

## Industry conditions, growth opportunities and market reactions to convertible debt financing decisions

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### Abstract

Firms that issue convertible debt have high debt- and equity-related costs of external finance. Existing theories of convertible debt finance differ primarily in their identification of the specific causes of the debt- and equity-related costs of external finance. To assess the theoretical issuance motives separately, we propose a simple framework that characterizes how issuers should design convertible debt to efficiently mitigate specific debt- and equity-related costs of external finance. We provide evidence from 588 security offer announcements that supports the hypotheses that: (1) convertible debt can be designed to mitigate different combinations of debt- and equity-related costs of external finance and (2) share price reactions depend on the security design decisions. The results also illustrate that the relations between firm value, financial leverage, investment opportunities, and the rate of future growth are more complex among convertible debt issuers than situations where firms issue standard financial securities.

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## 1. Introduction

Models of corporate financing decisions imply that firm value depends on leverage decisions, investment opportunities, and growth rates when capital markets are imperfect. These models provide corporate managers with straightforward guidance for making optimal financing decisions. High-growth firms with valuable investment opportunities should choose equity finance, while firms with poor investment opportunities should grow more slowly and rely on debt financing.<sup>1</sup>

These financing implications provide no guidance, however, for security choice decisions other than straight debt and common equity. One important limitation is that they fail to recognize that some issuers may simultaneously face high debt- and equity-related costs of external finance. Higher leverage is not an effective disciplinary mechanism for firms with relatively poor investment opportunities if they also face high agency costs of debt. External equity finance is not an efficient financing choice for firms with highly profitable investment opportunities if they also face costly adverse selection problems.

A firm seeking external capital that confronts high debt- and equity-related financing costs has at least three responses. First, it may defer or postpone investment, thereby foregoing the intended use of the issue proceeds (see, e.g., Stiglitz and Weiss, 1981). Second, a firm may raise capital by bearing the incremental costs of choosing to issue the wrong security (see, e.g., Jung et al., 1996). Third, a firm may issue a hybrid security, such as convertible debt. Our goal in this paper is to analyze the impact of debt- and equity-related costs of external finance on a firm's use and design of convertible debt.

Several theories suggest that managers can design convertible debt to mitigate a variety of debt- and equity-related costs of external finance, including asset substitution problems (Green, 1984); financial distress and asymmetric information problems (Stein, 1992); risk uncertainty (Brennan and Schwartz, 1988); and overinvestment problems (Mayers, 1998). A common feature of these theories is the prediction that information and agency problems limit the ability of issuers to raise capital efficiently and to fund profitable investment opportunities. Since convertible debt issuers face different sources of external finance costs, security design is an important way to distinguish between the theories. That is, different external financing problems are expected to induce distinct security design decisions.

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<sup>1</sup> Myers (1977) argues that firms with valuable investment opportunities should maintain low debt levels to avoid debt overhang, or the underinvestment problem. If debt levels are too high, a firm may be unable or unwilling to raise new investment capital, even if it has immediate access to positive NPV projects. Therefore, bondholder/stockholder agency conflicts suggest that these firms maintain low debt levels. Jensen (1986) and Stulz (1990) note that debt policy can have a positive impact on corporate value. For mature firms with few new profitable investment opportunities and strong current cash flow, high debt levels would constrain management's ability to squander internal cash flows on poor reinvestment opportunities. High debt levels can also enhance firm value by mitigating management/stockholder agency conflicts. Empirical evidence provided in Kaplan (1989), Smith and Watts (1992), McConnell and Servaes (1995), Lang et al. (1996), and Jung et al. (1996) support both these views.

In this paper, we investigate an empirical model of convertible debt security design. This model presumes that firms issuing convertible debt face high debt- and equity-related costs of external finance and that financial and operating characteristics can be used to characterize the sources of costly external finance.

An important contribution of the paper is to illustrate that even a simple characterization of issuance motives can provide new and improved insights regarding investor reactions to convertible debt security offers. We find that specific capital market imperfections influence the likelihood of a security issuance as well as security design decisions.

Because convertible debt can be structured to mitigate several different combinations of debt- and equity-related costs of external finance, an empirical examination of average valuation effects for the full issuer universe is likely to be uninformative. Dann and Mikkelson (1984), Eckbo (1986) and Mikkelson and Partch (1986) document that investor reactions to the announcement of convertible debt offers are negative on average. However, they are unable to identify factors that systematically explain the cross-sectional variation in investor reactions. Our analysis suggests that their inconclusive findings result from a failure to formally incorporate the effects of security issue expectations, security design choices, and capital structure determinants in the analysis.

Our research provides several new results on the use of convertible debt. First, we formalize the idea that security design decisions influence investor reactions. We rely on a simple model that characterizes security design on the basis of issue date conversion probabilities. Implicit in this approach is the assumption that firms design security offerings to minimize their costs of external finance. Minimizing these costs is important because it increases the net benefit of new investment or refinancing decisions. The model is used to characterize the distinctive attributes of convertible debt issuers according to their perceived issuance motives. We document that issuers seem to design their convertible debt offers by relying on their own preissue financial and operating performance information as well as relative industry performance information and macroeconomic conditions.

Second, theory suggests several different but not mutually exclusive reasons that firms offer convertible debt. If investors use preissue information to forecast issue decisions and the type of security that a firm is likely to offer, any empirical analysis of the full issuer universe obscures the interpretation of investor reactions. We use a logistic regression model to compare the characteristics of issuing firms and industry “composite” firms. If our method of characterizing security design is related to different sources of debt- and equity-related costs of external finance, the factor(s) distinguishing issuance decisions will vary according to the actual security design chosen by managers. We find considerable differences between issuers and their industries, which suggests that convertible debt security design decisions depend on which combination of debt- and equity-related financing problems the offer is designed to mitigate. Thus, the results illustrate that the interaction between capital market imperfections and security design decisions can enhance our understanding of the use of convertible debt.

We then empirically examine the effects of capital market imperfections and security design decisions on investor reactions to convertible debt offer announcements. We use the same explanatory factors as we use in the issue decision analysis to control for offer anticipation by investors. If issuers design convertible debt to mitigate costly capital market imperfections, and investors understand the information content of the security design, the factors influencing the likelihood of a convertible debt offer are predicted to be different from the factors influencing investor reaction to the security offer. The results are consistent with the hypothesis that incremental investor reactions are largely unrelated to the formation of expectations of the security issue decision.

Finally, several previous studies document that investor reactions to standard security issuance decisions seem to vary through time. Choe et al. (1993) and Bayless and Chaplinsky (1996) attribute this to time-varying adverse selection. Like common equity offers, we find evidence of time variation in convertible debt security design and investor reactions to convertible debt security offers. Similar to common equity offers, we find that average price reactions to convertible debt offer announcements are higher in hot markets than normal or cold markets. Further analysis suggests that the influence of various debt- and equity-related sources of costly external finance also varies across different market conditions. Thus, our results are not completely consistent with the hypothesis that the time variation in investor returns is caused solely by adverse selection. Rather, we interpret our findings as evidence that financing costs other than adverse selection are also important determinants of security choice decisions, and that there is time variation in these other financing costs as well.<sup>2</sup>

The remainder of the paper is organized as follows. Section 2 discusses the debt- and equity-related costs of external finance that have been hypothesized to explain the use of convertible debt. Sample selection procedures and a description of our data are contained in Section 3. Section 4 presents our analysis of the convertible debt security design and issue decision. Section 5 examines investor reactions to those design and issue decisions. Time variation in convertible debt security design and investor reactions to convertible debt issuance decisions is investigated in Section 6. Section 7 concludes the paper.

## **2. What are the financing benefits of convertible debt?**

Security choice and design decisions are important because they influence the cost and terms of raising new investment capital. A variety of debt- and equity-related

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<sup>2</sup> Choe et al. (1993) and Bayless and Chaplinsky (1996) differ in the way that they identify time periods when adverse selection is likely to be high or low. Choe et al. (1993) use macroeconomic variables while Bayless and Chaplinsky (1996) use issue volume in the seasoned equity market. Adverse selection costs are hypothesized to be low during expansionary phases of the business cycle or during periods of relatively high equity issue volume.

financing costs have been hypothesized to motivate the use and design of convertible debt.

### *2.1. Reduction of bondholder/stockholder agency costs*

Green (1984) models the disagreement that can arise between bondholders and stockholders over corporate investment and financing decisions. According to this theory, agency costs of debt are an important motive for convertible debt security offers. Stockholder wealth increases when managers invest in positive net present value (NPV) projects, or when investment policies transfer wealth to stockholders from other claimants, such as bondholders. Firms with highly profitable investment projects are less likely to pursue investment projects that transfer wealth. Stockholder wealth is more likely to benefit from the adoption of positive NPV projects than from projects designed to simply transfer wealth from creditors. Therefore, this theory predicts that firms issuing convertible debt are characterized by marginally profitable, high-risk investment opportunities.

Green (1984) does not explicitly identify a specific equity-related cost of external finance. Jensen (1986) and Stulz (1990) suggest that free cash flow problems are likely to be especially acute for firms with few positive NPV investment opportunities. Equity finance creates managerial discretion, which allows managers to pursue their own objectives, such as excessive firm growth, at the expense of shareholders.

While convertible debt creates less managerial discretion than an equivalent-size common stock issue, it does create more flexibility than a similar straight debt issue. Therefore, for firms facing asset substitution and free cash flow problems, the theory predicts a negative stock price reaction to issues of convertible debt by firms with poorer investment opportunities and greater amounts of free cash flow.

### *2.2. Hedging against the impact of uncertain risk*

Brennan and Schwartz (1988) suggest convertible debt is likely to be issued by companies that investors perceive as risky, firms whose risk is hard to assess, or firms whose investment policies are hard to predict. Companies with high operating and financial risk are likely to face high costs of issuing standard securities like straight debt or common equity. The value of convertible debt, however, is relatively insensitive to the risk of the issuing company. This effect makes it easier for issuers and investors to agree on the value of the financing instrument, even though they may disagree on the risk of the company.

This type of financing problem suggests that it is not the incremental profitability of the issuer's investment opportunities, but rather the riskiness of the company's business operations that motivates the use of convertible debt. The relevant risk depends not only on the risk of the firm's existing operations but also on the risk of the future investment opportunities over the life of the financing arrangement. For these

firms, we expect that the riskiness of the firm's assets and investment opportunities will be an influential determinant of the decision to issue convertible debt. If managers have private information about the firm's true level of risk, the theory predicts a negative price reaction to issues of convertible debt by firms with high operating and financial risk.

### *2.3. Reduction of adverse selection costs and financial distress*

Stein (1992) predicts that debt-constrained firms with significant asymmetric information problems will issue convertible debt. Firms that face significant debt constraints would not be expected to issue straight debt. For these firms, the incremental costs of financial distress would be too large. While an equity issue would reduce the firm's financial leverage, and therefore its marginal costs of financial distress, asymmetric information problems may render an equity offer too costly. Investors understand that managers prefer to issue equity when their shares are overpriced, and hence react negatively to such offers.

High-growth firms, firms with significant amounts of financial leverage, and firms with very profitable investment opportunities are often characterized as issuers that would be vulnerable to financial distress costs (including underinvestment problems) and asymmetric information problems. Therefore, the theory predicts that issuers characterized by significant adverse selection and financial distress costs offer convertible debt to minimize these aggregate financing costs.

### *2.4. Time-varying financing costs*

Another possible explanation for the insignificant relationship between investor reactions and firm-specific explanatory variables may be that previous studies fail to control for macroeconomic factors or market conditions. For example, debt- and equity-related costs of external finance may differ during periods with more or less promising investment opportunities and more or less uncertainty about assets-in-place. If so, these additional factors could obscure the true relation between the firm-specific variables and investor reactions.

Choe et al. (1993) and Bayless and Chaplinsky (1996) present evidence that is consistent with the hypothesis that equity-related costs of external finance vary through time. Both studies suggest that time variation in security choice decisions and investor reactions are due to time-varying adverse selection costs. Time variation in adverse selection costs is important because the issuance of information-sensitive securities should occur during periods when these costs are low.

Therefore, while issuer-specific operating and financing characteristics are expected to influence investor expectations of security choice decisions, macroeconomic conditions (Choe, Masulis, and Nanda) and high-volume issue periods (Bayless and Chaplinsky) are also expected to impact investor reaction to convertible debt offer announcements. A straightforward extension of these arguments suggests that time variation in other sources of external financing costs,

such as agency costs of debt, managerial discretion costs and uncertainty about issuer risk, may also influence investor reactions to the decision to issue convertible debt.

### 3. Sample selection and data description

#### 3.1. Sample selection procedure

Our sample of convertible debt issues is drawn from a listing of all domestic public offerings of convertible debt included in the *Investment Dealers' Digest Domestic and International New Issues* database during the years 1978 through 1992. The sample is limited to issuers whose daily common stock returns are included in the Center for Research in Security Prices (CRSP) Daily Returns File for the full calendar year prior to the announcement date.

Three separate sources are used to identify offer announcement dates: the *Wall Street Journal Index*, SEC filing dates, and *Dow Jones News Retrieval*. When sources identify different issue announcement dates, the earliest mention is chosen as the announcement date. Financial institution and regulated public utility issues are eliminated. Finally, we require the issuing company to appear on the COMPUSTAT Annual Research Tapes in the years immediately before and after the issue announcement date. The final sample consists of 588 convertible bond issues.

#### 3.2. Identification of debt-like, hedge-like, and equity-like issuers

Theory suggests several different but not mutually exclusive reasons for issuing convertible debt. A key feature of each theory is that an appropriately designed convertible bond can overcome certain financing problems that would be exacerbated by standard security offerings. By conditioning on the actual security design chosen by the issuers, we can increase the power to test these alternative theories.

When firms design a hybrid security like a convertible bond, they choose how 'debt-like' or 'equity-like' the offer will be by specifying security characteristics such as the conversion ratio, maturity date, coupon rate, call period, and the time to first call. Since the interaction of all these features determines the actual security design, it is inappropriate to use any one of these variables in isolation to characterize security design. For example, a conversion option can be made more 'equity-like' by lengthening the maturity date.<sup>3</sup> As a result, it is important to specify a single measure of security design that simultaneously considers all of these features. In this study, we use the actual probability (measured on the issue date) that the bond will be converted into equity at maturity. The higher

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<sup>3</sup> Since equity volatility is proportional to the square root of the time to maturity when stock prices follow a geometric Brownian motion process, an increase in maturity effectively increases the volatility of the conversion option.

the conversion probability is, the more ‘equity-like’ the issue becomes. Conversion probability values are estimated using the standard Black–Scholes assumptions.<sup>4,5</sup>

Since we consider three different theories, the convertible debt issuer universe is sorted into three groups based on conversion probabilities on the issue date. A bond is classified as “debt-like” if the probability of conversion is less than 40%; as “hedge-like” if the probability of conversion is between 40% and 60%; and as “equity-like” if the probability is greater than 60%.<sup>6</sup>

The cutoffs chosen here reflect the simple observation that a higher conversion probability is more likely to be interpreted as an equity-like security by investors. We conjecture that convertible debt designed in this manner is most likely to be viewed as “backdoor equity” (Stein, 1992). Security designs with conversion probabilities between 40% and 60% are considered hedge-like securities because the probability of conversion and no-conversion are similar. Securities designed this way have debt and equity components that provide the type of hedge suggested by Brennan and Schwartz (1988). Debt-like securities have a lower issue date probability of conversion, but still constrain managerial incentives to overinvest in risky projects over longer time periods. Therefore, convertible debt designed in this manner is most likely to be interpreted by investors as a bonding mechanism against overinvestment in high-risk projects (Green, 1984).

Table 1 presents the number of convertible debt issue announcements sorted by calendar year and security design. The number of convertible bond issues varies considerably over time. The sample is most heavily concentrated in the years 1985–1987, which contains 42.3% of the convertible debt offerings. This variation may simply reflect the equity-linked nature of these securities, since the frequency of equity issues varies considerably over time. If the clustering of seasoned equity issues is due to

<sup>4</sup> Specifically, we assume that the underlying common stock follows a diffusion process described by geometric Brownian motion. This probability is then estimated as  $N(d_2)$  where  $N(\bullet)$  is the cumulative probability under a standard normal distribution function, and

$$d_2 = \frac{\ln(S/X) + (r - \text{div} - \sigma^2/2)T}{\sigma\sqrt{T}}$$

where  $S$  is the current price of the underlying common stock;  $X$  is the conversion price;  $r$  is the continuously compounded yield estimated from a 10-year U.S. Treasury bond on the issue date;  $\text{div}$  is the issuing firm’s continuously compounded dividend yield for the fiscal year-end immediately preceding the offer date;  $\sigma$  is the standard deviation of the continuously compounded common equity return estimated over the period –240 to –40 trading days prior to the issue date; and  $T$  is the number of years until maturity for the convertible bond.

<sup>5</sup> Most convertible bonds are callable, and they are often called prior to maturity. Hence, an alternative to computing the probability of conversion at maturity would be to calculate the probability of call or the expected time to call. However, the convertible call decision is complicated, and a simple rule does not work in all circumstances (Asquith et al., 1999; Sarkar, 2000). This problem makes it quite difficult to incorporate the call decision in empirical work.

<sup>6</sup> We also partition the convertible debt issuer universe using 45–55% and 35–65% cutoffs. These alternative cutoffs produce qualitatively similar results.



Table 1  
Issue dates by year for the Sample of 588 convertible debt offerings firms over the period 1978–1992

Year	Number of offerings			
	Debt-like offers	Hedge-like offers	Equity-like offers	Total offers
1978	6	0	0	6
1979	12	0	3	15
1980	6	15	33	54
1981	7	4	24	35
1982	6	5	25	36
1983	7	10	31	48
1984	2	11	23	36
1985	6	12	63	81
1986	3	6	96	105
1987	4	3	56	63
1988	1	0	20	21
1989	0	4	30	34
1990	0	0	16	16
1991	2	4	25	31
1992	0	0	7	7
Total	62	74	452	588

time variation in adverse selection costs, however, as Choe et al. (1993) and Bayless and Chaplinsky (1996) suggest, periods of high equity issuance would not necessarily be expected to coincide with periods of high convertible debt volume. We explore this issue in more detail in Section 6.

More than three-fourths (76.9%) of all convertible debt issues were classified as equity-like during the sample period. Hedge-like offers account for 12.6% of issues, and debt-like issues account for the remaining 10.5%. For debt-like issues, 1978–1983 is the most intense period of issuance, while hedge-like and equity-like issues are more frequent during the mid-1980s. The design of convertible debt security offers varies through time, which may in turn influence investors' perception of (and therefore reaction to) issue motive.

### 3.3. Calculation of two-day excess returns

We follow standard event study methodology and measure the share price response to the financing event over a two-day period using the market model as the pricing benchmark. Excess returns are computed as the actual return minus the market model predicted return:

$$XS_{it} = R_{it} - \alpha_i - \beta_i R_{mt}, \quad (1)$$

where  $R_{it}$  is the rate of return on stock  $i$  over day  $t$  and  $R_{mt}$  is the corresponding rate of return on an equally weighted index of NYSE, AMEX, and NASDAQ companies on the CRSP tape over day  $t$ . The coefficients  $\alpha_i$  and  $\beta_i$  are ordinary least squares estimates of firm  $i$ 's market model parameters. Our market index is an equally weighted average of returns on the NYSE, AMEX, and NASDAQ market indices

because our sample consists of both NYSE/AMEX and NASDAQ issues firms.<sup>7</sup> Excess returns are based on market model parameter estimates over 280 trading days spanning the combined intervals  $[-200, -61]$  plus  $[+61, +200]$ , where day 0 is the announcement date.

### 3.4. Selection and measurement of explanatory variables

Several different financial and operating characteristics are predicted to influence investor expectations of and reactions to convertible debt security offer announcements.

#### 3.4.1. Investment opportunities variables

Green (1984), Brennan and Schwartz (1988), and Stein (1992) emphasize the demand for investment capital as a motive for convertible debt issue. Our empirical tests rely upon two attributes of a firm's investment policies: the rate of future growth and the profitability of future investment allocations.

We measure investment growth as the change in total assets during the year surrounding the convertible debt security offer announcement. The change in total assets is calculated as the difference between the book value of assets at fiscal year-end immediately after the issue announcement date minus the book value of assets for the fiscal year-end prior to the issue announcement date, divided by the book value of assets at the fiscal year-end prior to the issue announcement. This measure captures the rate of change of investment during the period immediately surrounding the decision to offer convertible debt.

All else equal, firms experiencing a large increase in total assets require greater amounts of investment capital to grow. A higher rate of capital expenditures is expected to reduce the likelihood that overvaluation is an issuance motive. By contrast, total assets will not increase if a firm plans to use the proceeds to recapitalize its balance sheet.<sup>8</sup>

The profitability of future investment decisions is measured using the earnings-price ratio and the market-to-book ratio. The earnings-price ratio is calculated as earnings per share divided by the market price per share. The market-to-book ratio is calculated as the sum of total assets plus the market value of common stock minus the book value of common equity, divided by the book value of total assets. Our

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<sup>7</sup> For completeness, excess returns were also calculated for the NYSE/AMEX sample using an equally weighted NYSE/AMEX market index and for the NASDAQ sample using an equally weighted NASDAQ market index. Our results are unaffected by this alternative calculation method.

<sup>8</sup> We tried two other variables that measure investment activity: capital expenditures and the change in long-term assets. Long-term assets are calculated as the book value of total assets net of cash and marketable securities. Both variables control for firms that opportunistically issue overpriced securities and retain the issue proceeds rather than invest in new projects. We do not use capital expenditures because missing values for this variable in COMPUSTAT significantly reduce the sample size. We also do not use the change in long-term assets because we want to separately consider financial slack (cash plus marketable securities) in our regression analysis. Although not reported, our results are qualitatively similar using either variable.

results are similar but more statistically significant when we use the earnings-price ratio to proxy for growth opportunities. However, we report only the market-to-book ratio results for expositional clarity and to facilitate comparison with other empirical studies of corporate financing behavior.

Firms with high market-to-book ratios and low earnings-to-price ratios face high financial distress costs (see, e.g., Gilson et al., 1995; McConnell and Servaes, 1995). They are also likely to face significant asymmetric information problems, especially regarding the profitability of their future investment opportunities. By contrast, the costs of managerial discretion and asset substitution problems are higher when firms have low market-to-book ratios. Therefore, theory suggests that firms with many and few growth opportunities may optimally choose convertible debt financing.

#### 3.4.2. *Financing-related variables*

Theories of convertible debt financing also emphasize financing-related motivations. Since existing financial conditions may independently influence corporate financing decisions, we include several standard measures of debt- and equity-related financing costs as control variables. Debt-related financing costs are proxied by long-term debt/long-term debt plus the market value of common equity; taxes/total assets; and volatility. Firms face high debt-related financing costs when financial leverage is high, marginal tax rates are low, and volatility is high.<sup>9</sup>

Equity-related financing costs are proxied by issue size, total assets, and the pre-issue runup in the issuer's stock price. Issuers face high equity-related financing costs when capital needs are large, the firm is small, and the security issue follows a substantial increase in the firm's stock price.

#### 3.4.3. *Other control variables*

We also include several additional control variables in the regression analyses. Since investment decisions may be related to the availability of internal funds, we use two measures of internal cash flow. The first is internally available slack, which is calculated as cash plus marketable securities divided by total assets. An increase in financial slack makes the firm more able to finance projects from internal sources, and increases the costs of adverse selection. The second is net income to total assets, which is a measure of the profitability of assets-in-place. A higher level of profitability from existing assets should reduce the need to raise funds externally. Higher profitability also reduces debt-related costs of external finance.

Finally, we also include the preissue runup in the market as a measure of overall market and economic conditions during the period leading up to the security offer. For equity issues, investor reactions are typically smaller (i.e., less negative) following increases in stock market prices. Choe et al. (1993) interpret this relation as an

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<sup>9</sup> We measure volatility based on changes in equity value. An alternative approach would be to measure volatility based on changes in firm value. We do not use this approach because the book value of debt changes at most one time over the 75-day used to make the calculation. In effect, the changes in equity will determine the variance in this case.

indication that information costs of external equity finance are lower during market expansions.

### 3.5. Issue and issuer characteristics

Table 2 reports descriptive statistics for the entire sample and subsets of issuers sorted by offer type. The Kruskal–Wallis test is used to test the hypothesis that the three populations represented by the debt-like, hedge-like, and equity-like issuers are identical. The Waller–Duncan *K*-ratio *T* test also is used to determine whether the mean values across issuer groups are different. Each issuer group with the same alphabetic letter (a, b, or c) has a mean that is not statistically different. Different letters represent issuer groups that have statistically different means. Groups with “lower” letters have higher means. For example, groups denoted by ‘a’ have a higher mean than groups denoted by ‘b’. We use the letter ‘d’ when the Waller–Duncan *K*-ratio *T* test fails to detect a significant difference across all groups.

We also provide industry information to present a more complete picture of the operating and financial characteristics of firms that offer convertible debt. Maksimovic (1988) suggests that industry characteristics are likely to be an important determinant of the convertible debt issue decision. Table 3 presents summary characteristic information for the issuer’s industry, for the entire sample and the issuer subgroups. Industry affiliation is determined on the basis of SIC codes listed in COMPUSTAT. Industry mean and median performance measures are calculated by using all other firms with the same 3-digit SIC code that did not issue convertible debt during the year prior to the announcement date.

Overall, the descriptive evidence in Tables 2 and 3 suggests that managers design convertible debt offerings on the basis of both firm-specific and industry conditions. The descriptive statistics document the following relations between convertible debt security design and issuer operating and financial characteristics.

- *Debt-like issuers:* Debt-like issuers tend to be larger firms with favorable industry-adjusted growth opportunities. However, the absolute level of their growth opportunities is low. Debt-like issuers have comparatively high leverage in high-leverage industries, and relatively low investment growth rates in industries with high investment growth. The relatively high leverage, low tax rates, and high volatility suggest these issuers face high debt-related costs of external finance. Given these characteristics, creditor and investor concerns about asset substitution and overinvestment are likely to be important.
- *Hedge-like issuers:* Hedge-like issuers are large firms with fewer profitable growth opportunities compared to other issuers. They also tend to be large relative to the firms in their industry. Volatility is somewhat lower for hedge-like issuers than either equity-like or debt-like issuers, but it is comparable to the volatility of other firms in their industry. The relatively low growth opportunities in industries with exceptionally poor investment opportunities, comparable industry-level volatility, and low investment growth rates suggest that hedge-like issuers may operate in an

Table 2  
Summary statistics for the Sample of 588 convertible debt offerings 1978–1992

	All issuers (588 observations)		Debt-like issuers (62 observations)		Hedge-like issuers (74 observations)		Equity-like issuers (452 observations)		Kruskal– Wallis <i>p</i> -value
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Issue size (millions)	107.2	50.0	108.3 <sup>d</sup>	27.5	142.4 <sup>d</sup>	55.0	101.2 <sup>d</sup>	50.0	0.0008
Issue size/market value of common stock	0.27	0.20	0.20 <sup>b</sup>	0.11	0.14 <sup>c</sup>	0.10	0.31 <sup>a</sup>	0.25	0.0001
Total assets (millions)	1157.0	228.4	2195.0 <sup>a</sup>	228.4	2577.7 <sup>a</sup>	733.8	779.7 <sup>b</sup>	194.6	0.0001
Sales	1011.5	260.4	1764.4 <sup>a</sup>	257.3	1682.8 <sup>a</sup>	583.1	804.5 <sup>b</sup>	213.1	0.0005
Market-book	1.686	1.366	1.433 <sup>b</sup>	1.079	1.240 <sup>b</sup>	1.093	1.794 <sup>a</sup>	1.488	0.0001
Earnings-price	0.044	0.064	0.015 <sup>d</sup>	0.086	0.065 <sup>d</sup>	0.101	0.045 <sup>d</sup>	0.059	0.0001
Long-term debt/total assets	0.237	0.215	0.266 <sup>a</sup>	0.266	0.221 <sup>a</sup>	0.216	0.236 <sup>b</sup>	0.206	0.0001
Change in assets	0.210	0.207	0.074 <sup>a,b</sup>	0.063	−0.043 <sup>b</sup>	0.025	0.270 <sup>a</sup>	0.262	0.0001
Slack	0.104	0.054	0.080 <sup>b</sup>	0.042	0.059 <sup>b</sup>	0.035	0.115 <sup>a</sup>	0.062	0.0022
Taxes/total assets	0.034	0.030	0.019 <sup>b</sup>	0.012	0.026 <sup>b</sup>	0.017	0.037 <sup>a</sup>	0.034	0.0001
Net income/total assets	0.131	0.142	0.078 <sup>b</sup>	0.118	0.105 <sup>b</sup>	0.117	0.143 <sup>a</sup>	0.150	0.0002
Volatility	0.024	0.022	0.028 <sup>a</sup>	0.024	0.025 <sup>a,b</sup>	0.019	0.024 <sup>b</sup>	0.022	0.0317
Preissue runup in stock price	20.41%	19.46%	15.73% <sup>d</sup>	16.71%	18.96% <sup>d</sup>	16.96%	21.33% <sup>d</sup>	20.91%	0.0678
Preissue runup in market	11.49%	12.02%	10.90% <sup>d</sup>	11.91%	12.10% <sup>d</sup>	13.15%	11.47% <sup>d</sup>	11.96%	0.8845
Two-day announcement date excess return	−1.09%	−0.98%	−1.22% <sup>d</sup>	−0.98%	−1.11% <sup>d</sup>	−0.96%	−1.06% <sup>d</sup>	−1.00%	0.7654

All market and accounting data are for the end of the fiscal year end prior to the issue, unless otherwise indicated. Issue size is equal to the gross proceeds of the issue in millions. Total assets equals the book value of assets (#6). The market value of common stock is measured as the closing stock price at the fiscal year-end immediately preceding the announcement date (#199) multiplied by the number of shares outstanding at the same date (#25). Sales is equal to net sales (#12). Market-book is the market-to-book ratio, defined as the sum of total assets plus the market value of common stock minus the book value of common equity (#60) divided by the book value of total assets. Earnings-price is the earnings-to-price ratio, defined as earnings per share (#58) divided by the market price per share (#199). Long-term debt/total assets is equal to the book value of the firm's long-term debt (#9) divided by total assets. Change in assets is the difference between total assets in the issue year and the year immediately prior to issue. Slack is equal to cash plus marketable securities (#1) divided by total assets. Taxes/total assets equals taxes (#16) divided by total assets. Net income/total assets equals net income (#16) divided by total assets. Volatility is the standard deviation of the issuer's raw return over the 75 days preceding the announcement date. Preissue runup in stock price is equal to the issuer's raw return over 75 days preceding the announcement date. Preissue runup in market is equal to the market's raw return over the 75 days preceding the announcement date. The announcement date excess return is calculated using the day immediately prior to and the day of the announcement. The Waller–Duncan *K*-ratio *T* test is used to determine whether the mean values across issuer groups are different. Each issuer group with the same alphabetic letter (a, b, or c) has a mean that is not statistically different. Different letters represent issuer groups that have statistically different means. Groups with “lower” letters have higher means. The letter ‘d’ indicates that the Waller–Duncan *K*-ratio *T* test fails to detect a significant difference across all groups.

Table 3  
Summary statistics for the convertible issuer's industry 1978–1992

	All issuers (588 observations)		Debt-like issuers (62 observations)		Hedge-like issuers (74 observations)		Equity-like issuers (452 observations)		Kruskal– Wallis <i>p</i> -value
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
Total assets (millions)	273.3	48.1	538.4 <sup>a</sup>	53.5	373.7 <sup>a,b</sup>	87.5	214.2 <sup>b</sup>	42.9	0.0168
Sales	231.3	59.4	308.3 <sup>d</sup>	72.2	253.4 <sup>d</sup>	99.0	215.3 <sup>d</sup>	48.8	0.1047
Market-book	1.150	0.875	0.965 <sup>b</sup>	0.706	0.823 <sup>b</sup>	0.649	1.234 <sup>a</sup>	0.978	0.0001
Earnings-price	0.048	0.043	0.065 <sup>a</sup>	0.058	0.072 <sup>a</sup>	0.067	0.041 <sup>b</sup>	0.037	0.0001
Long-term debt/total assets	0.225	0.168	0.258 <sup>d</sup>	0.209	0.232 <sup>d</sup>	0.200	0.218 <sup>d</sup>	0.158	0.0870
Change in assets	0.245	0.146	0.140 <sup>d</sup>	0.085	0.259 <sup>d</sup>	0.211	0.259 <sup>d</sup>	0.143	0.1893
Slack	0.076	0.063	0.065 <sup>d</sup>	0.053	0.076 <sup>d</sup>	0.062	0.078 <sup>d</sup>	0.063	0.3349
Taxes/total assets	0.005	0.001	0.006 <sup>b</sup>	0.002	0.008 <sup>a</sup>	0.004	0.004 <sup>b</sup>	0.001	0.0001
Net income/total assets	0.036	0.037	0.033 <sup>d</sup>	0.035	0.039 <sup>d</sup>	0.041	0.035 <sup>d</sup>	0.037	0.4105
Volatility	0.028	0.025	0.026 <sup>a,b</sup>	0.023	0.025 <sup>b</sup>	0.024	0.028 <sup>a</sup>	0.026	0.0021
Preissue runup in stock price	8.55%	8.2%	8.8% <sup>d</sup>	8.9%	11.5% <sup>d</sup>	10.4%	8.0% <sup>d</sup>	8.0%	0.2817

Industry mean and median performance measures are calculated by using all other firms with the same 3-digit SIC Code in COMPUSTAT that did not issue convertible debt during the year prior to the announcement date. All market and announcing data are for the end of the fiscal year end prior to the issue, unless otherwise indicated. Total assets equals the book value of assets (#6). The market value of common stock is measured as the closing stock price at the fiscal year end immediately preceding the announcement date (#199) multiplied by the number of shares outstanding at the same date (#25) sales is equal to net sales (#12). Market-book is the market-to-book ratio, defined as the sum of the total assets plus the market value of common stock minus the book value of common equity (#60) divided by the book value of total assets. Earnings-price is the earnings-to-price ratio, defined as earnings per share (#58) divided by the market price per share (#199). Long-term debt/total assets is equal to the book value of the firm's long-term debt (#9) divided by total assets. Change in assets is the difference between total assets in the issue year and the year immediately prior to issue. Slack is equal to cash plus marketable securities (#1) divided by total assets. Taxes/total assets equals taxes (#16) divided by total assets. Net income/total assets equals net income (#16) divided by total assets. Volatility is the standard deviation of the issuer's raw return over the 75 days preceding the announcement date. Preissue runup in stock price is equal to the issuer's raw return over the 75 days preceding the announcement date. The Waller–Duncan *K*-ratio *T* test is used to determine whether the mean values across issuer groups are different. Each issuer group with the same alphabetic letter (a,b, or c) has a mean that is not statistically different. Different letters represent issuer groups that have statistically different means. Groups with “lower” letters have higher means. The letter ‘d’ indicates that the Waller–Duncan *K*-ratio *T* test fails to detect a significant difference across all groups.

environment where asymmetric information about investment policies and risk levels is important to investors.

- *Equity-like issuers:* Equity-like issuers are small firms that make large investments in profitable investment opportunities. They tend to be in industries of smaller firms that also have profitable growth opportunities. Relative to debt-like and hedge-like issuers, industry investment rates are moderate. However, equity-like issuers invest capital at very high rates compared with issuers of other types of convertible debt, even though investor concerns about adverse selection and underinvestment are likely to be important.

#### 4. Effect of industry performance and growth opportunities on the issue decision

This section presents a multivariate analysis of the firm-specific and industry characteristics of convertible debt issuers. We use a logistic regression model to compare the characteristics of issuing firms and industry “composite” firms. To form the composite firm, we use the industry median of each explanatory variable. This approach avoids choosing a particular performance measure upon which to select a matching company.<sup>10</sup>

We estimate separate models for the full sample of convertible debt issuers and for the subsamples of debt-like, hedge-like, and equity-like issuers. We estimate the following logit model for each sample of issuing firms:

$$\begin{aligned} \text{CD} = & \text{intercept} + \beta_1 \text{ market-to-book ratio} + \beta_2 \text{ net income/total assets} \\ & + \beta_3 \text{ change in total assets} + \beta_4 \text{ long-term debt/total assets} \\ & + \beta_5 \text{ firm size} + \beta_6 \text{ slack} + \beta_7 \text{ volatility} \\ & + \beta_8 \text{ preissue stock price runup} + e, \end{aligned} \quad (2)$$

where CD equals one if the company issues convertible debt, a value of zero is assigned to the “composite” company that did not issue convertible debt during the offer year, and  $e$  is the model residual.

##### 4.1. Regression results for the full issuer universe

Column 1 in Table 4 reports coefficient estimates and chi-square statistics for the logit model. The full-sample model results indicate that relative industry performance is an important determinant of the decision to issue convertible debt. The model correctly classifies 91.8% of the observations, and has a pseudo- $R^2$  of 0.44.

<sup>10</sup> Our analysis can be considered an investigation of the decision to issue convertible debt versus the decision not to raise new capital. Since the initial part of the analysis focuses on expectations of a security offer, this is the relevant comparison. For an analysis of factors that influence the selection of convertible debt versus other standard security offers like common equity or convertible debt (see Lewis et al., 1999).

Table 4  
Logit analysis of issuer and issuer's industry characteristics for 588 convertible debt offerings 1978–1992

Independent variables	All issuers		Debt-like issuers		Hedge-like issuers		Equity-like issuers	
	(1)		(2)		(3)		(4)	
	Coefficient	<i>p</i> -value	Coefficient	<i>p</i> -value	Coefficient	<i>p</i> -value	Coefficient	<i>p</i> -value
Intercept	−5.395	0.0001***	−6.482	0.0001***	−4.948	0.0001***	−5.868	0.0001***
Market-book	1.373	0.0001***	2.935	0.0001***	2.468	0.0001***	1.121	0.0001***
Net income/total assets	17.108	0.0001***	8.056	0.0344**	8.807	0.0001***	26.869	0.0001***
Change in total assets	−0.336	0.0218**	−1.453	0.0628*	−1.284	0.0161**	−0.175	0.3016
Long-term debt/total assets	3.676	0.0001***	3.789	0.0193**	3.565	0.0138**	4.011	0.0001***
Firm size	0.001	0.0001***	0.001	0.0593*	0.001	0.0084***	0.001	0.0001***
Slack	4.808	0.0001***	11.004	0.0155**	−4.133	0.2979	8.345	0.0001***
Volatility	5.863	0.4443	11.805	0.6627	8.893	0.5864	−9.888	0.4079
Preissue stock price runup	3.360	0.0001***	3.955	0.0562*	2.462	0.1142	3.574	0.0001***
Pseudo- <i>R</i> <sup>2</sup>	0.442		0.461		0.435		0.541	
Percentage correct	91.8%		91.4%		91.6%		94.0%	

The dependent variable equals 1 if the observation is an issuing firm and 0 if the observation is on issuer's industry. *Independent variables.* All market and accounting data are for the end of the fiscal year prior to the issue, unless otherwise indicated. Market-book is the market-to-book ratio, defined as the sum of the total assets (#6) plus the market value of common stock minus the book value of common equity (#60) divided by the book value of total assets. The market value of common stock is measured as the closing stock price at the fiscal year-end immediately preceding the announcement date (#199) multiplied by the number of shares outstanding at the same date (#25). Net income/total assets equals net income (#16) divided by total assets. Change in total assets is the difference between total assets at the end of the fiscal year immediately following the offer date minus total assets in the fiscal year immediately preceding the offer date. Long-term debt/total assets is equal to the book value of the firm's long-term debt (#9) divided by total assets. Firm size is the natural logarithm of the market value of common stock. Slack is equal to cash plus marketable securities (#1) divided by total assets. Volatility is the standard deviation of the issuer's raw return over the 75 days preceding the announcement date. Preissue runup in stock price is equal to the issuer's raw return over the 75 days preceding the announcement date.

\* Significance at 0.10 level.

\*\* Significance at 0.05 level.

\*\*\* Significance at 0.01 level.



Overall, the model explains a significant proportion of the cross-sectional variation in the convertible debt issue decision.

Both investment-related and financing-related variables influence the convertible debt issue decision. Relative to the industry composite firm, convertible debt issuers have more profitable investment opportunities but lower investment growth rates. Thus, convertible debt may serve as a bonding mechanism against overinvestment by these firms.

In addition, both debt- and equity-related costs of external finance influence the convertible debt issue decision. Debt-related costs of external finance increase with leverage but decrease with income. All else equal, the incremental impact of high leverage may render straight debt financing too expensive for firms that issue convertible debt even though their relative industry income levels would appear to decrease debt-related external financing costs. Equity-related costs of external finance increase with financial slack and preissue stock price performance and decrease with firm size. All else equal, the incremental costs of high financial slack and preissue stock price performance may render common equity financing too expensive for firms that issue convertible debt.

#### 4.2. Issuer subsample regression results

If convertible debt security design is related to issuer differences in debt- and equity-related costs of external finance, the factors underlying the issue decision of a company characterized by asset substitution problems are likely to differ from the factors influencing the decisions of firms facing private information problems or financial distress. The results reported in Columns 2 through 4 in Table 4 demonstrate that, even though there are some common characteristics influencing convertible debt security choice decisions, there are several significant differences between issuer types.

As in the full-sample results, we find that, relative to median industry levels, investment opportunities are more profitable, leverage is higher, firm size is larger, and preissue stock performance is better across all issuer groups. Once again, relative volatility is not a significant determinant of the use of convertible debt. Unlike the full-sample results, earnings, investment growth, and financial slack are related to security offer type.

- *Debt-like issuers:* Debt-like issuers (Column 2) have significantly lower investment growth rates than other firms in the same industry, even though they have more profitable investment opportunities. Since firms in the debt-like issuer category operate in low market-to-book industries, investors may still be concerned with risk shifting, particularly given that issuers have not invested as intensely as other firms in the same industry. We conjecture that asset substitution is most likely to be a significant problem for firms that have low market-to-book ratios (near 1.0). Thus, the results suggest that even firms in low market-to-book industries may find the use of convertible debt to be beneficial if their own firm-specific investment opportunities are sufficiently valuable. The coefficients on the financing-related variables

suggest that the same debt- and equity-related costs of external finance influencing the full sample have a similar impact on the debt-like convertible debt issuers.

- *Hedge-like issuers:* For hedge-like issuers (Column 3), investment-related characteristics have a similar impact on the convertible debt issuance decision as for debt-like issuers. Thus, even though investment opportunities are more profitable for hedge-like than debt-like issuers, convertible debt serves an important role here as well. Brennan and Schwartz (1988) suggest that convertible securities are especially useful for firms whose investment policy is hard to predict. Two factors that characterize investment policy may be at work here. First, firms with high market-to-book ratios may have operating risks that are more difficult to assess than firms with considerable assets-in-place. Second, managerial discretion may be a more important determinant of the profitability of high market-to-book companies because a more significant fraction of the firm's value depends on the optimal exercise of future growth opportunities.<sup>11</sup>

The results for the hedge-like and debt-like issuers suggest that it is not simply the level of investment opportunities and growth rates that influence the convertible debt issue decision, but rather the relations between the firm's investment opportunities and growth rates on the one hand, and the industry levels on the other hand. What seems important is that issuer's investment opportunities are more valuable and its growth rate is lower than the industry composite. Note also that slack and pre-issue stock price runup are insignificant for hedge-like issuers, suggesting that equity-related costs of external finance are somewhat less influential on the convertible debt decision for this set of firms.

- *Equity-like issuers:* For equity-like issuers (Column 4), investment opportunity profitability is significant but growth rates are not. Since this group of issuers has the most profitable investment opportunities, and they tend to compete in highly profitable industries, investor concerns about growth rates are less influential on the convertible debt issue decision. However, both debt-related and equity-related costs of external finance are significant determinants of the issuance decision for these firms.

Overall, the results are consistent with the interpretation that the demand for capital in convertible debt security offers derives from a combination of investment-related and financing-related costs of external finance. The actual design of the convertible debt security depends on both the sources and uses of the incremental capital. Moreover, the logistic regression results suggest that convertible debt issues and security design depend on differences between the operating and financial performance of issuers and their industry composite. The results support the hypothesis that firms choose to issue convertible debt as both debt- and equity-related costs of external finance increase.

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<sup>11</sup> Kahan and Yermack (1998) argue that, for these types of firms, control of managerial decision-making through convertibility provisions is preferable to the extensive use of covenants.

## 5. Effect of industry performance, growth opportunities, and external finance costs on investor reactions

To determine how the relation between an issuer's operating and financial characteristics and those of other firms in the same industry influences investor reactions to convertible debt security offer announcements, we adjust all the firm-specific variables in two ways. First, we calculate the difference between the issuer's variables and the industry median. This adjusts for differences in the level of performance across industries. Second, we divide the difference by the standard deviation of the performance measure in each industry. By effectively transforming the explanatory variables to the same scale, we control for differences in the variation of performance across industries.

Table 5 presents the results of estimating cross-sectional regressions for the full sample (Columns 1 and 2) and for subsamples sorted by security design characteristics (Columns 3–5). To control for possible heteroscedasticity among the explanatory variables, we estimate weighted least squares regressions where the weights are based on the standard deviation of stock returns in the 75-day pre-event period. Table 5 also reports *p*-values based on heteroscedasticity consistent standard errors.

### 5.1. Regression results for the full issuer universe

For the full sample (Column 1), the results suggest that two equity-related costs of external finance influence investor reactions. Excess returns are higher for issuers with high levels of financial slack, and lower for issuers with positive preissue stock price performance. Neither investment-related nor debt-related costs of external finance appear to influence investor reactions for the full sample.

The finding that investor reactions are largely unrelated to firm-specific performance measures in the full sample regression analysis is similar to the results reported in Dann and Mikkelsen (1984), Eckbo (1986), and Mikkelsen and Partch (1986). We suggest that there are two plausible explanations for these findings. First, as illustrated in Table 4, investors utilize investment-related and debt-related information to form expectations of convertible debt issues. Thus, at least to some extent, expectations of a convertible debt security offer may already be impounded in the issuer's stock price. Second, issuers may offer convertible debt for different reasons, and therefore analysis of the full sample may obscure the role of issuance motives on investor reactions. We explore this issue in more detail in Section 5.2 below where we investigate share price reactions to convertible debt offers by debt-like, hedge-like and equity-like issuers separately.

Before we conduct the subsample analysis, however, we note that there is a potential adverse selection problem for firms that have high levels of growth opportunities if investors realize that firms are unlikely to use the issue proceeds to invest in positive NPV projects. We address this concern by interacting the market-to-book ratio with an investment dummy variable. The dummy variable is set to one if the change in total assets exceeds its median and zero if the change in total assets is below its median.

Table 5

WLS estimates of coefficients in cross-sectional regressions of the two-day announcement date excess return on indicated explanatory variables for 588 convertible debt offerings 1978–1992 and sorted by actual security design

Independent variables	All issuers		All issuers		Debt-like issuers		Hedge-like issuers		Equity-like issuers	
	(1)		(2)		(3)		(4)		(5)	
	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value
Intercept	−0.825	0.121	−0.796	0.134	−5.497	0.047**	1.317	0.436	−1.118	0.111
Market-book	−0.011	0.963	−0.699	0.106	0.927	0.725	3.124	0.056*	−0.924	0.049**
Market-book × change in asset dummy	–	–	0.864	0.059*	−0.770	0.736	−4.441	0.021**	1.235	0.014**
Net income/total assets	−3.292	0.243	−3.081	0.274	−4.958	0.785**	−7.552	0.329	−5.292	0.170
Change in total assets	0.082	0.780	−0.051	0.865	−1.395	0.414	0.445	0.701	−0.041	0.902
Long-term debt/total assets	−0.619	0.550	−0.647	0.531	−2.290	0.668	−5.603	0.093*	−0.481	0.676
Firm size	−0.003	0.983	−0.014	0.914	0.245	0.660	−0.560	0.139	0.082	0.586
Slack	3.396	0.052**	3.533	0.043**	18.515	0.018**	−14.598	0.181	3.277	0.081*
Volatility	2.995	0.708	4.788	0.551	117.887	0.044**	−10.872	0.467	5.688	0.769
Issue size	0.299	0.804	0.085	0.927	−2.051	0.770	1.448	0.720	0.349	0.735
Preissue runup in stock price	−5.340	0.013**	−4.991	0.020***	−0.894	0.912	−18.307	0.005***	−3.334	0.174
Preissue runup in market	1.460	0.131	1.233	0.204	3.538	0.613	8.406	0.035**	0.567	0.598
Adjusted <i>R</i> <sup>2</sup>	0.0119		0.0174		0.1419		0.1229		0.0102	

The dependent variable is the two-day announcement date excess return, which is calculated using the day immediately prior to and the day of the announcement. *Independent variables.* With the exception of issue size and the preissue runup in market, all independent variables are calculated by subtracting the industry mean. All market and accounting data are for the end of the fiscal year prior to the issue, unless otherwise indicated. Market-book is the market-to-book ratio, defined as the sum of the total assets (#6) plus the market value of common stock minus the book value of common equity (#60) divided by the book value of total assets. The market value of common stock is measured as the closing stock price at the fiscal year end immediately preceding the announcement date (#199) multiplied by the number of shares outstanding at the same date (#25). The change in asset dummy equals one if the change in total assets is positive and zero otherwise. Change in total assets is the difference between total assets at the end of the fiscal year immediately following the offer date minus total assets in the fiscal year immediately preceding the offer date. Net income/total assets equals net income (#16) divided by total assets. Long-term debt/total assets is equal to the book value of the firm's long-term debt (#9) divided by total assets. Firm size is the natural logarithm of the market value of common stock. Slack is equal to cash plus marketable securities (#1) divided by total assets. Volatility is the standard deviation of the issuer's raw return over the 75 days preceding the announcement date. Issue size is equal to the gross proceeds of the issue divided by total assets. Preissue runup in stock price is equal to the issuer's raw return over the 75 days preceding the announcement date. Preissue runup in market is equal to the market's raw return over the 75 days preceding the announcement date.

- \* Significance at 0.10 level.
- \*\* Significance at 0.05 level.
- \*\*\* Significance at 0.01 level.

If investors believe that firms are investing issue proceeds in positive NPV projects, the interaction term should be positive. If investors believe that the firm is opportunistically offering overpriced securities, there is an adverse selection problem for high-growth firms. In this case, investors realize that issue proceeds will not be invested, and the coefficient for the market-to-book ratio will be negative.

The regression in Column 2 reports the results from interacting the market-to-book ratio and the change in total assets. The regression coefficient for market-to-book is negative and insignificant, and the regression coefficient for the interaction effect is positive and statistically significant. The stock price reaction to firms that invest the offer proceeds is 86 basis points higher than those that do not. Thus, the use of proceeds from convertible debt security offers is an important determinant of the investor reaction to the security offer announcement. All other results in Column 2 are comparable to the regression results reported in Column 1.

## 5.2. Issuer subsample regression results

The evidence in Columns 3–5 indicates that the factors influencing investor reaction to convertible debt offers depend on design of the security. The sorting of convertible debt issuers according to perceived issuance motive increases the explanatory power of the investor reaction regression analysis because investors react differently to alternative issue characteristics.

### 5.2.1. Investor reactions to debt-like issuers

Regression (3) indicates that investor reactions to debt-like offers are insignificantly related to the investment-related performance variables. One possible explanation for this finding is offered by Green (1984), who suggests that an efficient convertible debt security offer by debt-like issuers mitigates adverse investment incentives. Thus, conditional on the expectation of issuance motive and security design, investment incentives will not be adversely impacted by the use of convertible debt.

Investor reactions are, however, influenced by external finance costs. For example, high profitability is expected to reduce debt-related external financing costs, and high volatility is expected to increase debt-related financing costs. For debt-like issuers, high levels of profitability decrease investor reactions and high levels of volatility increase investor returns.

Equity-related costs of external finance also influence investor reactions. High levels of financial slack have a positive impact of share price reactions. To the extent that adverse selection is an important source of equity issuance costs for debt-like issuers, the results suggest that investors view the decision to offer convertible debt as good news. The negative profitability variable and positive slack variable suggest that investor uncertainty about the value of assets-in-place (as opposed to growth opportunities) may be the source of asymmetric information for these issuers. The positive volatility parameter suggests that, conditional on the expectation of a debt-like offer, investors react more positively to offers by higher-risk firms.

A comparison of the results in Tables 4 and 5 suggests that the factors influencing the likelihood of a convertible debt security offer by a debt-like issuer are largely different from the factors influencing investor reaction to the security offer. If issuers design convertible debt to mitigate capital market imperfections, we would expect this result.

### *5.2.2. Investor reactions to hedge-like issuers*

Regression (4) shows that the factors explaining investor reactions to hedge-like security offers also differ from the factors influencing the likelihood of the offer. In contrast to debt-like issuers, investment-related performance variables are a significant determinant of investor reaction to hedge-like convertible debt security offers. Share price reactions are positively related to the profitability of the issuer's investment opportunities. However, this positive impact is lower for hedge-like issuers that have high investment growth rates. Apparently, for these issuers, investors have concerns about the incremental investment-related costs of rapid growth.

Equity- and debt-related costs of external finance also influence investor reactions to hedge-like offers. Share price reactions are negatively related to leverage, which suggests that hedge-like convertible debt security design may not completely mitigate risk concerns for high leverage firms (Brennan and Schwartz, 1988). Similar to the case of equity issuers (Choe et al., 1993), share price reactions are positively related to the preissue stock market performance and negatively related to the issuer's own preissue stock price performance. This suggests that adverse selection remains an investor concern for these issuers, at least for firms with the best preissue stock price performance.

Note also that, like debt-like convertible debt security offers, debt- and equity-related costs of external finance influence investor reactions. However, the specific sources of the costs differ across these issuer classes. In other words, while debt- and equity-related costs of external finance influence convertible debt security design and investor reactions, there are important cross-sectional differences in the underlying market imperfection that causes these external financing costs. This finding supports our contention that full sample analyses of convertible debt issuers may obscure underlying issuance motives.

### *5.2.3. Investor reactions to equity-like issuers*

For equity-like issuers, regression (5) indicates that investor reactions are related to investment-related performance variables. In contrast to the hedge-like issuers, however, share price reactions are negatively related to the profitability of the issuer's investment opportunities. Investors respond negatively to firms that have high industry-adjusted growth opportunities but fail to invest the proceeds in new projects. The negative impact is mitigated, however, for the equity-like issuers that have high investment growth rates. Since the explanatory variables are industry-adjusted, firms that issue convertible debt with growth opportunities that are one standard deviation from the median have a negative 92 basis point reaction. Investors respond positively if the same firm invests the proceeds in a new project. In this case, there is a positive 124 basis point reaction.

This evidence is consistent with Stein's (1992) backdoor equity hypothesis. That is, firms issue equity-like convertible debt to overcome adverse selection problems when they plan to use the issue proceeds for new investment. If investors cannot infer that the firm has immediate plans for the issue proceeds, the security design is not effective, and investors respond skeptically.

In contrast to the debt-like and hedge-like issuers, financing-related variables play only a modest role in explaining share price reactions. None of the debt-related financing cost variables are significant. And, among the equity-related financing cost variables, only the slack variable is significant. Firms with higher financial slack have less negative (more positive) share price reactions. Thus, for equity-like issuers, it appears that investment-related variables are more important determinants of investor reactions than are the financing-related variables.

## 6. Windows of opportunity and investor reaction to issuance decisions

Investor reactions to security offer announcements could vary if the costs associated with capital market imperfections change through time. Choe et al. (1993) and Bayless and Chaplinsky (1996) suggest that firms time their seasoned equity issuance decisions to coincide with periods of reduced information costs. Both studies examine this hypothesis by comparing excess returns during time periods characterized by different information costs. They find that excess returns are less negative when information costs are hypothesized to be low. The authors conclude that their evidence is consistent with time variation in adverse selection costs.

We follow Bayless and Chaplinsky and use the aggregate volume of equity issues to identify periods when convertible debt can be issued at favorable terms.<sup>12</sup> We use equity issue volume for several reasons. First, Bayless and Chaplinsky (1996) and Choe et al. (1993) provide evidence that equity issue volume affects both security choice decision and investor reaction to the financing decisions in the case of seasoned equity issues. An examination of security choice decisions and investor reactions during periods known to be favorable for seasoned equity offers provides additional evidence on factors influencing the use of other types of security offers.

Second, by examining periods when adverse selection costs for all issuers are hypothesized to be low, we are able to provide evidence on the relative importance of asymmetric information costs and, indirectly, other financing costs in the convertible debt financing decision. Stein (1992) suggests that adverse selection costs are an important determinant of the convertible debt issue decision.

Finally, by focusing on distinct time periods when adverse selection costs vary, our analysis can also shed light on the possibility of time variation in the financing costs of other sources of investment capital.

Table 6 summarizes the number of debt-like, hedge-like, and equity-like convertible debt offers sorted by equity issue volume periods. Cold market issues account for

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<sup>12</sup> We thank Susan Chaplinsky for providing us with an updated list of the Bayless and Chaplinsky (1996) hot and cold market periods based upon equity issue volume.

Table 6

Issue-type and issue volume period frequency for the Sample of 588 convertible debt offerings firms 1978–1992

Issue volume period	Debt-like offers	Hedge-like offers	Equity-like offers	Total
Cold offers	13	2	45	60
Normal offers	15	34	112	161
Hot offers	34	38	295	367
	62	74	452	588

10.2% of total sample period offers; normal market issues account for 27.4% of total sample period offers; and, hot market issues account for 62.4% of total sample period offers. More firms issue convertible debt when market conditions are favorable for seasoned equity issues. The clustering of convertible debt offers during high equity issue volume periods is consistent with the view that certain time periods offer a window of opportunity, and that conditions favorable to seasoned equity issues are also advantageous for convertible debt security offers.

If the level of asymmetric information is low in high-volume equity issue periods, then why do not these firms issue common equity? This is especially puzzling, given that survey evidence reports that many managers regard convertible debt as a delayed equity offer (Hoffmeister, 1977; Brigham, 1966; Pilcher, 1955). We address this question by conducting several tests, which we discuss below.

A Pearson  $\chi^2$  test indicates that the association between convertible debt security design and equity issue volume is not very strong. We observe similar frequencies of debt-like, hedge-like, and equity-like convertible debt security offers across different market conditions. Regardless of issue volume conditions, issuers seem to favor equity-like convertible debt offers over debt-like or hedge-like issues. If equity issue volume changes due to time-varying adverse selection, these results are not expected.

In Table 7, we estimate cross-sectional regressions designed to evaluate whether investor reactions to convertible debt security offer announcements are significantly different in cold, normal, and hot equity issue volume markets. We present results for estimating cross-sectional regressions for the full sample (Columns 1 and 2) and for subsamples sorted by security design characteristics (Columns 3–5).

To control for possible heteroscedasticity among the explanatory variables, we estimate weighted least squares regressions where the weights are based on the standard deviation of stock returns in the 75-day pre-event period. Table 7 also reports *p*-values based on heteroscedasticity consistent standard errors.

### 6.1. Regression results for the full issuer universe

Regression results for the full sample are reported in Column 1. To measure the marginal impact of issue volume conditions on investor reactions, the regression includes two dichotomous variables. Hot issue period is equal to one if the issue occurs in a hot market and zero otherwise. Cold issue period is equal to one if the issue occurs in a cold market and zero otherwise.



Table 7

WLS estimates of coefficients in cross-sectional regressions of the two-day announcement date excess return on indicated explanatory variables for 588 convertible debt offerings 1978–1992 and sorted by issue volume conditions

Independent variables	All issues		Cold issue period		Normal issue period		Hot issue period	
	(1)		(2)		(3)		(4)	
	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value	Coefficient × 100	<i>p</i> -value
Intercept	-1.609	0.013**	-2.632	0.234	-1.561	0.107	-0.724	0.373
Hot issue period	1.019	0.023**	–	–	–	–	–	–
Cold issue period	0.998	0.196	–	–	–	–	–	–
Market-book (MB)	-0.441	0.205	0.751	0.422	-0.927	0.071*	-0.439	0.432
MB × change in asset dummy × equity-like	0.645	0.091*	-1.808	0.281	0.843	0.139	1.083	0.067*
Net income/TA	-3.676	0.191	37.571	0.016**	-7.054	0.099*	-5.313	0.174
Change in total assets	-0.015	0.961	0.965	0.448	-0.388	0.454	-0.198	0.610
Long-term debt/TA	-1.004	0.336	-4.646	0.172	-1.752	0.340	0.210	0.880
Firm size	0.021	0.875	-0.506	0.183	0.168	0.497	0.028	0.875
Slack	3.592	0.040**	9.910	0.053*	2.528	0.484	1.946	0.378
Volatility	7.155	0.377	163.647	0.017***	4.194	0.671	8.024	0.707
Issue size	-0.170	0.854	-2.191	0.502	-2.791	0.141	1.079	0.336
Preissue runup in stock price	-4.552	0.036**	-7.039	0.535	5.503	0.159	-11.624	0.000***
Preissue runup in market	1.154	0.235	-1.533	0.543	-1.462	0.449	3.149	0.012**
Adjusted <i>R</i> <sup>2</sup>	0.0242		0.4565		0.0285		0.0502	

The dependent variable is the two-day announcement date excess return, which is calculated using the day immediately prior to and the day of the announcement. *Independent variables.* With the exception of issue size and the preissue runup in market, all independent variables are “calculated by subtracting the industry mean. All market and accounting data are for the end of the fiscal year prior to the issue, unless otherwise indicated. Market-book is the market-to-book ratio, defined as the sum of the total assets (#6) plus the market value of common stock minus the book value of common equity (#60) divided by the book value of total assets. The market value of common stock is measured as the closing stock price at the fiscal year end immediately preceding the announcement date (#199) multiplied by the number of shares outstanding at the same date (#25). The change in asset dummy equals one if the change in total assets is positive and zero otherwise. Change in total assets is the difference between total assets at the end of the fiscal year immediately following the offer date minus total assets in the fiscal year immediately preceding the offer date. Net income/total assets equals net income (#16) divided by total assets. Long-term debt/total assets is equal to the book value of the firm’s long-term debt (#9) divided by total assets. Firm size is the natural logarithm of the market value of common stock. Slack is equal to cash plus marketable securities (#1) divided by total assets. Volatility is the standard deviation of the issuer’s raw return over the 75 days preceding the announcement date. Issue size is equal to the gross proceeds of the issue divided by total assets. Preissue runup in stock price is equal to the issuer’s raw return over the 75 days preceding the announcement date. Preissue runup in market is equal to the market’s raw return over the 75 days preceding the announcement date.

\* Significance at 0.10 level.

\*\* Significance at 0.05 level.

\*\*\* Significance at 0.01 level.

The results indicate that the hot market coefficient is positive and significant. Like seasoned equity issue returns, excess returns surrounding convertible debt security offers are significantly less negative on average in hot markets than in normal markets. The cold market coefficient is also positive but insignificant. Unlike seasoned equity issue returns, excess returns surrounding convertible debt security offers are insignificantly different in cold markets and normal markets. To the extent that windows of opportunity are due to time-varying asymmetric information, our results suggest that convertible debt issuers may face other time-varying costs of issue.

After controlling for differences in market conditions, we also find that investment-related variables impact investor reactions. Price reactions are more positive (less negative) for equity-like convertible debt offers by high growth issuers with valuable investment opportunities. Regardless of actual market conditions, investors seem to respond favorably to offers by this type of firm.

We also find that debt-related financing cost variables have no incremental impact on investor reactions once we control for market conditions. Equity-related financing costs do, however, provide incremental explanatory power. Preissue stock price runup has a negative incremental impact while slack has a positive impact. Thus, for the full sample, adverse selection costs seem to have an impact on investor reactions, regardless of market conditions.

## *6.2. Issuer subsample regression results*

The marginal impact of the explanatory variables on investor reactions could also vary in different market conditions. We examine this possibility by estimating separate regressions for convertible debt security offers by firms in cold, normal and hot market conditions. These results are presented in Columns 2–4 in Table 7.

### *6.2.1. Investor reactions in cold issue periods*

Bayless and Chaplinsky (1996) suggest that investors may have a more difficult time discriminating between good firms and bad firms in cold markets. They argue therefore that investors will put more weight on firm-specific factors in these market conditions.

Regression (2) indicates that three variables are statistically significant for cold market issuers. Investor reactions are significantly affected by firm-specific and market variables. The positive net income and positive volatility coefficients suggest that debt-related costs of external finance are particularly important to investors during cold market periods. For example, the significant positive volatility coefficient is consistent with the hypothesis that asset substitution problems are likely to be especially important during cold markets. Investments designed to transfer wealth rather than create wealth are likely to be more prevalent during such periods. The results also indicate that investor reactions are higher for issuers with high income levels during these periods.

Equity-related costs of external finance are also significant during cold markets. Investor reactions are higher for issuers with high levels of financial slack, which suggests that adverse selection concerns are important. Both Choe et al. (1993) and Bay-

less and Chaplinsky (1996) argue that information asymmetries are likely to be especially high in these market conditions. Our results would be consistent with this interpretation. What's new in our study is the illustration that other costs of external finance also have a time-variation component as well. Finally, it is noteworthy that investment-related variables have no incremental impact on investor reactions during cold market periods.

#### *6.2.2. Investor reactions in hot issue periods*

By contrast, regression (4) shows that market-related and investment-related variables influence investor reactions in hot market periods, but firm-specific characteristics do not. Investor reactions are negatively related to the issuer's preissue stock price performance and positively related to the preissue market return. These results are the same as the results reported in Choe et al. (1993) for seasoned equity issuers. They also find that investor reactions to seasoned equity issues are positively related to the preissue market return and negatively related to the issuer's preissue stock price performance. Our result indicates that, in hot markets, investors believe that firms substituting convertible debt for a seasoned equity offer are overvalued as well.

This market-related effect can be mitigated, at least to some extent, by high growth firms with more profitable investment opportunities. Equity-like issues by firms that are growing rapidly with profitable investment opportunities have less negative price reactions than other types of convertible debt offers in hot issue markets. That is, investors distinguish between issuers following large preissue stock price run-ups on the basis of security design and investment-related performance information. We interpret this result as indicating that, for these issuers, investors are less concerned about the issue being motivated by overvaluation.

#### *6.2.3. Investor reactions in normal issue periods*

Regression (3) indicates that investment-related and financing-related variables both influence investor reactions during normal markets. Investor reactions are negatively related to the profitability of the firm's investment opportunities. In addition, price reactions are more negative for issuers with higher levels of profitability. Both results are only marginally significant, however, which may suggest that equity prices already reflect the valuation consequences of convertible debt issues during normal market conditions.

Overall, our results suggest that investor reactions to convertible debt security offers depend on issue volume conditions in the seasoned equity market, and that different factors influence investor reaction in different market conditions. Firm-specific factors appear to be more important in cold markets, suggesting that investors rely on issuer-specific information much more when equity issues are unattractive.

## **7. Summary and conclusion**

The evidence presented in this paper suggests that firms issue convertible debt in response to a combination of costly debt- and equity-related financing problems. In

addition, security design features allow managers to issue convertible debt in response to several different sources of debt- and equity-related costs of external finance. One might be tempted to argue that the aggregate volume of straight debt and common equity issues relative to convertible debt suggests that firms more frequently face debt- or equity-related financing problems, but not both. For many firms, however, our evidence is supportive of the conclusion that complex hybrid securities serve an important role in the financing decisions of many firms. In addition, if a firm facing both debt- and equity-related costs of external finance holds a profitable investment or refinancing opportunity, then the issuance of convertible debt is likely to lead to a better outcome than the issuance of an inefficient standard security or foregoing the opportunity altogether.

While the use of a simple framework to sort issuers by perceived issuance motives highlights the importance of recognizing heterogeneity within the convertible debt issuer universe, one potential limitation of our study is that we do not explicitly demonstrate that issue date conversion probabilities are the best sorting mechanism. Future work should develop and assess additional measures of issuer motivation in order to investigate whether further insights into the convertible debt offering process are possible. We note, however, that Lewis et al. (1999) have shown that issue date conversion probabilities also play a significant role in explaining security choice decisions. Therefore, the development of other issuance motive measures should be assessed by their ability to explain security choice decisions, security design decisions, and investor reactions to convertible debt offer announcements.

Finally, this paper contributes to the literature that examines the relationships between security choice decisions and firm value, financial leverage, investment opportunities, and the rate of future growth. Because prior studies largely focus on the use of only straight debt or common equity, very little is known about whether the previous findings are representative of firms issuing complex hybrid securities or firms facing multiple financing problems. As our results illustrate, studies that limit their analyses to the use of standard financial securities may understate the complexity of the relationships between security choice decisions and firm value, financial leverage, investment opportunities, and the rate of future growth.

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