convertible bonds. After we found a company that a user mentioned was issuing such financing, we then looked through that company's 10-Ks or 10-Qs in the SEC-Edgar database to see if the company actually issued floating-priced convertible bonds.

Once we confirmed that a company was issuing floating-priced convertible bonds we checked details of the floating-priced convertible bond in the 10-K or 10-Q. These details

were the conversion discount, interest rate, issue date, maturity date, the dollar value of each issuance, and the total number of issuances per firm. We then used Nasdaq.com, Google Finance, and Yahoo Finance to look at the stock price, trading volume and shares outstanding of each company at the time of each issuance, number of conversations on Yahoo Finance discussion board about the firm, whether there was insider trading, and how long it took a company to issue its first floating-priced convertible bond after its IPO. Firms' financial data at various times were also collected from the above sources. For example, market value, profit margin, trading volume, market-to-book ratio and debt ratio of each firm before the first issuance, at the first and last issuances. Stock price change from the first issuance to the last issuance is also calculated.

After finding our floating-priced convertible bond issuers, we also searched matching fixed-priced convertible bond issuers with matching industry and firm size on the first issuance date in the similar manner. This is our control group. As firms that issue floating-priced convertible bonds are relatively sparse, the success rate of randomly checking a firm's name in Google to find whether it actually issues floating-priced convertible bonds is very low. Manually picking matching non-issuers by randomly checking firm sizes is also very time-consuming. We were able to collect 33 firms that issue floating-priced convertible bonds. However, for three of them, we could not obtain their firm characteristic data. They were discarded after collection. As a result, the dataset has a total of 396 observations from January 2010 to December 2016, with 326 issues of floating-priced convertible bonds from 30 issuers and 70 issues of fixed-priced convertible bonds from 19 matching non-issuers.

Floating-priced convertible debt issuers are in various industries, such as semiconductors, software, physical and biological research, metal mining, beverages, business services, groceries, etc. However, biological and technology sectors have a higher weight in the industry composition. This industry allocation is more diverse than in Hillion and Vermaelen (2004) where 50 percent of firms came from the above two industries 20 years ago.

Discount rate (DS) is the percentage of discount based on the market price over a short period before conversion. DS is an average discount rate per firm. This discount mechanism makes the conversion profitable with certainty for buyers as they can always guarantee a deep discount no matter what is the market price when converting, as long as the company is still alive with enough liquidity so that the buyers can sell back converted shares to market at full price. DS only applies to floating-priced convertible bonds as fixed-priced convertible bonds have a fixed conversion price. Interest rate (INT) is the coupon rate charged by both floating and fixed-priced convertible bond issuers. Bond issue size (BS) is the average bond issuing value per firm. The total bond value (BST) is the total bond issuing value per firm. N is the total number of floating or fixed-priced convertible bond issues per firm. Stock price at the first issuance (PRF) is the market price of the firm at the first issuance. Stock price change over the first issuance to the last issuance (PCH) is calculated as the percentage change of stock price divided by stock price on the first issuance date. AGE is the number of years the firm issues its first floating or fixed-priced convertible bond after its IPO date. It is obtained by checking the firm's filing date of its registration for IPO in the SEC-Edgar database. INS is a binary variable takes the value one if there is insider trading of the firm and zero otherwise. It reflects the corporate governance condition of the firm when making decision to issue floating or fixed-priced convertible bonds. Market reaction to firms' issuing activities are also considered in the study. CON is the number of comments left by the investors in the Yahoo finance

discussion board under the firm when data were extracted to reflect the market attention level about the firm.

Firms' financial status is also collected at three different times. 0 denotes the first issuance date of convertibles, -1 denotes the date before the first issuance, which is the closest date to the first issuance with available 10K or 10Q, and +1 denotes the date after the first issuance, which is one year after the last issuance or the last available date for the firm if it is less than one year. MV is the market value of the firm obtained by the multiplication of stock price and shares outstanding scaled by thousands of dollars. PM is the profit margin of the firm obtained by dividing net income by sales. If sales are 0 on the given date, then 1 is added to sales to make it divisible. M/B is the market to book ratio of the firm obtained by dividing MV by book value of the firm on the given date. 1 is added to book value to make it divisible when it is 0. VOL is the trading volume of the firm scaled by the number of shares outstanding. DR is the debt ratio of the firm obtained by diving total debt by total assets. Most of the firms in the dataset have negative equity, in which case total assets is smaller than total debt or even 0. Two firms have zero assets and zero sales. They both have going concern opinions from their auditors. We assign each an asset value of $1 in order to calculate ratios.

METHODOLOGY AND RESULTS

In order to find out what type of firms are more likely to issue floating-priced convertible debt, we first compare the means and medians of the key firm characteristics between issuers and matching non-issuers. Wilcoxon rank-sum tests are also run to find out firm characteristics that are statistically different between issuers and non-issuers. A Logit model is used to test Hypotheses 1 to 3. Last, an OLS model is used to examine Hypothesis 4 and predicts factors that will cause certain type of firms to have more price impact from the issuance of floating or fixed-priced convertible debt.

Summary Statistics

Table 1 provides the mean and median values of bond terms and firm characteristics of floating and fixed-priced convertible debt issuers in the data set from January 2010 to December 2016. INT is the coupon rate of the floating or fixed-priced convertible bonds. The medians are 8% for both issuers and non-issuers. Discount rate (DS) is the percentage of discount based on the market price over a short period before conversion. DS is an average discount rate per firm. It only applies to floating-priced convertible bonds as fixed-priced convertible bonds have a fixed conversion price. The mean and medians are very close at 53 percent and 52 percent respectively. These numbers are much higher than 15.5 percent and 17 percent in Hillion and Vermaelen (2004) with data collected 20 years ago. Floating-priced convertible bond issuers are more aggressive in offering discounts to attract buyers than 20 years ago. BS is the average size of the floating or fixed-priced convertible bonds. The means and medians are quite different for both floating and fixed-priced convertible bonds, which shows that the variable is probably not normally distributed. The median issue sizes are $50,000 and $177,250 for floating and fixed-priced convertible bonds respectively. Fixed-priced convertible bonds have a bigger average issue size. Perhaps the floating-priced issues are short-term, to be replaced by another short-term offering. This is the opposite in total issue size per firm (BST). The median BST is

$1,004,509 for floating-priced convertible bonds, which is much larger than $669,380 for fixed-priced convertible bonds. This can be explained by the total issues per firm (N). The median total issues per firm for floating-priced convertible issuers are 6.50, whereas non-issuers have only 2 issues. The initial price at the first issuance (PRF) is lower for floating-priced convertible issuers. The median price is $0.70 per share for issuers and $0.85 per share for non-issuers. The mean price is quite different, with $58.22 for issuers and $7.38 for non-issuers.

As the sample size is relatively small, median numbers are more reliable as they are less affected by the potential outliers or influential observations. PCH is the percentage of stock price change from the first issuance to the last issuance. Floating-priced convertible debt issuers suffer a substantial equity price drop of -77 percent, which is a far greater price decline than the 7 percent price drop of the non-issuers. This is the reason that floating-priced convertible bonds are also called “toxic” debt. AGE is number of years between firm’s IPO and the time when the firm issues the first floating or fixed-priced convertible bonds. The median age for issuers are 2 years, which is 2 years less than the non-issuers. Thus, on average issuers are relatively younger when they start using floating-priced convertible bonds. This supports Hypothesis 2 that young firms are more likely to issue floating-priced convertible debt. INS is a binary variable that takes on the value 1 when the firm has insider transactions and 0 when there is no such transaction from 2010 to 2016. Both issuers and non-issuers have a median of 1, which means both have insider trading during the time period. CON is the number of conversations about the firm in Yahoo finance discussion boards when the data were collected. Issuers relatively attracted more attention in the market with a median conversation number of 14.50 than 12.00 per firm for non-issuers. The potential profitability from the deep discount or more frequent issuances of the floating-priced convertible bonds may attract more attention in the market.

Table 1: Summary Statistics of Floating-Priced Convertible Debt Issuers and Matching Non-Issuers from 2010 to 2016

	INT	DS	BS	BST	N	PRF	PCH	AGE	INS	CON
Panel A: Issuers means & medians										
Mean	0.09	0.53	116,572	1,280,420	10.80	58.22	0.34	2.03	0.60	279.07
Median	0.08	0.52	50,000	1,004,509	6.50	0.70	-0.77	2.00	1.00	14.50
Panel B: Non-issuers means & medians										
Mean	0.08	N.A.	647,499	2,388,815	3.84	7.38	0.16	4.58	0.84	51.32
Median	0.08	N.A.	177,250	669,380	2.00	0.85	-0.07	4.00	1.00	12.00

Panel A reports the mean and median values of bond terms and firm characteristics of floating-priced convertible debt issuers in the data set. Panel B reports similar data for matching non-issuers that issue fixed-priced convertible debt.

Table 2 compares the medians of the firm characteristics at three different times for issuers and matching non-issuers. It is interesting to find out whether firms' financial status changes after their first issuance. Medians are calculated to avoid influence of possible outliers or influential observations. Three points in time are investigated. Time 0 represents the first issuing date of the floating or fixed-priced convertible debt. Time -1 represents the closest date before the first issuing date of convertible debt whenever the 10K or 10Q is available. Time +1 presents one year after the last issuing date or the last available date if it is less than one year. On average both issuers and non-issuers' financial status become worse, but issuers are more negatively affected. For example, the market value of the firm obtained by the multiplication of stock price and shares outstanding scaled by thousands of dollars (MV) plummeted from $84,932,000 right before the first issuance to $2,084,000 one year after the last issuance or the last date available if it is less than one year for issuers.

The market value for the non-issuers also shrunk from $21,287,000 to $19,555,000, which is a much smaller decline than for issuers. Both groups had bad profitability from the beginning and both deteriorated after issuance. PM is the profit margin of the firm obtained by dividing net income by sales. If sales are 0 on the given date, then 1 is added to sales to make it divisible. PM of issuers dropped from -763 percent to -862 percent, whereas, non-issuers dropped from -193 percent to -791 percent. This may explain why both groups did not choose more traditional financing methods of straight debt or equity. However, issuers had much greater losses before first issuance as shown from PM ratios. At the same time, both groups are heavy borrowers before their first issuance. DR is the debt ratio of the firm obtained by diving total debt by total assets. Almost all firms in our sample have total assets lower than total debt, resulting in large negative equity. Two firms have zero assets and zero sales. They both have going concern opinions from their auditors. We assign each an asset value of $1 in order to calculate ratios. The median debt ratio at three points in time for issuers are 208 percent, 373 percent and 852 percent respectively. The numbers are better for non-issuers at 88 percent, 105 percent and 108 percent.

The result of DR shows that firms with higher debt ratios are more likely to choose floating-priced convertible debt, which supports Hypothesis 1. The debt ratio did not increase substantially for non-issuers, but it rose dramatically for issuers. It became four times bigger within one year for issuers. M/B is the market to book ratio of the firm obtained by dividing MV by book value of the firm on the given date. 1 is added to book value to make it divisible when book value is 0. Investors are willing to pay more for non-issuers than issuers. The M/B ratios for non-issuers are 0.50, -6.29 and -0.17 at time -1, 0, +1. For issuers, the M/B ratios are -21.42, -3.90, and -1.08 at time -1, 0, +1. VOL is the trading volume of the firm scaled by the number of shares outstanding. Both groups experienced more trading activity one year after the last issuance. The trading volume increased from 0.001 percent to 0.193 percent for issuers, and 0.09 percent to 0.10 percent for non-issuers. Even though the trading volumes are similar for the two groups one year after the last issuance, non-issuers are much more liquid in terms of trading volume before and at the first issuance.

Table 2: Comparison of Financial Status

	MV	PM	M/B	VOL	DR
Panel A: Issuers medians					
-1	84,932	-7.63	-21.42	0.00001	2.08
0	13,779	-22.17	-3.90	0.00002	3.73
+1	2,084	-8.62	-1.08	0.00193	8.52
Panel B: Non-issuers medians					
-1	21,287	-1.93	0.50	0.0009	0.88
0	27,827	-1.71	-6.29	0.0002	1.05
+1	19,555	-7.91	-0.17	0.0010	1.08

Comparison of financial status between issuers and non-issuers before the first issuance date, on the first issuance date and after the last issuance date. Panel A reports the median financial ratios for issuers at three different times. Panel B reports similar data for matching non-issuers that issue fixed-priced convertible debt.

Wilcoxon Rank-Sum Tests

Two sample t-tests or Wilcoxon tests are considered to find out which firm characteristics are statistically different between issuers and non-issuers. As t-tests are only reliable when the variables are normally distributed, normality check was conducted first for all variables.

Table 3 reports the normality check of bond terms and firm characteristics. From the Shapiro-Wilk statistics and p values, almost all tests rejected the null hypothesis that these variables are normally distributed at the 1 percent significance level, except PCH. Therefore, t-tests are not applicable to all variables except PCH. For simplicity, Wilcoxon tests are reported for all variables.[1] Wilcoxon rank-sum tests are chosen over Wilcoxon signed-rank tests as our two groups have different sample sizes. According to Wilcoxon rank-sum tests, INT, BS, N, PCH, AGE are statistically different between our issuers and non-issuers at the 1 percent significance level. Therefore, young firms are more likely to issue floating-priced convertible debt, which supports Hypothesis 3. However, there is no statistical difference between issuers and non-issuers in terms of total issue size (BST), stock price before first issuance (PRF), and number of discussions about the firm on Yahoo finance discussion board. Insider trading is marginally different at the 10 percent significance level.

[1] T-test result for PCH is the same with Wilcoxon rank-sum test.

Table 3: Normality Check and Wilcoxon Rank-Sum Tests on Firm Characteristics

	INT	BS	BST	N	PRF	PCH	AGE	INS	CON
Panel A: Normality Check									
Issuers									
Shapiro-Wilk	0.71	0.31	0.93	0.84	0.34	0.37	0.84	0.62	0.33
p value	<0.01	<0.01	0.04	<0.01	<0.01	0.71	<0.01	<0.01	<0.01
Non-issuers									
Shapiro-Wilk	0.96	0.62	0.77	0.72	0.51	0.58	0.91	0.44	0.70
p value	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	<0.01	<0.01
Panel B: Wilcoxon Rank-Sum Test									
Statistics	10,470	18,672	483	343.50	366	520	601.50	544	439
p value	<0.01	<0.01	0.89	0.01	1.00	0.01	0.01	0.08	0.47

Normality check and Wilcoxon rank-sum tests to compare firm characteristics between issuers and matching non-issuers[2]. Panel A reports normality check of the variables between issuers and matching non-issuers. Panel B reports the Wilcoxon rank-sum tests of the same variables in Panel A for issuers and matching non-issuers.

Table 4: Normality Check and Wilcoxon Rank-Sum Tests on Firm Financial Status before First Issuance

	MV_{-1}	PM_{-1}	M/B_{-1}	VOL_{-1}	DR_{-1}
Panel A: Normality Check					
Issuers					
Shapiro-Wilk	0.44	0.42	0.42	0.23	0.18
p value	<0.01	<0.01	<0.01	<0.01	<0.01
Non-issuers					
Shapiro-Wilk	0.34	0.35	0.25	0.51	0.27
p value	<0.01	<0.01	<0.01	<0.01	<0.01
Panel B: Wilcoxon Rank-Sum Test					
Statistics	437	540	519	496	370
p value	0.45	0.19	0.38	0.25	0.04

Comparison of firm financial status before the first issuance between floating-priced convertible debt issuers and matching non-issuers. Panel A reports normality check of financial variables between issuers and matching non-issuers. Panel B reports the Wilcoxon rank-sum tests of the same variables in Panel A for issuers and matching non-issuers.

Table 4 above demonstrates the results of normality check and Wilcoxon rank-sum tests on firm financial status right before the first issuance. All variables in Table 4 reject

[2] DS is not included in the table as there is no DS data for the matching non-issuers.

normality at the 1 percent significance level. Therefore, t-tests are also not suitable in this situation and Wilcoxon rank-sum tests were performed. Market value, profit margin, market-to-book ratio and trading volume are all consistent with the null hypothesis that there is no significant difference between issuers and matching non-issuers. This also shows the control group is selected well as matching non-issuers. However, debt ratio before first issuance is statistically different between issuers and matching non-issuers at the 5 percent significance level. From Table 2, issuers have a 2.08 debt ratio, which is 1.20 more than the non-issuers. This shows issuers do have more debt before they start issuing floating-priced convertible debt. This supports Hypothesis 1 that firms with more debt are more likely to issue floating-priced convertible debt, as floating-priced convertible debt may serve as the last resort to those firms that have used up their borrowing capacity. This finding is also consistent with the last-resort financing hypothesis in Hillion and Vermaelen (2004).

Binary Logit Model

A binary logit model is used to estimate the probability of firms to issue floating-priced convertible debt. Specifically, what type of firms are more likely to become issuers? The dependent variable Floater is a dummy variable that takes the value one if the firm issues floating-priced convertible debt between the period of 2010 to 2016, and zero otherwise. The explanatory variables are firm characteristics such as financial status, life cycle, corporate governance and market opinion.

Maximum likelihood estimation is used to estimate the regression parameters. The results are listed in Table 5. The overall fit of the model is good with a likelihood ratio of 20.4965. It is statistically significant at the 1 percent level which means the model is significantly better than the model with intercept only.

Table 5: Binary Logit Model of Likelihood to Issue Floating-priced Convertible Debt

Regressor	Coefficients	Standard Error	Wald Chi-Square	p value
Intercept	2.5488	1.3292	3.6770	0.0552
PRF	0.0024	0.0072	0.1141	0.7355
AGE	-0.5119	0.2278	5.0519	0.0246
INS	-1.2696	1.1604	1.1971	0.2736
CON	0.0008	0.0013	0.4204	0.5167
MV_{-1}	0.0000	0.0000	0.0291	0.8645
PM_{-1}	0.0000	0.0000	1.3482	0.2456
VOL_{-1}	-38.5132	54.0574	0.5076	0.4762
DR_{-1}	0.0000	0.0002	0.0075	0.9309
Model Fitness				
Likelihood Ratio (Chi-Square): 20.4965			Pr> ChiSq: 0.01	

The Logit model shows only AGE is statistically significant at 5 percent level. It has a negative coefficient of -0.5119, which means when the firms are younger, they are more likely to issue floating-priced convertible bonds. This is consistent with Hypothesis 3. However, Hypothesis 1 and 2 are not supported by the Logit model. Neither debt ratio nor

profit margin has explanatory power in predicting firms' likelihood to issue floating-priced convertible debt.

OLS Regression

A key variable of interest is the firm stock price drop after issuance of floating or fixed-priced convertibles. An OLS regression is estimated to find out the causal relationship between firm characteristics and stock price drop. The dependent variable is price change from first issuance to the last issuance (PCH) for both issuers and non-issuers. The independent variables are whether the firm is an issuer or not, firm characteristics reflecting firm's financial status, life cycle, corporate governance, and market opinion.

Results are shown in Table 6 below. The overall fitness is good with an F value of 18.20, which is statistically significant at the 1 percent level. The R-squares and Adjusted R-squares are very high at 0.8585 percent and 0.8113 percent respectively. However, most of the coefficients are not significant at 5 percent level. Variance inflation factors (VIF) are calculated to rule out the possibility of multicollinearity. From Table 6, all of the VIFs are far below 10, which is a conventional threshold for small samples. Consequently, there is no multicollinearity in the model and the model has a good fit. Robust errors were computed to get more reliable t statistics.

Table 6 demonstrates that only VOL_{-1} is statistically significant at the 1 percent level. This means firms with less trading activities before the first issuance are more likely to experience a deeper price drop after the first issuance for both issuers and non-issuers. This is contradictory to faulty contract hypothesis in Hillion and Vermaelen (2004) that more liquid firms are likely to attract hedge funds to finance them through floating-priced convertibles as they need to profit through short sales. When more short sales happen, price should plummet more. This is not the case here. Instead, another explanation could be that illiquid firms are typically subject to more severe information asymmetry. Therefore, the market tends to react more when those firms issue convertible debt, no matter whether they issue floating or fixed-priced convertibles. This supports Hypothesis 4.

Table 6: OLS Regression of Stock Price Change.

Regressor	Coefficients	Robust Stand. Error	t	p value	VIF
Intercept	-1.4288	0.9624	-1.48	0.1455	0
Floater	0.1683	0.7184	0.23	0.8160	1.8750
PRF	-0.0013	0.0009	-1.42	0.1621	1.7332
AGE	0.1568	0.1477	1.06	0.2947	1.4986
INS	-0.2396	0.5195	-0.46	0.6472	1.4401
CON	0.0002	0.0002	1.16	0.2534	1.2061
N	0.0616	0.0577	1.07	0.2921	2.8405
MV_{-1}	-0.0000	0.0000	-0.30	0.7638	1.9653
PM_{-1}	-0.0000	0.0000	-1.29	0.2029	1.4575
VOL_{-1}	226.4846	56.3704	4.02	0.0003	2.4308
DR_{-1}	-0.0000	0.0000	-1.74	0.0893	1.1549
Model Fitness					
F Value: 18.20	Pr> F: <0.0001		R-Square: 0.8585		Adj R-Sq: 0.8113

CONCLUSION

Theoretically, floating-priced convertibles rescue firms with asymmetric information problems. Issuing equity or fixed-priced convertibles send negative signals to the market, which increases the financing cost of the firms. This situation is even worse when those firms are undervalued. However, the discount mechanism of floating-priced convertibles combined with short sales gives high profitability to buyers but significant loss to current stockholders, as stock price typically plummets over a short period of time after issuance.

This left an interesting question about what type of firms are willing to issue this "toxic" type of financing. In addition, what characteristics of the issuers will predict a larger price cut after its issuance?

Our empirical results show that young firms with more information costs are more likely to issue floating-priced convertibles. Median debt ratio is statistically higher for issuers than non-issuers according to Wilcoxon rank-sum test; however, it does not have explanatory power to predict the propensity of firms to issue floating-priced convertibles in the binary logit model. Firm profitability does not have predictive power in determining whether the firm will issue floating-priced convertibles. Firms that are illiquid before first issuance are more likely to have a big price drop after issuance. Illiquid firms have less information conveyed to the market through trading which makes them subject to more asymmetric information. Outside investors react more negatively to those firms when they have unfavorable information.

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