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Abstract

We discuss several measurements of equity components in CBs and then examine the short-run announcement effects and the long-run performances surrounding CB issuances by dividing the whole sample of CBs into a debt-like portfolio, a mixed portfolio and an equity-like portfolio. At the time of the CB issuance announcements, the market reactions to different portfolios strictly follow a hierarchy predicted by the pecking order hypothesis. In the long-run subsequent to the CB issuances, the buy and hold stock returns of the equity-like portfolio significantly underperform the industry and market benchmarks and the debt-like portfolio; the operating performances of the issuers that issuance equity-like CBs significantly deteriorated from the pre issuance period, inducing them to underperform both the issuers that issuance debt-like CBs and their non-issuing counterparts; and also, the equity-like portfolio went through the most significant increase in the idiosyncratic risk and the total equity risk, which however still do not differ significantly from their industry levels. Furthermore, we notice that the CB issuers' post issuance long-run performances are to a large extent consistent with the short-run market reactions they received. By controlling the equity risks, we contend that the market is able to form an unbiased foresight of the future operating performances of the CB issuers at the time of the CB issuances, and the short-run announcement effects are mostly determined by this market perception.

Keywords: convertible bond issuance, hedge ratio, announcement effect, long-run performance.

Contents

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1. Introduction

Convertible Bonds (CBs) are hybrid securities with mixed characteristics of straight debts, common equities, as well as options. They share the most similarities with straight debts when they are issued by companies, and they embody potential characteristics of common equities if they get converted during their life time. The most fascinating feature of CB is that it involves dual options for both the issuer and the investors. On one hand, CBs which are callable allow the issuers to forcibly convert them into equities when satisfying certain conditions. On the other hand, the investors can opt whether to convert by the time the CB is called by the issuer or by the time of the final maturity. If the CB ends up with being in-the-money, the investor can exercise the imbedded call warrant by converting the CB into a predetermined amount of equities of the issuer's. Otherwise, if the issuer's stock performs poorly and the CB ends up with being out-of-the-money, the investors will not convert and the issuer has to redeem the CB by paying cash to the investors.

In a CB contract, many provisions and conditions are stipulated, which allow for more flexibility for both the issuer and the investors, but they complicate the valuation and investigation of CB in the meantime. For example, in some cases the CB contracts specify call notice periods, which require the issuers to announce the dates to call in advance. Some contracts also have call protections or soft call features, the former of which restrict the CBs to be non-callable within the period of call protections and the latter of which restrict the CB to be callable only when the underlying stock prices maintain above a level for a certain period of time. In some other cases, put options are also provided so that the investors can even choose to return CBs to the issuers at a specific time and price. In general, the opportunity to convert CBs into equities benefits the investors by allowing them to share the growth potential of the bond issuer, whereas in compensation the investors receive coupon payments lower than that of the regular straight debts.

In literatures, researches from various aspects are developed to shed light on this complex hybrid security, such as investigations in the issuers' decision-makings to offer CBs, the optimal call strategies of the issuers, the market reactions to companies' announcements of CB issuances, the market reactions when CBs are formally issued, the market reactions when companies announce call decisions, the post-issuance long-run performances of the CB issuers' stock returns and operations, the investors' and arbitragers' decision-makings, the models for pricing and valuating CB, and so forth.

Empirical studies into the market reactions to CB issuances find that on average market reacts negatively to companies' CB issuance announcements. The negative announcement effects due to companies' external financing decisions have been well documented in literatures, which describe that the announcements of companies' external financings are often accompanied with non-positive stock market reactions to the issuer's outstanding shares. The announcements of common equity issuances (IPOs or SEOs) are found to be followed by large degrees of negative market reactions, slightly and insignificantly non-positive market reactions are found to be concomitant with the straight debt issuances, and the degrees of negative reactions to CB issuances are found to be in between that of the equity issuances and the straight debt issuances. For example, Mikkelson and Partch (1986) report that at the announcement of CB issuances, the abnormal stock returns are significantly negative (average prediction error = -1.97%, z-value=-4.94), which is lower than the abnormal returns at the common stock issuances (average prediction error=-3.56%, z-value=-9.81) and much higher than that at the straight debt issuances (-0.23 %, z-value=-1.40).

The different announcement effects for different financing instruments can be explained by the pecking order hypothesis of the “M&M model” (Myers and Majluf, 1984), which is developed under the assumption of asymmetric information. The hypothesis assumes that managers have information advantages over the public about the firms’ assets-in-place and investment opportunities, thereby they decide to offer equities when their outstanding shares are overvalued by the market. Consequently, the issuances of equity or risky securities signal information of overvaluations to the market. Furthermore, the more risky the security is issued, the more negative the information is signaled about the firm, and then the more negatively the market reacts. Among a variety of instruments for external financing, common equities and straight debts are regarded as the most risky and the least risky ones, respectively. CB, which has mixed characteristics of straight debt and common equity, is thought to have a risk level in between that of the straight debt and the common equity. So, the different degrees of market reactions to the issuances of common equities, CBs, and straight debts are consistent with the prediction of pecking order hypothesis.

However, unlike standard financing instruments such as the common equities and the straight debts, CBs are nonstandard financing instruments whose exact characteristics are contingent on whether they get converted in the future, making the analysis into CB issuances more complicated. As Stein (1992) noted that CBs in general can be viewed as backdoor equities, because most companies that offer CBs are in the hope of converting them into equities in a later time. Davidson, Glascock and Schwartz (1995) also argued that on average the issuance of CBs send an equity-like signal to the market.

As the usages of CBs came into popularity since the 1980s, researchers turned to analyze CBs from a subsampling perspective rather than studying all of them as a whole, because the differences in conversion opportunities render them to be heterogeneous. In fact, some of the CBs are designed to be more like common equities, while others share more similarities with straight debts. Different measurements of equity components in CBs are put forward, for example, Janjigian (1987), Davidson, Glascock and Schwartz (1995), Burlacu (2000), Loncarski, Horst and Veld (2006), Ammann, Fehr and Seiz (2006), and so forth. The studies into the announcement effects of CB issuances find that the announcement effects differ for CBs with different degrees of equity components. In general it is found that the more equity-like the CB is offered, the more negatively the market reacts, which suggests the validity of the prediction from pecking order hypothesis within the universe of CBs.

While many researches are restricted to the announcement period market reactions to CB issuances, attention paid to the issuers' post-issuance long-run performances is quite insufficient. Lee and Loughran (1998) examined the long-run performances of CB issuers' stock returns, and they reported that in the long-run subsequent to the CB issuances, the issuers' stocks returns significantly underperform the market benchmarks. Still less attention is paid to analyzing the issuers' post-issuance long-run operating performances. Since stock prices are reflections of the issuers' operating and thus earning performances, it is likely that the poor performances in stock returns are fundamentally driven by the downturns in the issuers' operating performances. A study into the long-run operating performances of the CB issuers' is therefore quite necessary. According to the predictions of the pecking order theory, companies that offer common equities worth less than what the market perceives. Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995) found that issuers of SEOs underperform the non-issuing matching firms during the five years following the equity issuances, and Lee and Loughran (1998) and Lewis, Rogalski and Seward (2001) found similar underperformance for companies that offer CBs.

The CB market in the United States makes up the largest proportion of the global CB market, which is a highly liquid. In this paper, we explore the data of CB issuances on the US market over the past 3 decades from 1976 to 2006, and we analyze both the short-run announcement effects and the long-run performances of CB issuers. In view of the heterogeneity among different CBs, our study is developed from a subsampling perspective. We test our conjecture that in the long-run subsequent to the CB issuances, companies that offer equity-like CBs underperform the companies that offer debt-like CBs both in terms of stock returns and in terms of operating incomes, which is in line with the pecking order prediction.

This paper contributes to the existing literatures mainly in the following aspects. Firstly, to our knowledge, this is the first study that intends to analyze the long-run performances of CB issuances from a subsampling perspective according to the relative equity components in CBs. Secondly, several different variables that measure the equity components in CBs are introduced and discussed in this paper. Thirdly, for our study objective, the US CB issuances, it is the first study that examines both the announcement effect and the long-run performance from a subsampling perspective. Fourthly, we confirm the findings in previous researches that the stock market on average reacts negatively to the CB issuances at the announcement periods and that the issuers on average experience post-issuance long-term underperformances in both stock returns and operating incomes. Fifthly, we report that in the short-run announcement period, the equity-like portfolio (debt-like) receives the largest (slightest) degree of negative market reaction, and in the long-run subsequent the CB issuances, the issuers that offer equity-like CBs significantly underperform companies that offer debt-like CBs in terms of stock return performances as well as operating performances, which are not driven by the industry factors. Also, the equity-like portfolio experienced the most significant increase in idiosyncratic risk and total equity-risk during the years subsequent to the CB issuances. Lastly, by associating the short-run announcement period market reactions with the long-run stock return and operating performances of each subsample CBs, we find that the long-run performances and the short-run announcement effects are to a large extend consistent with each others. Therefore, we contend that the market is able to adjust its previous conception and then form an unbiased forecast of the CB issuers' future operating performances immediately after the CB issuances.

The rest of this paper is organized as follows. In section 2, we review into the existing literatures about the reason why firms offer CBs, the announcement effects CB issuances, the long-run performances of the CB issuers, and the explanations for the empirical evidence. In section 3, we summarize and compare several variables that measure the relative equity-components in different CBs. In section 4, we describe the data and sample used in this paper, and then we view into the differences between the subsample portfolios. In section 5, we report and discuss our findings of the short-run announcement effect and the issuers' long-run stock return performances, operating performances, and changes in equity risks. In section 6, we reach a conclusion and put forward some directions for future research.

2. Literatures Review

2.1 Why Firms Offer Convertible Bonds

Many researchers, such as Pilcher (1955), Brigham (1966), Hoffmeister (1977), Stein (1992), Davidson, Glascock and Schwarz (1995) hold the view that the ultimate goals of most CB issuers are to raise equities through conversions. But if so, why don't these firms offer common equities directly, instead of using the indirect way of CBs? A lot of researches therefore try to address this issue.

According to traditional capital structure theories, firms make financing decisions out of considerations of reaching an optimal capital structure. By issuing CBs, firms on one hand benefit from the reduction in tax and the agency costs of free cash flow, and on the other hand increase other costs such as the cost of bankruptcy. So, an optimal debt-equity ratio is achieved by balancing the effects so as to maximize the firm's value.

Another point of view suggests that CBs can help firms mitigate problems caused by capital market imperfections, such as information costs, risk-shifting problems, managerial discretion, security overpricing, and overinvestment in risky projects or negative NPV projects. Brennan and Schwartz (1988) and Stein (1992) consider that firms use CBs to signal information about the reduced adverse selection costs associated with pure equity issues. It is also believed that firms are able to use CB to mitigate the risk shifting problem (Green, 1984), by applying the call provisions to shorten the effective maturity of the bonds. In addition, firms who issue CBs can restrict the overinvestment incentives of managers (Mayers, 1998). Although there are alternative solutions to the problems of capital market imperfections, such as waiting until information costs decline, eliminating risk-shifting problems by maintaining all-equity capital structures, and mitigating managerial discretion problems by increasing debt levels, each alternative also has limitations. Likewise, the employments of CBs are also out of considerations of balancing benefits and costs.

The sequential financing hypothesis, which is based on the assumption of uncertainties about firms' future investment opportunities, gains lots of agreements in literatures in explaining the function of CBs. Harris and Artur (1985) first modeled and pointed out that CBs can be designed to satisfy firms' sequential financing requirements. Mayers (1998) argue that firms finance their planned multistage investment programs with convertibles, where the call provision plays an essential role in reducing the costs in sequential financing problem. By forcing conversion, firms can retain the funds that they raised previously, and thus reduce costs by accessing the capital market. Chang, Chen and Liu (2004) noted that CBs are cost-effective for firms with promising growth opportunities, because CBs allows the issuers to proceed with their financing plans by forcing conversion when the investment options are valuable. Much evidence is found to be consistent with sequential signaling hypothesis. Korkeamaki and Moore (2004) found that call protections are shorter for firms that experience higher levels of capital investment soon after the issuances and that CBs with weak or no call protection are offered by firms which invest greater amounts soon after issuance than those issuing CBs with strong protection. Therefore, Korkeamaki and Moore (2004) concluded that the designs of call provisions are consistent with the firm's need for short-term financing flexibility.

Some other theories consider that CBs may not necessarily be offered in order to signal information, eliminate risk-shifting problems, or reduce overinvestment incentives. Brennan and Schwartz (1988) argue that firms with difficulties in estimating their risks are likely to issue CBs. Lewis, Rogalski and Seward (2001) argued that firms may choose to issue CBs when they have anticipated declines in operating profits which dominate a corresponding reduction in systematic business risks. They further deduce that the reason why firms choose CBs rather than common equities might be because those firms are rationed out of the equity market due to high costs of adverse selection. Since adverse selection costs are higher in larger security offers (Krasker, 1986), firms may not be able to obtain larger amounts of capital from the stock market. Cornelli and Yosha (2003) showed that convertible securities and stage financing are extensively used in venture capital financing. Isagawa (2002) showed that CBs may be designed so that it will not be converted after undertaking a value-decreasing project but it will be converted after undertaking a value-increasing project. Hence, well-designed CBs can simultaneously eliminate the threat of a hostile takeover and the threat of bankruptcy, and CBs are therefore more desirable than straight debt for a self-interested manager.

2.2 Evidence of Announcement Effects

CB issuers in the US market have long been the most intensely studied objectives in literatures. Many researches reveal that on average the US stock market reacts significantly negative to the announcements of CB issuances. Dann and Mikkelson (1984) reported a -2.31% announcement period average abnormal stock returns, Mikkelson and Partch (1986) reported a -1.97% change in issuers' stock prices, and similar results are also found by Eckbo (1986), Janjigian (1987), Eugene (1992), Davidson, Glascock and Schwartz (1995), Lewis, Rogalski and Seward (2003), etc. The only exception is found by Fields and Mais (1991) when they examined the privately placed CBs. They reported a significantly positive (1.8 %) stock market reaction. But because most CBs are offered to the public, private placements can be assessed separately, which do not affect the general finding of negative market reactions to CB issuances.

Besides the US CB market, Japan, Europe, and Non-Japan Asia regions are the other major CB markets worldwide. Researches on market reactions to CB issuances in markets other than the US market are carried out more recently. For instance, Abhyankar and Dunning (1999) studied the UK market, Burlacu (2000) studied the French market, Dutordoir and Gucht (2004) studied the western European market, Loncarski, Horst and Veld (2006) studied the Canadian market, and Ammann, Fehr and Seiz (2006) studied the Germany and Switzerland market. Those studies report negative market reactions to CB issuances, which are similar to the findings in the US market. However, few exceptions are noticed outside of the US market as well. De Roon and Veld (1995) examined CB issuances in Dutch market and found significantly positive market reactions. Chang, Chen and Liu (2004) explored the Taiwanese-listed firms and found significantly positive abnormal returns. Results found on the Japanese market are inconsistent. Kang and Stulz (1996) showed a significantly positive market reaction to the Japanese CB issuers, and they argued that such phenomenon was due to the unique features of the corporate finance arrangements of Japanese companies. Whereas, the latest research by Cheng, Visaltanachoti and Kesayan (2005) report that the market reactions to CB issuances in the Japanese market are also significantly negative.

2.3 Evidence of Long-run Performances of Convertible Bond Issuers

Previous researches have examined the post issuance performances of straight debt issuers, CB issuers, and common stock issuers. Hansen and Crutchley (1990) found that all issuers experienced post issuance earning decreases and the decreases for the common stocks issuers were the largest. Bae, Jeong, Sun and Tang (2002) found that prior to the security issuances, the buy-and-hold stock returns of all issuers were higher than the benchmarks[1], and the outperformance of the common stock issuers were found to be significant. After the security issuances, all issuers underperform benchmarks in terms of average buy-and-hold returns, where only the buy-and-hold returns of the median straight debt issuer continued to outperform benchmarks. Bae, Jeong, Sun and Tang (2002) also examined the issuers' operating performances surrounding the securities issuances and found similar outperformances in operating performances prior to the issuances of all three types of securities and post issuance downturns in their performances.

In researches that focus on CB issuances, empirical evidence show that during the post-issuance years, the CB issuers on average underperform both in terms of stock returns and in terms of operating incomes. Lee and Loughran (1998) found that the average annual return by holding the CB issuers' shares over five years after the CB issuances was 8.6%, compared to 12.5% of that of that of the matching firms' and 14.5% of that of the NYSE/Amex value-weighted index's. On the other hand, they showed that the CB issuers' average annual stock return during years prior to the issuances was 54.2%, compared to 23.2% of that of the value-weighted market index's. Similar findings are documented by Hansen and Crutchley (1990) that stock prices increased prior to the issuances of CBs and decreased since then, Spiess and Affleck-Graves (1999) that the median issuer's five-year holding period return underperformed that of its matched counterpart's by -19.8% (significantly different from zero), Eckbo, Masulis and Norli

[1] Bae, Jeong, Sun and Tang (2002) chose benchmarks from nonissuers whose market value of equity and book-to-market ratio are the closest to the issuers'.

(2000) that the equal-weighed five-year buy and hold stock return of the NYSE/Amex-listed CB issuers underperform that of their industry and size matchers by -29.5% (p-value=0.012), and Lewis, Rogalski and Seward (2001) that during the five years after CB issuances, issuers underperform the CRSP value-weighted index and their comparison firms by 580 and 530 basis points, respectively, on a per year basis.

Concurrent with the low stock returns subsequent to the CB issuances, the operating performances of the issuers' are also found to be degenerate. Lee and Loughran (1998) and Lewis, Rogalski and Seward (2001) reported that in the four years prior to the CB issuances, the issuers' annual operating performance exceeded that of the comparison firms, while in contrast, in the years following the CB issuances, the issuers' operating performances declined greatly, and the poor performance can only be partly explained by the issuers' industry factors.

2.4 Explanations for Empirical Evidences

Many studies both theoretical and empirical have been carried out trying to interpret the reasons why the stock market reacts negatively to CB issuances and what are the determinants of the post-issuance poor performances of the issuers. Basically, these explanations are developed under the assumption of asymmetric information, where corporate managers are assumed to have information advantages over the outside investors about firms' true values and growth prospects.

The agency problem (Jensen and Meckling, 1976) and the problem of free cash flows (Jensen, 1986) are firstly noticed by researchers out of the consideration of asymmetric information. Both theories imply that external financing activities by companies which have severer agency problems are received more negatively by the market. But empirically such prediction is not substantiated, because companies' financial slacks are found to be insignificantly related to the degrees of announcement period market reactions, for example Eugene (1992).

Green (1984), Ambarish, John and Williams (1987), and Eugene (1992) suggest that the market reactions to new financings are associated with the growth opportunities of the issuers'. They argue that upon a new equity issuance, a negative stock price response may be observed in the mature firms and a positive stock price response may be expected in the growth firms. Eugene (1992) proxied companies' growth opportunities using dividend policies, and he empirically showed that the announcement period abnormal return for the mature issuers are significantly negative (-1.13), while the reaction to growth issuers are non-negative (0.01, although insignificant), which support this explanation.

Miller and Rock (1985) modeled that market reactions are related to the sizes of the financings, which has an explanation similar to an earlier capital structure decision model of Fama and Miller (1972). Fama and Miller (1972) predicted that unanticipated financing signals information of firms' earnings downturns, and Miller and Rock (1985) predicted that the amount of unexpected outside financings are commensurate with the discrepancies between the actual and the expected earnings cash flows. As a result, the larger the amount of unexpected funding is, the worse the stock market reacts. But such predictions were rejected by empirical tests, such as Eckbo (1986), Mikkelson and Partch (1986), Hansen and Crutchley (1990), and Lee and Loughran (1998), all of which found insignificant relationship between the market reactions and the sizes of the proceeds.

Under the assumption of asymmetric information, Myers and Majluf (1984) modeled and predicted that if managers act in the interests of the existing share holders, they will make decisions to issue new stocks when their outstanding shares are overvalued by the market. By realizing this, the market reacts negatively to the announcements of new equity issuances, and firms follow a pecking order to procure financings, starting with a best choice of internal financings, followed by debt financings, and ending with the last choice of equity financings. The companies' financing decision hence signal information to the market. The degrees of negative market reactions are dependent on different level of risks that the newly offered securities involve. The riskier the security is offered, the more negatively the market will interpret it.

Empirical findings are generally in support of the pecking order hypothesis. Loughran and Ritter (1995) further developed the windows of opportunity hypothesis from a similar starting point, and they predict that firms will issue common stocks when they are overvalued and then those firms will experience lower post issuance performances. In addition, it is found that the prediction from pecking order hypothesis is compatible with the growth hypothesis of Green (1984), Ambarish, John and Williams (1987), and

Eugene (1992). Eugene (1992) showed that after controlling differences in companies' growth opportunities, the declines in stock prices upon issuances of common equities are significantly greater than the declines upon debt issuances. He thus concluded that the market response to a security issuance is a function of the growth opportunities of the issuers and the riskiness the new issuance involves.

3. Valuation and Equity Components of Convertible Bonds

3.1 Valuation of Convertible Bonds

One approach to valuing CB is to view one unit of CB as one unit of straight debt plus one unit of call warrant. Therefore, CB also has its issue size (gross proceeds), issue date, date of maturity, par value (denomination), and coupon rate, which is the same as a straight debt. The additional features of CB due to its embedded warrant are conversion price and conversion ratio. The conversion price is the price at which investors may exchange CBs for the issuers' equities, and the conversion ratio is the rate defining how many shares of equities each unit of CB can be converted. On top of that, CBs which have call protections cannot be called by issuers within the time periods when CBs are under protections.

Following this approach, the theoretical value of CB is the sum of the straight investment value and the warrant value. Since the call warrant embedded in a CB is the same as a typical call option, except that the exercise of a call option does not change the number of the issuer's outstanding shares but the exercise of a call warrant creates dilution effect by increasing the number of outstanding shares, the value of the embedded call warrant can thus be approximated by the value of the call option. (The exact value of warrant which takes into account the dilution effect is provided in Appendix I.)

Assume that the underlying stock price of CB, S_t, follow a geometric Brownian motion (or Wiener process), which is a specific type of stochastic Markov process, where the change in price is unpredictable using its historical performances, so that

$$dS_t / S_t = \mu\, dt + \sigma\, dW_t \tag{1}$$

where μ is the drift, σ is the stock volatility, and W_t is standard Brownian motion. Under this assumption, the modified Black-Scholes option pricing model which accommodates dividend payments (Black and Scholes, 1973 and Merton, 1973) defines the value of the European call option as:

$$C = S \cdot e^{-dT} \cdot N(d_1) - K \cdot e^{-rT} \cdot N(d_2) \tag{2}$$

where *S* is current stock price and *K* is the conversion price, which are both lognormally distributed. σ is the standard deviation of the continuously compounded stock return, *d* is the continuous compounded dividend yield, *T* is time to maturity, *r* is the continuously compounded risk free interest rate, N( ) is cumulative distribution function of a standard normal variable, $d_1 = \frac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}$, and $d_2 = d_1 - \sigma\sqrt{T}$.

The investment value of CB is the sum of future coupons and principal payments and changes with time, interest rate, and credit spreads. When CB is exchanged for stock, the investment value is forgone, so the exercise value equals the investment value.

$$Investment\ value = \sum_{t=1}^{n} \frac{coupon}{(1+YTM)^{t}} + \frac{par\ value}{(1+YTM)^{n}} \tag{3}$$

However, several defects follow from the above approach. Firstly, although we are able to make an adjustment for a continuously compounded dividend when applying the Black-Scholes model, discrete dividend payments could not be accommodated. Other complications such as issuer's right to force conversion and investors rights to put are also not accounted in. The binomial tree model which determines the current value of CBs using backward inductions from the maturity provides a better solution to these problems. Firstly, the binomial tree model adjusts for discrete dividend payments at any given node of the tree. Secondly, the model also allows for force conversion, because most CBs are callable by the issuer. CBs that are callable are beneficial for the issuers because issuers have flexibility to change capital structures or refinance if interest rates fall. Since the gain of the issuers is the loss for investors, so the value of CB which is callable worth less than a CB which is not callable. Thirdly, some CBs also provide put options which allow the investors to return CBs to the issuer at a specific time and price in exchange for either cash or equities. The put option embedded in CB raises the value of CB. In addition, the binomial tree model also admits variation in the discount rates used at different nodes.

A third way of valuing CB is to view CB as a yield-enhanced stock plus a put option. The value of equity portion amounts to parity value of CB, which is equivalent to the multiple of the current stock price and the conversion ratio. The value of the put option can be obtained through put-call-parity, $C = S \cdot e^{-dT} + P - K \cdot e^{-rT}$, so that

$$P = K \cdot e^{-rT} \cdot N(-d_2) - S \cdot e^{-dT} \cdot N(-d_1) \tag{4}$$

As a special type of debt, CB is also subject to the risk of default by its issuer, therefore several models also take into consideration the default probability. One approach is called structural approach, which assumes that when firm's value reduces to a low threshold level, there will be default, such as Brennan and Schwartz (1977) and Ingersoll (1977), which assume that the interest rates are non-stochastic, and Brennan and Schwartz (1980), which assumes stochastic interest rates. Another approach is the reduced-form approach, the valuation of which does not depend on assumption of capital structure. At any point in time, the probability of default is determined by a Poisson process and characterized by a hazard function, for instance, the Tsiveriotis-Fernandes (1998) model and Ayache, Forsyth and Vetzal (2003) model.

3.2 Measurements of Equity Components in Convertible Bonds

Although all CBs embody hybrid properties of both debts and equities, some CBs are more like common equities by having greater potentials of getting converted into equities, while the other CBs are more resemblant to straight debts by having less conversion opportunities. As a result, a subsampling perspective which allows us to differentiate the heterogeneities among subsample CBs is important because otherwise it will lead to confusions, and in addition a thorough examination into subsamples of CBs provides us an overview into the whole range of debt-equity capital structure. In the following part, we evaluate and compare several variables which measure the relative equity components in CBs.

3.2.1 Moneyness

It is almost always the case that CBs are offered out-of-the-money and become in-the-money by the time of the final maturity or by the time when they are called. The distance between the current stock price (*S*) and the predetermined conversion price (*K*) provides a natural although rough measurement of the relative equity components in CBs. The difference between the conversion price and the current stock price is "*moneyness*", the definitions for which do not reach a consensus among literatures.

Bechmann (2001) define "*moneyness*" as the ratio of "*conversion value/ the call payment*", which is the inverse of Beatty and Johnson (1985)'s definition, and both of them measure the potential of forced conversions of callable CBs. Carayannopoulos and Kalimipalli (2003) and Ammann, Kind and Wilde (2003) estimate the degree of "*moneyness*" as the ratio "*CV/SB*", which is the ratio of the *conversion value* to the *equivalent straight bond value* (in terms of maturity, coupon, call features) obtained during the numerical process that derived the value of the CB. Yu (2005) and Zabolotnyuk, Jones and Veld (2007) define "*moneyness*" as the ratio of "*S/K*", the "*current stock price/ the conversion price*", which is the inverse of Kuhlman and

Radcliffe (1992)'s definition, measuring the potentials that managers motivate CB holders to convert soon after the issuances.

Lower value of "*moneyness*" indicates larger distance between the current stock price and the conversion price, and thus the CB is viewed as more debt-like.

3.2.2 Expected Time to Becoming At-the-money

Unlike *"moneyness"*, which merely contrasts the current stock price with the conversion price, Davidson, Glascock and Schwartz (1995) put forward a measurement of the "*expected time to becoming at-the-money*", which take into consideration the growth rate of the issuer's stock price appreciation. The shorter the expected time to becoming at-the-money is, the more equity-like the CB is.

Assume that the CB's underlying stock price follows geometric Brownian motion, $dS_t / S_t = \mu\, dt + \sigma\, dW_t$, where the drift parameter μ measures is the expected rate of appreciation of the issuer's stock price and σ is the stock volatility, the expected stock price at a future time t is $E(S_t) = S_0 e^{\mu t}$, where S_0 is the present stock price.

The estimated time to becoming at-the-money, denoted as "*Time*", is then derived by estimating μ and setting S_t =*K* and S_0 =*S*, where "*K*" and "*S*" are defined as above. Therefore, *Time* = [*ln(K)-ln(S)*]/ μ .

3.2.3 Conversion Probability

Another way of measuring the relative equity component is to estimate the CB's conversion probability, which is roughly regarded as the probability that the CB becomes at-the-money (or in-the-money) by the time of the final maturity.

Janjigian (1987) assumed that the underlying stock prices are lognormally distributed and the logarithm of the prices are normally distributed, and then he estimated the probability of conversion to be equal to $N(\frac{\ln(K)-\ln(S)}{\sigma T})$, where "*K*", "*S*", and σ are defined to be the same as above, and *T* is the remaining time to maturity.

Lewis, Rogalski and Seward (1999) equated CBs with European call options on the issuers' outstanding common equities, with the strike prices equal to the CBs' conversion prices. By assuming that the stock prices follow geometric Brownian motion, $dS_t / S_t = \mu\, dt + \sigma\, dW_t$, they proxied the probability that the CB get converted by the end of the maturity as $p = N(d_2)$, where $d_1 = \frac{\ln(S/K)+(r-d-\sigma^2/2)T}{\sigma\sqrt{T}}$, which is derived from the modified version of Black-Scholes option pricing model.

3.2.4 Hedge Ratio

Assume that the call warrant in CB is the only portion that is affected by changes in the stock price, the change in the value of CB due to a change in the stock price is measured by the hedge ratio delta, Δ, which reflects the sensitivity of CB to the issuer's outstanding common equity. Using replicate portfolio technique, the payoff from holding a unit of CB can be obtained by holding Δ units of the underlying stock and borrowing an amount of cash up to *B*, such that $CB = \Delta S + B$.

Under the modified Black-Scholes option pricing framework, Δ equals to $e^{-dT} N(d_1)$, where $d_1 = \dfrac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}$, and the input variables are the same as those for computing the conversion probability "*p*" in Lewis, Rogalski and Seward (1999).

Burlacu (2000) was the first to employ the hedge ratio Δ to divide the whole sample of CBs into different subsamples with different proportions of relative equity components. This measurement has also been applied by Ammann, Fehr and Seiz (2006) and Loncarski, Horst and Veld (2006) to analyze subsamples of CBs.

3.3 Comparison among Various Measurements of Equity Components

Both the issuers' current stock prices (*S*) and the conversion prices (*K*) are directly observable by the time the CBs are offered, therefore "*moneyness*", which merely base on *S* and *K*, is the easiest to compute. But the weakness in "*moneyness*" is apparent, since it does not take into account effects other than the distance between the current stock price and the conversion price. Also we notice that the effect of "*moneyness*" is incorporated in the other variables introduced above.

The expected time to becoming at-the-money, "*Time*", is superior to "*moneyness*" in that it includes the growth rates of the underlying stock prices (μ). But the major difficulty in computing "*Time*" is the estimation of μ, which is not directly observable. The conversion probability defined in Janjigian (1987) is also superior to "*moneyness*" by adding the effects of the volatility of the underlying stock returns (σ) and CB's time to maturity (*T*).

The conversion probability (*p*) introduced by Lewis, Rogalski and Seward (1999) and the hedge ratio Δ are both derived from the modified Black-Scholes model, which not only incorporate the effect of "*moneyness*", but also covers the effects of the issuer's dividend policy (*d*), the volatility of the underlying stock return (σ), as well as the time to maturity (*T*). The dividend policy is useful because the investors need to compare the coupon rate of a CB with the issuer's dividend payouts when deciding whether to convert the CB into equities, and the volatility of the underlying stock returns is also important because higher volatility indicates a higher probability that the stock price surpasses the conversion price within a given period of time, rendering the CB to be more equity-like.

Because of the wide coverage of input variables, "*p*" and Δ are superior to "*moneyness*" and "*Time*". However, we notice that "*p*", which is derived under the risk neutral probability measure, may not reflect the true probability that the investors convert CBs into equities. The returns by investing in CBs equal to the risk-free rate of return (*r*) under the risk neutral probability measure, but in reality what the investors require are more than the risk-free rate of return (*r*) due to the risks involved. A correct conversion probability should be derived under the true probability measure (Derivation for a corrected conversion probability under the modified Black-Scholes framework is given in the Appendix I).

By comparison, we therefore recommend the use of Δ as a preferable measurement of the relative equity components in CBs, and in this paper we employ Δ as the criterion to divide the whole sample of CBs into different subsamples. Besides, we also compute *"moneyness"* and the expected time to becoming at-the-money, "*Time*", as references. The "*Time*" used here is a little different from that in Davidson, Glascock and Schwartz (1995), where we assume a continuous compounded rate of stock price appreciation[2], and *"moneyness"* is modified from that of Yu (2005)'s and Zabolotnyuk, Jones and Veld (2007)'s to be equal to $(S\text{-}K)/K$.

4. Data and Sample Description

4.1 Data

4.1.1 Data Sources

Our initial sample consists of all the CB issuances on the US market from 1976 to 2006, which is obtained from the Securities Data Company (SDC Platinum) global new issues database[3]. The information for CB issuers' stock prices and stock returns are obtained

[2] We also computed the "expected time to becoming at-the-money" in exactly the way introduced by Davidson, Glascock and Schwarz (1995), where the expected rate of stock price appreciation is not continuously compounded, and we find that the results do not differ very much. The modification of "moneyness" also does not change the results qualitatively from using "S/K" directly as in Yu (2005) etc.

[3] The SDC global new issue database report the records for convertible bond issuances started from 1970, but the complete data descriptions started from 1976.

from the Center for Research in Security Prices (CRSP) daily returns and monthly returns files. The issuers' financial data are obtained from Standard & Poor's COMPUSTAT Industrial annual database. We also referred to DataStream for the daily US treasure constant maturities 10 year-middle rate, the International Brokers Estimate System (IBES) database for the estimation of the issuers' EPS growth rate, and the Lexis-Nexis for manual collation of each of the announcement date of CB issuances.

4.1.2 Data Selection

The SDC global new issues database reports 1733 CB issuances over the period from 1976 to 2006, and the raw data from SDC are then processed by the following steps.

Firstly, we follow the literatures to exclude the issuers from the regulated utilities industry, the financial institutions, and their holding companies, whose capital structure arrangements and market reactions are found to be different from industrial companies. The issuers' industries are identified by their 3-digit Standard Industry Classification codes (SIC codes). The utility industry has SIC codes equal to 481, 491, 492, 493, and 494, and the financial industry has SIC codes from 600 to 699. This step reduces the sample to be 1319 observations.

Secondly, we exclude the CB issuance observations whose initiators do not have outstanding equities' information over a [-250, 250] days' window in CRSP daily returns file. This step further reduces the sample size to be 977 observations.

Thirdly, we manually collate the announcement date of each CB issuance by comparing the SDC "filing date" with the announcements in Lexis-Nexis dataset[4]. The SDC "filing date" is the date on which a company files a registration statement with the Securities and Exchange Commission (SEC), which can be roughly taken as the announcement date of a CB issuance. But due to the sensitivity of an event study to the event dates, we refer to the Lexis-Nexis dataset to guarantee a more accurate date of the announcement of CB issuance. 8 more observations are deleted either because their SDC "filing dates" are not verified by information in the Lexis-Nexis dataset or because the issuers announced multiple CB issuances on one day. After this step, the sample contains 969 observations, which constitute the sample for short-run event study.

For the purpose of a long-run analysis, where we examine the annual performance of CB issuers' over [-3, 3] years, a 7-year sample period centered on the year of CB issuances, we need to further eliminate the issuers that do not have financial data reported in COMPUSTAT within the [-3, 3] years' widow. This step reduces the sample size to be 726 observations[5]. One more problem confronting the long-run analysis is the overlapping issuances that are observed within the same event window. Some firms are found to have multiple issuances within one year or during years that are very close to one another, and the inclusion of overlapping issuances will lead to bias. In order to circumvent this problem and maintain accuracy in the post-issuance long run analysis, for

4 We use 2 files of Lexis-Nexis, namely, the „Major Newspapers" and the „Wire Service Stories". „Major Newspapers" include US newspapers that are listed in the top 50 circulation in Editor & Publisher Year Book, such as the New York Times and the Washington Post, and the newspapers published outside the US are listed in Benn's World Media directory or one of the top 5% in circulation for the country. The „Wire services" group file contains all newswires from the ALLNWS group file.

5 Two observations are deleted because of inconsistent data reported in COMPUSTAT.

each issuer we retain its first issuance in the whole sample period (corresponding to year 0) and delete all the issuances that occur within the (0, 3] years' window. When a second issuance is retained, similar procedure is applied to eliminate issuance observations within (0, 3] of this second one. Finally, we have a clean sample of 619 observations for the long-run analysis.

4.2 Sample Description

4.2.1 Whole Sample of Convertible Bond Issuances

Table 1 describes the yearly distribution for CB issuances over the year 1976 to 2006, and Figure 1.1 displays the annual CB issuances in terms of frequency throughout the 31 years[6]. We notice that during the bearish period of the stock market in the 1970s, only few firms issued CBs, and as the stock market gradually revived in the 1980s, the number of CB issuances saw a large increase. The CB issuance activity peaked in the mid 1980s, and thereafter it remained at a relatively stable level. This trend is very similar to the SEO activity as reported in Loughran and Ritter (1997). Figure 1.2 describes the dollar amount of CB issuances measured by gross proceeds, from which we notice that the annual issuance amount is increasing.

[Insert Table 1, Table 2, Figure 1 and Figure 2 Here]

Table 2 and Figure 2 describe the industry distribution of CB issuances in the form of a table and a pie chart. In comparison with the industry distribution of SEOs in Loughran

[6] The reported sample has 969 observations, which constitute the sample of our short-run study. The information for the sample of long-run analysis is qualitatively the same, and thus the report is omitted.

and Ritter (1997)'s, we find that the industries on the top of the CB issuance frequency list are the same as the top industries that initiate SEOs. The top six industries make up 81.26% of all the CB issuances in the past three decades.

4.2.2 Subsampling Criterion

We employ the hedge ratio Δ, derived from the modified Black-Scholes option pricing model, as the subsampling criterion. Δ measures the sensitivity of CBs to the issuers' outstanding equities, which is defined as:

$$\Delta = e^{-dT} N\{\frac{\ln(S/K)+(r-d+\sigma^2/2)T}{\sigma\sqrt{T}}\}, \qquad (5)$$

where N{ } is CDF of standard normal distribution, and the input variables are:

i) The current stock price (*S*), estimated by the average stock price in the 2 weeks prior to the CB issuance announcement, that is [-15,-6] trading days relative the issuance announcement date (day 0);

ii) The conversion price (*K*), obtained directly from SDC;

iii) The annualized continuously compounded risk free rate on the date of the CB issuance announcement (*r*), estimated using the daily US treasure constant maturities 10 year-middle rate reported by DataStream, and then converted into a continuously compounded form[7];

iv) The annualized continuously compounded dividend yield of CB issuer (*d*), computed as the ratio of the issuer's ex-date dividends per share (COMPUSTAT data item 26) / Fiscal year close price (COMPUSTAT data item 199) immediately prior to the year of the issuance and then transferred into a continuously compounded form;

v) The annualized volatility of the issuer's continuous compounded log stock returns (σ), which is calculated using the [-240, -40] days' historical stock price data from CRSP[8];

vi) The time to maturity (*T*), calculated as the number of years between the "final maturity" (obtained from SDC) and the year of the CB issuance.

The distribution of the estimated Δ is displayed in Figure 3, and the summary statistics for Δ are reported in Table 3.1. Δ ranges from a minimum of 0 to a maximum of 1, with a mean of 0.7627. The higher the value of Δ, the more equity-like the CB is. When Δ approaches 1, the CB can be viewed as quasi-equity, and as Δ approaches 0, it can be viewed as quasi-debt.

[7] The US treasure constant maturities 10 year-middle rate reported in DataStream is already in annualized form, on a 360 days per year basis.
[8] Annualized on a 252 trading day basis.

[Insert Table 3 and Figure 3 Here]

By setting aside the observations where Δ are calculated as missing (corresponding to 174 observations), the whole sample of CB issuances is then divided into 3 subsample portfolios, the debt-like portfolio, the mixed portfolio, and the equity portfolio, with equal sizes of 265 CB issuance observations. Summary statistics for the subsamples CBs are reported in Table 3.2. The debt-like portfolio consists of CBs with the least proportions of equity components (average $\Delta = 0.456$), the equity-like portfolio consist of CBs with the most proportions of equity components (average $\Delta = 0.974$), and the mixed portfolio consists of CBs with undistinguishable components of equity and debt (average $\Delta = 0.859$). The mixed portfolio itself is not a subject of interest because of the ambiguous information it signals, but the introduction of it allows us to better focus on the 2 extreme portfolios.

The other three measurements of the equity components in CBs, "*moneyness*", "*Time*", and "conversion probability" are also computed and reported.

$$moneyness = (S-K)/K \qquad (6)$$

$$Time = [ln(K)-ln(S)]/\mu \qquad (7)$$

$$Pr = \mathrm{N}\left(\frac{\ln(S_t / K) + T(\mu - \sigma^2 / 2)}{\sigma\sqrt{T}}\right) \qquad (8)$$

where S and K are defined and calculated the same as those in computing Δ, and μ is the estimated growth rate of the issuer's EPS. Following Davidson, Glascock and Schwartz (1995), we proxy μ using the "Estimated Five-year Growth Rate-Median" obtained from the IBES tapes, which is the expected average annual growth rate over 5 years subsequent to the CB issuance, and then we convert it into a continuously compounded version.

As shown in Table 3.1, "*moneyness*" ranges from -0.8454 to 11.3733 with a mean of -0.1075. Negative values of "*moneyness*" correspond to out-of-the-money CB issuances and positive values of "*moneyness*" correspond to in-the-money CB issuances. CBs that are offered deep out-of-the-money tend to be more debt-like. We notice that 848 out of the 960 CBs are offered out-of-the-money, 120 CBs are offered in-the-money, and 1 CB is offered exactly at-the-money. Because of the existence of in-the-money and at-the-money CB issuances, when computing "*Time*", the expected time to becoming at-the-money, we set those "*Time*" which are calculated as negative to be 0[9]. Table 3.1 shows that the maximum "*Time*" is 243.39 years, with an average value of 1.82 years and a standard deviation of 10.43, indicating that "*Time*" is very volatile.

From Table 3.2 we see that the average "*moneyness*" of the debt-like portfolio, the mixed portfolio, and the equity-like portfolio are -0.094, -0.149, and -0.083, respectively, and the average "*Time*" of the debt-like portfolio, the mixed portfolio, and the equity-like portfolio are 3.315 years, 1.277 years, and 1.013 years, respectively.

[9] By setting the value of *Time* to be 0 for all the in-the-money issuances, we find that the statistical significance of *Time* in explaining the announcement effect becomes a little smaller than if we do not (as in Davidson, Glascock, and Schwarz, 1995). But this change does not affect the qualitative result, and we maintain it because this allows us to better reflect the reality.

Also shown in Table 3 are summary statistics for the input elements in computing Δ. They are volatility, dividend yield, risk free rate, current stock price, and time to maturity. The Pearson correlation coefficients between Δ, "*moneyness*", and "*Time*" are also reported. Δ and "*moneyness*" are positively correlated with a correlation coefficient of 2.53%, and "*Time*" is negatively correlated with both Δ and "*moneyness*".

4.2.3 Differences of Characteristics of Subsample Portfolios

The differences among subsample CB portfolios are examined and reported in Table 4. We notice that although the other two measurements of equity components, "*moneyness*" and "*Time*", exhibit differences among subsample portfolios, the differences are not significant under the 10% level.

[Insert Table 4 Here]

All of the variables that characterize a specific CB issuance (the conversion price *K*, the current stock price *S*, the dividend yield *d*, the stock volatility σ, the time to maturity *T*, the coupon rate, and the issue size) are significantly different between the debt-like portfolio and the equity-like portfolio, except for the dividend yield *d*. Moreover, we notice that although both the conversion price *K* and the current price *S* of the debt-like portfolio are significantly higher than that of the equity-like portfolio, they are in fact positively correlated with each others, which may be the reason why "*moneyness*" do not differ significantly between these two portfolios. The outstanding shares of the debt-like portfolio have higher dividend yield and lower volatility. Also, the CBs in the debt-like portfolio are designed to have shorter time to maturity, lower coupon rates, and larger issue sizes.

The characteristics of issuers from different subsample portfolios also exhibit some differences. First, the issuers that offer debt-like CBs are of larger firm scales, characterized by having the highest total assets and market value of equity (MVE). The issuers that offer equity-like CBs, in contrast, are small firms with the fewest assets and the lowest MVE. Second, both the common shares outstanding and the debt in current liabilities are higher of the debt-like portfolio than that of the equity-portfolio, but they may be correlated with the effects of the firm scale because the financial leverage do not differ significantly between them. Third, companies that offer debt-like CBs have more sales and higher earnings, while they incur higher R&D expenditures and higher capital expenditures. Notice, however, when we the expenses are scaled by total assets, we find that the equity-like portfolio have significantly higher relative expenditures. Fourth, firms from the equity-like portfolio are supposed to have higher growth opportunities, because all the indices indicating growth opportunities, such as the median estimate of the growth rate of EPS, μ, the market to book ratio (M/B), and the Tobin's Q ratio of the equity-like portfolio are all higher than that of the debt-like portfolio.

5. Main Findings

5.1 Short-run Announcement Effects of Convertible Bond Issuances

5.1.1 Methodology of Short-run Event Study

In order to capture the short-run announcement effects of CB issuances, we first apply the event study methodology to compute the announcement period abnormal stock returns for the whole sample and subsamples, respectively.

The announcement period abnormal stock returns (also referred to as "prediction errors" in some literatures) are estimated using the market model. At time-t, the market model for the i-th CB issuer is

$$R_{i,\,t} = \alpha_i + \beta_i R_{m,\,t} + \varepsilon_{i,\,t} \tag{9}$$

where $R_{i,\,t}$ is the time-t return for the i-th issuer's outstanding equity and $R_{m,\,t}$ is the time-t return of the market. $E(\varepsilon_{i,\,t}) = 0$ and $Var(\varepsilon_{i,t}) = \sigma^2_{\varepsilon_{i,\,t}}$.

The data of daily stock returns in the [-250, -50] days' window are used to estimate the parameters of the market model. The input data are obtained from the CRSP daily return file, and $R_{m,\,t}$ is proxied by the CRSP valued-weight NYSE/AMES/Nasdaq index return.

Mackinlay (1997) pointed out that although other multifactor models or economics models, such as the CAPM and APT, are also available to estimate the stock returns with perhaps better forecast abilities, the market model is sufficient to capture the event period abnormal stock returns. Also, he showed that the OLS estimators of the market model are consistent and efficient, which are estimated to be:

$$\hat{\beta}_i = \frac{\sum_{t=-250}^{-50}(R_{i,t} - \hat{\mu}_i)(R_{m,t} - \hat{\mu}_m)}{\sum_{t=-250}^{-50}(R_{m,t} - \hat{\mu}_m)^2} \tag{10}$$

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i \hat{\mu}_m \tag{11}$$

where $\hat{\mu}_i = \frac{1}{251}\sum_{t=-250}^{-50} R_{i,t}$, $\hat{\mu}_m = \frac{1}{251}\sum_{t=-250}^{-50} R_{m,t}$, and the residual variance is estimated as $\hat{\sigma}_{\varepsilon_i}^2 = \frac{1}{249}\sum_{t=-250}^{-50}(R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t})$.

The abnormal stock returns are thus computed as the market model residuals:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t} \tag{12}$$

Under the null hypothesis that the announcements of CB issuances has no impact on the stock returns, $AR_{i,t}$ are jointly normally distributed with a conditional mean equal to zero and the conditional variance is $\hat{\sigma}_{\varepsilon_i}^2 + \frac{1}{251}\left(1 + \frac{(R_{m,t} - \mu_m)^2}{\hat{\sigma}_m^2}\right)$.

We compute the announcement period abnormal stock returns over several different event windows one week before the issuance announcement until one week after it. The cumulative abnormal return, $\text{CAR}(t_1, t_2)$, is defined as the sum of abnormal returns of from t_1 to t_2 relative to the issuance announcement date (date 0). For example, CAR (-2, 2) = $\sum_{t=-2}^{2} AR_{i,\,t}$. The average cumulative abnormal return $\text{ACAR}(t_1, t_2)$ is defined as the average of the CAR across *n* observations.

Under the null hypothesis of no announcement effect, $\text{CAR}(t_1, t_2) \sim \text{N}\ (0, (t_2 - t_1 + 1)\sigma_{\varepsilon_i}^2)$, and $\text{ACAR}(t_1, t_2) \sim \text{N}\ (0,\ \sum_{i=1}^{n}(t_2 - t_1 + 1)\sigma_{\varepsilon_i}^2 / n^2)$.

Four different test statistics, namely, the ordinary cross-sectional t statistics, the standardized cross-sectional t statistics, the nonparametric sign-test statistics, and the GARCH-based test statistics, are applied to measure the statistical significance of the abnormal stock returns.

The ordinary cross-sectional test assumes that the abnormal returns are cross-sectionally independent and allows for event-induced variance changes. The test statistics from ordinary cross-sectional test is defined as:

$$\text{t} = \frac{\sum_{i=1}^{n} AR_i / n}{\sqrt{\sum_{i=1}^{n}(AR_i - \sum_{i=1}^{n} AR_i / n)^2} / \sqrt{n(n-1)}} \qquad (13)$$

The standardized cross-sectional test is developed by Boehmer et al (1991), which incorporates information from both the estimation period and the event period. The event period abnormal returns are first standardized by the estimation period standard deviation. The test statistics is defined as:

$$t = \frac{\sum_{i=1}^{n} SR_i / n}{\sqrt{\sum_{i=1}^{n} (SR_i - \sum_{i=1}^{n} SR_i / n)^2} / \sqrt{n(n-1)}} \tag{14}$$

where $SR_i = CAR_i(t_1, t_2) / \sqrt{(t_2 - t_1)\sigma^2_{\varepsilon_{i,t}}}$.

The nonparametric sign test also assumes abnormal stock returns to be cross-sectionally independent, but it does not require specific assumptions on the distribution of abnormal returns. Denote n^+ as the number of observations with positive abnormal stock return, and the statistics is:

$$t = \frac{(n^+ / n - 0.5)}{0.25 / \sqrt{n}} \tag{15}$$

The GARCH-based test statistic is introduced to accommodate the event-induced return volatilities, which are found to bias the performances of the traditional test statistics. Basing on the GARCH (1,1) model, the relationship between the return of equity i and the market return is model by (16).

$$R_{i,t} = \alpha_i + \beta_i \cdot R_{m,t} + \gamma_i \cdot D_t + \eta_{i,t} \tag{16}$$

D_t is an indicator variable which takes a value of 1 if date t is an event day, and 0 otherwise. The conditional distribution of the error terms $\eta_{i,t}$ is assumed to be standard normal, $\eta_{i,t} \mid \Omega_t \sim N(0, h_{i,t})$, where Ω_t denotes the set of information available by date t. The conditional variance is modeled by:

$$h_{i,t} = a_i + b_i \cdot h_{i,t-1} + c_i \cdot \eta_{i,t-1}^2 + d_i \cdot D_t \tag{17}$$

The test statistics t can be formulated as:

$$t = \frac{\sum_{i=1}^{n} S_i / n}{\sqrt{\sum_{i=1}^{n} (S_i - \sum_{i=1}^{n} S_i / n)^2} / \sqrt{n(n-1)}} \tag{18}$$

where $S_i = \hat{\gamma}_i / \sqrt{\hat{h}_{i,t}}$. Savickas (2003) shows that the above statistic has a higher power in detecting abnormal returns than the traditional tests statistics when event induce volatilities, which also has an appropriate size.

5.1.2 Results and Discussions

The results of average abnormal stock returns (AAR) and average cumulative abnormal returns (ACAR) are reported in Table 5 for the whole sample and the subsamples portfolios.

[Insert Table 5 Here]

From Table 5 we notice that there are a few positive abnormal stock returns before and after the issuance announcements, but on exactly the day of announcements and days closely next to the announcements, the abnormal stock returns are all negative. The days with significantly negative abnormal stock returns are found in the [-1, 1] window. The cumulative abnormal stock returns over all the reported windows are significantly negative, suggesting that the announcement effect on a cumulative basis is more robust. As the window expands around the announcement date, however, the negative stock returns become less significant.

Table 5.1 also displays the AAR and ACAR for subsample portfolios. The differences in AAR among the subsamples are evident. During the days before the issuers' issuance announcements, the debt-like portfolio experienced a few days of significantly positive abnormal stock returns, while a similar behavior is not observed in either of the other 2 portfolios. On the date of the issuance announcements, all of the 3 portfolios suffered from significantly negative market reactions, while the degree of the reaction to the debt-like portfolio is the lowest (-0.0077) comparing with the equity-like portfolio (-0.0110) and the mixed portfolio (-0.0129). For the debt-like portfolio, the significantly negative market reaction appeared one day prior to the issuance announcement, and then from the second day after the issuance the stock returns rebounded back to non-negative. The significantly negative market reactions to the other 2 portfolios occurred exactly on the date of the issuance announcements, and the returns of the equity-like portfolio did not bounce back into positive subsequent to the issuances.

The ACAR for the 3 subsample portfolios are all significantly negative over our reported windows alike, but we notice that the degree of negative market reactions is strictly monotonically decreasing from the debt-like portfolio, through the mixed portfolio, to the equity-like portfolio. The ACAR (-2, 2), which is computed by summing up the abnormal returns one week around the issuance announcement, is -0.0136 for the debt-like portfolio, -0.0224 for the mixed portfolio, and -0.0269 for the equity-like portfolio. Also, the significance of the announcement effect, measured by the standardized cross sectional t statistics, is lower for the debt-like portfolio. All the findings are in support of the pecking order hypothesis that the equity-components signal more negative information to the market.

The testing results of differences in ACAR between pair-wised subsamples are reported in Table5.2, where we notice a strict hierarchy of pecking order (the negative market reactions to the equity-like portfolio are the most severe and the reactions to the debt-like portfolio are the slightest) except for the (0, 1) day window, when the most severe negative market reaction is found in the mixed portfolio.

Table 5.3 reports the result by regressing the announcement effect, measured by CAR (-2, 2), on hedge ratio Δ, from which we see that Δ is significantly and negatively related to the announcement effects (the slope coefficient is -0.2287 and the New-West heteroskedasticity consistent t statistic is -2.16).

5.2 Long-run Stock Return Performances

The efficiency of the stock market has long been questioned, casting doubt on the ability of the market to absorb all the information and make a full reaction in the short-run. Therefore a long-run analysis provides a better view into the effects of CB issuances. Lewis, Rogalski and Seward (2001) studied into the [-5, 5] years' long run performance of CB issuances between 1979 and 1990 in the US market, and their results show that the differences in performances between the CB issuers and the non-issuers became insignificant since the fourth year after the CB issuance. In our analysis, we hence examine the long-run performances [-3, 3] years around the CB issuances. Our whole sample for the long-run analysis consists of 620 CB issuance observations[10] over 1976 to 2006.

We intend to test the hypotheses that 1) the stock returns of the equity-like portfolio significantly reduced from the pre issuance period to the post issuance period, and 2) in the post issuance period, returns from the equity-like portfolio underperform that of the debt-like portfolio.

5.2.1 Comparison of the Pre and Post Issuance Stock Returns

A. Long-run buy-and-hold stock returns

[10] We have also studied into a [-5, 5] period long-run operating performance of CB issuers and find the similar diminishment in issuance impact since the fourth year after the issuance.

The long-run stock return performance is measured by the holding period buy and hold returns (BHR). We follow Eckbo, Masulis and Norli (2000) to define BHR for portfolio *j* with *n* equities components over a holding period from T_1 to T_2 as:

$$BHR_j \equiv \sum_{i=1}^{n} \omega_i \left[\prod_{t=T_1}^{T_2} (1+R_{i,t}) - 1\right] \tag{19}$$

where $\omega_i = MVE_i / \sum_{i=1}^{n} MVE_i$ for a value-weighted (V.W.) portfolio and $\omega_i = 1/n$ for an equal-weighed (E.W.) portfolio.

The CRSP monthly return file is referred to as a source of returns $R_{i,t}$. If a stock is delisted from the market before the end of the [-3, 3] years' window, then the holding period is calculated till the time when it is delisted. The abnormal performances are then measured by the differences between the CB issuers' BHR and the benchmarks' BHR, denoted as *diff.*. Two benchmarks are applied here. One is the non-issuing matching firms which are identified as what Lewis, Rogalski and Seward (2001) introduced, and the other one is the CRSP index, the data for which are also obtained from CRSP monthly return file. A detailed statement of how a non-issuing matching firm is identified for each CB issuer is given in next subsection (section 5.3).

Both the value-weighted and the equal-weighted portfolios are constructed, for value-weighted portfolios, the benchmarks are also value-weighted, and for equal-weighted portfolios, the benchmarks are also equal-weighted. The [-3, 3] years' buy and hold returns and the abnormal returns are reported in Table 6.1.

[Insert Table 6 Here]

During the pre-issuance [-3, 0] years' period, all the E.W. CB issuers outperformed their benchmarks at 1% significance levels, except for the E.W. debt-like portfolio which only insignificantly outperformed the matching firms. The results when using the V.W. portfolios are virtually the same, but the outperformances of the CB issuers' stock returns became less significant. This phenomenon is consistent with Brav et al. (1995), Mitchell and Stafford (1998), Loughran and Ritter (2000), and Spiess and Affleck-Graves (1999), who found insignificant long-run abnormal stock returns when using value-weighted portfolios. Loughran and Ritter (2000) argued that tests based on value-weighted returns have low power to detect economically significant abnormal performance when the abnormal performance is expected to be more severe among smaller firms. Spiess and Affleck-Graves (1999) claimed that the choice of equal-weighted or value-weighted portfolios is an issue of perspective rather than one of methodological correctness. When measuring the aggregate wealth effects experienced by investors, the value-weighting is appropriate. If the perspective is to measure the abnormal returns of a typical firm undergoing a particular event, then equal-weighting is appropriate.

In the 3 years subsequent to the CB issuances, returns from almost all the portfolios underperform that of the benchmarks. Using both value-weighting and equal-weighting, the underperformances experienced by the equity-like portfolio were the most significant and severe. On the other hand, the underperformance of the debt-like portfolio was not significant using either value-weighting or equal-weighting.

B. Fama French three factor model

In examining the port-issuance long-term abnormal stock return of the issuers, we also apply Fama and French (1993) three-factor regression model to construct calendar-time portfolios, which controls for cross-sectional dependence.

$$R(t) - RF(t) = \alpha + \beta[RM(t) - RF(t)] + sSMB(t) + hHML(t) + \varepsilon(t) \quad (20)$$

The Fama French three factor regression model takes a form of (16), where we form 383 monthly portfolios from February, 1976 to December, 2007 for the whole sample CB issuance observations. In order to be parallel with the other part of the paper, which examine [-3, 3] years' long-run performances of the issuers, we modify the portfolio selection period to be 36 months, so that $R(t)$ is the return of month-t portfolio which is the weighted stock returns by all issuers that offered CBs in the past 36 months. $RF(t)$ is risk-free rate at month-t, $RM(t)$ is the NYSE, Amex, and NASDAQ value-weighted stock return in month-t, $SMB(t)$ is the return on small firms minus the return on large firms in month-t, $HML(t)$ is the return on high book-to-market stock returns minus the low book-to-market stock returns in month-t, $\varepsilon(t)$ is the disturbance. Thus, the intercept α describes the abnormal stock return of the month-t portfolio.

[Insert Table 7 Here]

Again we construct the portfolios using both equal weighting and value weighting. Denote the number of companies included in each time series portfolio as n and ω_t is the weight for it, so that where $\omega_t = MVE_t / \sum_{t=1}^{n} MVE_t$ for a value-weighted (V.W.) portfolio and $\omega_t = 1/n$ for an equal-weighed (E.W.) portfolio. The number of companies in the 383 time series portfolios ranges from a maximum of 170 to a minimum of 1. Table 7.1 presents the result whole sample long-run stock returns. We notice that when using equal-weighted portfolio, the stock returns are significantly negative when we use both ordinary least squares (OLS) and weight least squares (WLS), the weight of which equals the number of companies in the monthly portfolios. However, when using value-weighted portfolio, the stock returns are insignificantly positive.

We also run the three factor regressions for each of the three sub-sample portfolios, respectively. There are 383 monthly bond-like portfolios from February, 1976 to December, 2007, with a maximum of 45 companies per portfolio to a minimum of 1 company in each portfolio. There are 382 monthly mixed portfolios from March, 1976 to December, 2007, with a maximum of 38 companies per portfolio to a minimum of 1 company in each portfolio. There are 342 discontinuous monthly equity-like portfolios from June, 1976 to December, 2007, with a maximum of 84 companies per portfolio to a minimum of 1 company in each portfolio. The results for subsample portfolios are reported in Table 7.2. We see that the abnormal stock returns for the equal-weighed debt-like portfolio are significantly negative when using both ordinary least square and weight least square. When value weighted, the negative abnormal stock return becomes insignificant using ordinary least square and the abnormal stock return becomes insignificantly positive when using weight least square. For the mixed CB issuances, the abnormal stock returns are negative when equal weighted and positive when value weighted. The abnormal stock return for the stock-like portfolios are all negative both equal weighted and value weighted, but the negative abnormal stock return is only significant when using weight least square.

5.2.2 Comparison of Long-run Stock Returns among Subsample Portfolios

Table 6.2 compares the average stock returns of the debt-like portfolio and the equity-like portfolios around the CB issuances. During the pre issuance [-3, 0] years' period, the stock returns of the equity-like portfolio significantly outperformed that of the debt-like portfolio's at a 10% significance level when valued-weighted and at a 5% significance level when both are equally-weighted. During the post issuance 3 years, the condition is reversed, and the equity-like portfolio significantly underperforms the debt-like portfolio at a 1% significance level when both of them are equal-weighted, although the underperformance is insignificant when they are value-weighted.

The results in Table 7.2 report the post-issuance long-run abnormal stock returns for subsample portfolios using three factor regression technique , from which we see that the negative abnormal stock return of the equity-like portfolio is always more severe than that of the debt-like portfolio either equal-weighted or value-weighted and regardless of using ordinary least square or weight least square.

5.3 Long-run Operating Performances

The stock return performances tend to be reflections of the issuers' operating performances. We then examine the [-3, 3] years' operating performances of the CB issuers', and we intend to test the hypotheses that over a post issuance long-run period, 1) the companies that offered equity-like CBs experience a more severe deterioration in their operating performances, and 2) they underperform companies that offered debt-like CBs.

5.3.1 Comparison of Pre and Post Issuance Operating Performance

In literatures, there is no one indicator of operating performance regarded as most preferable. McLaughlin, Safieddine, and Vasudevan (1998) and Barber and Lyon (1996) used pre-tax operating cash flows, Hansen and Crutchley (1990) used earnings before interest and taxes, and Loughran and Ritter (1997) used ROA, OIBD/Assets, etc.

We follow Loughran and Ritter (1997) and measure the companies' operating performances by OIBD/Assets, which is defined by dividing the sum of operating income before depreciation and interest rate by total assets[11]. OIBD/Assets is a measurement of the cash flow operating performance which provides evidence on the efficient utilization and profitability of the companies' assets-in-place.

[Insert Table 8 Here]

[11] OIBD/Assets =(COMPUSTAT data item 13+ COMPUSTAT data item 62)*100/ COMPUSTAT data item 6

Table 8.1 lists the raw operating performance for the whole sample and the subsample portfolios. When viewed as a whole, the CB issuers experienced a decline in their operating performances from the pre-issuance period to the post-issuance period. The average (median) pre-issuance operating performance is 12.312 (14.429), which is much higher than the post-issuance operating performance of 10.559 (12.271)[12]. The change in the mean (median) operating performance from the pre-issuance period to the post-issuance period is significant at a 5% (1%) level. Although we find a deterioration in the median CB issuer's post-issuance operating performance, which is similar to Lewis, Rogalski and Seward (2001), we do not observe a similar improvement in the median issuer's operating performance during the 3 years prior to the issuance, as Lewis, Rogalski and Seward (2001) reported.

By viewing into the results from a subsampling perspective, the mean (median) operating performance declined from the pre-issuance period to the post-issuance period for all the subsamples alike. The degree of operating performance deterioration exhibits a pecking order hierarchy where the equity-like portfolio went through the largest degree of performance deterioration and the debt-like portfolio experienced the slightest degree of performance deterioration. Although the median pre and post issuance changes for all the 3 subsamples are significant when using Wilcoxon signed-rank test, the change in average operating performances are neither significant for the debt-like portfolio nor significant for the mixed portfolio.

[12] The year of CB issuance is year 0, which is neither include in the pre-issuance period [-3, -1], nor included in the post-issuance period [1, 3].

We are concerned with how much the industry-wide factors affect the issuers' performances, so we remove the industry effects before assessing the issuers' abnormal performances. For each of the 620 CB issuers in our sample for long-run analysis, we find its non-issuing counterpart basing on similarities in industry affiliation, asset size, and normalized operating income, and then we compute the issuers' abnormal performances by subtracting the matching firms' OIBD/Asset from the issuers' realized OIBD/Assets.

Specifically, we follow the same procedure which Lewis, Rogalski and Seward (2001) introduced in finding a non-issuing matching firm for each CB issuer.

> Step 1: Select all the firms which are in the same industry of each issuer's (according to the issuer's the two-digit SIC code) and have stock information reported in CRSP and financial information reported in COMPUSTAT.
>
> Step 2: Retain the candidates whose end-of-year assets are within 25% to 200% of that of the issuer's, and then the one with the closest OIBD/Assets ratio to that of the issuer's is chosen as the matching firm.
>
> Step 3: If no non-issuer meets the criterion above, then all non-issuers with year 0 assets of 90% to 110% of the issuer's are ranked, and then the one with the closest, but higher, OIBD/Assets ratio is selected as the matching firm.

Table 8.2 reports the results for the issuers' abnormal operating performances in terms of mean and median. The CB issuers are observed to outperform their matching firms during a few temporary years prior to the issuances, whereas during the whole post-issuance period the issuers underperform their matching firms. From the first two columns, we notice that the changes in mean and median abnormal operating performances from the pre-issuance period to the post-issuance period are significant under the 5% and 1% levels, indicating that the industry effects do not play determinant roles in the deteriorations of CB issuers' operating performances.

Examination into the subsample issuers' performances allow us to see that the changes in average performances of the debt-like portfolio and mixed portfolio are not significant, and the change in average performance of the equity-like portfolio is only significant at a 10% level. The median changes are significant for all subsamples, but we notice that the median change of the debt-like portfolio becomes less significant when using abnormal performance measure (significant under 10% level in Table 8.2) than using the raw performance measure (significant under 5% level in Table 8.1), indicating that a part of the performance deterioration of the debt-like issuer is affected by industry factors, whereas, industry factors do not play as much important roles in the other two subsample portfolios.

5.3.2 Comparison of Operating Performance among Subsample Convertible Bonds

We notice from the results in Table 8.1 and Table 8.2 that although all of the 3 subsamples of issuers went through deteriorations in average operating performance from the pre-issuance period to the post-issuance period, significant deterioration in the average operating performance is only found in the equity-like portfolio (t-statistic= -3.14 in Table 8.1 and -1.79 in Table 8.2).

Table 8.3 displays the comparison results between the debt-like portfolio and the equity-like portfolio in average raw operating performance and average abnormal operating performance. During periods both before and after the CB issuances, the average debt-like issuer outperforms the average equity-like issuer, and this result is robust by removing the industry effect, indicating that the outperformance of the average debt-like issuer is driven by the issuer-specific factors.

As for the median performance, in the pre-issuance period, the median equity-like issuer strongly outperform the other CB issuers (16.155 relative to 14.485 of the median debt-like issuer and 13.180 of the median mixed issuer), and this outperformance is not driven by industry effects because its abnormal performance measure (0.237) is also higher than that for the median debt-like issuer (-0.023) and the median mixed issuer (-2.355). In stark contrast, in the post issuance period, the median equity-like issuer underperform the debt-like issuer and the mixed issuers to a great extend, which again is mostly determined by the issuer-specific reasons rather than by the industrial factors. The pre and post issuance performance changes are the most significant in the median equity-like CB issuers.

To get a clearer picture of how much the industry factors affect the issuers' performances, we compare the issuers and their matching firms over the [-3, 3] years' period. Results are displayed in Table 8.4, where the z-statistics of Wilcoxon sign rank test are reported, testing the null hypotheses of no difference between the median issuers and the median non-issuers. We notice that, for the whole sample of CB issuers, in years prior to the CB issuances, there were not significant differences between the issuers and the non-issuing matching firms, but the issuers' performances differ significantly from that of the non-issuers from exactly the year of the CB issuances, indicating a drastic change in the factors that determine the issuers' performance. When analyzing into subsample CB issuers, we notice that their performances do not differ significantly from their industry matchers before the CB issuances, but from the year of the CB issuances onwards, the median issuer of the mixed portfolio significantly underperformed the industry. Similar finding is observed in the equity-like portfolio, where we find that from the first year subsequent to the CB issuance, the median equity-like issuer underperform its industry to a great extend. But over the entire 7 years surrounding the issuances, the operating performance of the median debt-like issuer never differ significantly from its industry matcher.

5.4 Long-run Risks of Convertible Bond Issuers' Outstanding Equities

Besides the operating performance, it is suspected that the stock return performance is also related to the risk level of the equity. In this subsection, we examine into the changes in equity risks around CB issuances.

Referring to the market model, $R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}$, the total equity risk of firm-*i* is:

$$Var(R_{i,t}) = \beta_j^2 Var(R_{m,t}) + Var(\varepsilon_{i,t}) \tag{21}$$

The total risk consists of 2 parts, one is the systematic risk ($\beta_j^2 Var(R_{m,t})$), caused by the risk on the whole market ($Var(R_{m,t})$), and the other one is the residual variance ($Var(\varepsilon_{i,t}) = \sigma^2_{\varepsilon_{i,t}}$) which is idiosyncratic of firm- *i*.

[Insert Table 9 Here]

Table 9.1 reports changes in annual equity risks from pre issuance period to post issuance period for the whole sample CB issuers and each of the subsample portfolios. The equity risks in the first year prior to the issuances are estimated using the [-250, 0) days' daily stock returns, the equity risks in the second year prior to the issuances are calculated using the [-504, -250) days' daily stock returns, and the equity risks in the third year prior to the issuances are calculated using the [-756, -504) days' daily stock returns. Similarly, the post issuance years' annual risks are calculated using the corresponding daily stock returns.

We notice from Table 9.1 that firstly, from the pre issuance period to the post issuance period, both the average issuer and the median issuer of the whole sample experienced significant decrease in the equity beta and significant increase in the residual variance and the total equity risk. Secondly, the debt-like portfolio underwent significant decrease in the equity beta from the pre issuance period to the post issuance period. Although the other 2 portfolios also experienced decrease in equity-betas, neither of the changes is significant. Thirdly, the equity-like portfolio went through the most significant increase in residual variance and the total risk.

We also examine the role of industry effect in determining the changes in the equity risks. Table 9.2 displays the differences between the risks of the CB issuers and their non-issuing matching firms. First, for the whole sample of CB issuers, the equity beta significantly increased relative to their matching firms since the second year preceding the CB issuances, and the increase in equity-beta continued until the third years after the issuances. At the same time, the issuers' residual variances decreased significantly relative to their industry matchers from the second year prior to the CB issuances until two years after the issuances. The total equity risks of the issuers' also decrease significantly around the CB issuances. Second, for subsample portfolios, similar increases in equity beta relative to the matching firms are found, and the differences between the equity-like portfolio and their matching firms are observed to be the most significant. The equity beta of the debt-like portfolio only significant surpassed that of its matching firms' in the first year subsequent to the CB issuances. Third, the residual variance and the total risks of the debt-like portfolio significant decreased relative to their matching firms both before and after the CB issuances, while similar degrees of decrease in equity risks are not observed in the mixed portfolio or the equity-like portfolio.

By comparing the average equity risks of the debt-like portfolio and the equity-like portfolios (see Table 9.3), we find that in both the pre issuance years and the post issuance years, the debt-like portfolio is significant less risky than the equity-like portfolio under any one of the risk measures, the equity beta, the residual variance, or the total risk. It is worth noting that during the post issuance years, the idiosyncratic risks (residual variance) of the equity-portfolio increased significantly relative to the debt-like portfolio.

5.5 Combination of Results in the Long-run and the Short-run

So far, we have confirmed the findings in previous studies that the CB issuances in the US market as a whole are accompanied with negative abnormal stock returns in the short-run announcement period and the long-run post issuances years.

By surveying into different subsamples, we find that in the short-run, the equity-like CB issuances induce the largest degree of negative market reactions, which are also the most significant and last for the longest time. In the post-issuance long-run period, the companies issuing equity-like CBs went through the largest degree of abnormal underperformance in buy and hold stock returns, meanwhile its operating performance deteriorated the most severely, which significantly underperform both the debt-like CB issuers and their industry matchers.

Combining the findings in the short-run and the long-run, there seem to be a large degree of consistency, since the companies that receive the worst market reactions in the short-run indeed turn out to perform the worst in the long-run. We run regression of the short-run announcement effect on the issuers' long-run operating performances, and we find that the post-issuance operating performance turns out to be significant explanatory variable for the announcement effect. Results are reported in Table 10 and Table 11, the post-issuance 3-year average OIBD/Assets explains 0.95% of the cumulative abnormal stock returns over the (-2, 2) days' event window, where we notice in contrast that the pre-issuance operating performance does not have significant effect on the short-run announcement effect.

[Insert Table 10 Here]

We also study the effect of the issuer's long-run operating performance on the announcement effect by controlling the changes in the issuers' equity risks. We include the issuers' equity betas, the residual variances, and the total equity risks, and then re-run the regression of the announcement effect on the explanatory variables for the pre-issuance period and the post-issuance period, respectively. Results are reported in Table 11. We notice that in general the short-run announcement effects are not significantly relevant to the issuers' equity risk and the issuer's post-issuance operating performance still turns out to be a significant explanatory variable for the announcement effect.

[Insert Table 11 Here]

We explain the finding of the consistency between the long-run and short-run by claiming that the market unbiasedlly foresees the issuers' operating performances at the time of the CB issuance announcements. Moreover, when we refer back to Table 4, where the median estimate of growth rate of stock price appreciation, the market to book ratio, and Tobin's Q all indicate that firms in the equity-like portfolios are regarded to have greater growth opportunities prior to the CB issuances, it is understandable that the market is immediately adjusting its perception about the issuers' true future performance by observing information signaled by the CB issuances. This finding and explanation is compatible with Lewis, Rogalski and Seward (2001), who pointed out that the post issuance deteriorations in the CB issuers' operating performances are not predicted by professional analysts prior to the CB issuances.

6. Conclusions and Future Research Directions

6.1 Summary

The convertible bond (CB), which is a nonstandard financing instrument, is hybrid of the straight debt and the common equity, and it is viewed to have a risk level in between that of the straight debt and the common equity. Previous studies have revealed that the announcement period market reaction to CB issuances is right in between the reactions to the straight debt and common equity, for example Mikkelson and Partch (1986). Such phenomenon is consistent with the pecking order hypothesis of the M& M model (1984), which predicts that companies follow a pecking order when they make decisions to procure financings, beginning with a best choice of internal financing and ending up with a worst choice of equity financing. Since this strategy is well understood by the market, different financing decisions are interpreted and received differently by the market.

In this study, we notice that CBs are not uniformly the same throughout the whole sample. While some CBs are more resemblant to straight debts, others are more like common equities. We therefore examined the CBs from a subsampling perspective according to different degrees of equity components in different CBs. The whole universe of CBs can thus be regarded as a miniature of the whole range of debt-equity capital structure.

By introducing and evaluating several measurements of equity components in CBs, we recommend the use of hedge ratio Δ, and then we manage to divide the whole sample of CBs into a debt-like portfolio, a mixed portfolio, and an equity-like portfolio. We find that the short-run announcement effects on CB issuances follow a strict pecking order hierarchy that the companies issuance debt-like CBs receive the least degree of negative market reactions, the companies issuance equity-like CBs receive the largest degree of negative market reactions, and those that offer CBs with mixed components of debt and equity receive a degree of negative market reaction in between.

A long-run analysis into the CB issuers' stock return performances, operating performances, and changes in equity risks allow us to see that firstly during the years subsequent to the CB issuances, the long-run buy and hold stock returns of the equity-like issuers significantly underperform the industry benchmark and the market index benchmark, and it also significantly under perform the buy and hold stock returns of the debt-like portfolio when both of them are equally weighted. Secondly, in the post-issuance period, the issuers of the equity-like portfolio experienced the largest degree of deteriorations in their operating performances both in terms of means and in terms of medians, inducing them to significantly underperform the debt-like CB issuers as well as their industry matchers. Further, by removing the industry effects, we notice that the issuers' post issuance operating performances are largely determined by changes in the issuers' specific characteristics. Thirdly, the debt-like portfolio went through significant decrease in the systematic risk (equity beta) and significant increase in the idiosyncratic risk (residual variance) and total risk, while its systematic risk is still (insignificantly) higher than the industry level and the idiosyncratic risk and total risk are still (significantly) lower than the industry level. The equity-like portfolio experienced insignificant decrease in the systematic risk and a significant increase in the idiosyncratic risk and the total risk, while the systematic risk is still (significantly) higher than the industry and the idiosyncratic risk and the total risk are still (insignificantly) lower than the industry level.

Combining our findings for the CB issuers in the short-run and the long-run, we realize that the issuers' long-run performance are to a large extend consistent with the short-run market reactions they have received. In fact, the issuers' post issuance realized long-run operating performances significantly explain the announcement period market reactions. We thus conclude by saying that the market unbiasedlly forecasts the issuers' future operating performances basing on the specific designs of CBs at the time when the CBs are offered, and then it reacts accordingly. In the long-run subsequent to the CB issuances, the market perceptions turn into reality, and the perceived bad companies indeed experienced severe deteriorations in their performances, and at the same time they entail more idiosyncratic risks and total equity risks.

6.2 Future Research Directions

While the results in this paper provide us a miniature view into the debt-equity capital structure, further research can be easily extended by including real data of the straight debt issuances and the common equity issuances (SEO and IPO) to examine whether similar patterns exist during the short-run announcement period and the post issuance long-run period. Previous studies such as Bae, Jeong, Sun and Tang (2002) have examined different behaviors of issuers that offer straight debts, common equities, as well as CBs, and their results showed that issuers who offer straight debts indeed perform better both in the short-run and in the long-run. But according to their results, the distinctions between CB issuers and common equity issuers are less significant. We argue that because CBs are not uniformly the same, it is suggestible that we examine different CBs separately by assuming a subsampling perspective. In a study which includes all the data about straight debts, CBs, and equities, we expect that in the short-run announcement period, the degree of negative market reactions to different security issuers follows an increasing order from straight-debts, debt-like CBs, equity-like CBs, to common equities. In the post issuance long-run period, we expect that the holding period returns of the issuers’ outstanding shares follow a declining order from the straight-debt portfolio to the debt-like CB portfolio, followed by the equity-like CB portfolio, and finally the common equity portfolio. Meanwhile, the deterioration of the issuers’ operating performances would be the most dramatic in the common equities issuers, followed by the equity-like CB issuer, the debt-like CB issuers, and the issuers of straight debts. Also, some similar patterns in the long-run equity risks may also be expected.

Besides, future researches can also be carried out from the following aspects. Firstly, the information signaled by the mixed portfolio as defined in this study can be explored, which might be quite complicated because of a large amount of uncertainties involved. Secondly, future study may relax the classical assumption that the stock returns follow standard normal distribution, which is not exactly the case in reality. In this study, we still adopt the standard normal assumption because the subsampling criterion used here, the hedge ratio, is derived from the Black-Scholes option pricing framework, where the stock prices are assumed to follow geometric Brownian motion and standard normal stock return distribution is presumed. However, some other assumptions on the stock price dynamics and thus stock return distribution can also be tried if we divide our subsamples according to some other criteria.

Thirdly, further research can therefore be carried out to improve on the subsampling criterion. Hedge ratio is used this paper as the subsampling criterion, where we treat CBs almost equivalently as European call options. However, the defect follows from this is obvious, because early conversions are possible in the real practices for the callable CBs and many CBs are even putable by the investors before the final maturities. Hence, some other ways that can provide more accurate measurement of the equity components in CBs may be explored and applied. For example, a more accurate conversion probability of CBs can be derived by combining the studies of optimal call strategies of the CB issuers and taking into consideration of the probabilities of defaults. In addition, the estimation of hedge ratio can also be improved if we are able to find more accurate estimations for its input variables. For instance, in this paper we estimate the risk free interest rate (r) basing on the daily US treasure constant maturities 10 year-middle rate reported by DataStream. Future research can try to employ or develop more sophisticated techniques to estimate the risk free rate. Also, in this paper we estimate the drift parameter of the geometric Brownian motion by converting the IBES estimation of the EPS growth rate into a continuous compounded form and the stock volatility is estimated using historical data, but future research can apply other techniques to obtain better estimations.

Fourthly, improvements on the results may also be achieved by looking for some other ways of constructing and detecting the abnormal performances of the issuers'. (1) When studying the short-run announcement effect, in this paper we follow the conventional event study methodology by defining the abnormal stock returns as the differences between the realized stock returns and the expected returns estimated from market models, and we document the existence of abnormal returns basing on the standardized cross sectional t-statistics and nonparametric sign-test statistics. As we mentioned previously, some models other than the market model are also available for estimating stock returns with perhaps better forecast capacities, such as Fama French factor models, CAPM, and APT model. Further research can be developed by applying those models. In addition, while the standardized cross sectional t-statistics incorporates information from both the estimation period and the event period, the nonparametric sign-test statistics is free from a specific assumption about the stock returns, and the GARCH-based test statistic (Savickas 2003) models the event-induced volatilities, it is suspected that the size of the sample may affect the performances of the statistics. To overcome this criticism, we can for example use the bootstrap method and adopt the test of Baixauli (2007), which was designed to detecting abnormal returns when the event analyzed induces volatility and the portfolio is small. (2) When examining the long-run abnormal stock return performance, we use the difference between the buy-and-hold stock returns of CB issuers and that of the market or industry benchmarks'. Further research can try to construct the abnormal stock return performance using some other methods. For instance, the buy-and-hold reference portfolios detailed in Lyon et al. (1998) can be applied. (3) In addition, in our study, we adopt the exact procedure that Lewis, Rogalski and Seward (2001) used in identifying matching firms, where each issuer has one non-issuing counterpart which comes from the same industry with the closest firm size. Further research can apply some other ways of identifying matching firms. (4) The long-run operating performance in our study is evaluated using OIBD/Assets, while other accounting indicators such as ROA, profit margin, CRA can also be calculated, although we think that the results may not differ qualitatively. Also, like the discussion of Barber and Lyon (1996), further study can also include some simulation based method to examine the statistical power of the constructed measurement of abnormal performances.

Lastly, in this study we conclude by claiming that the market unbiasedlly forecasts the long-run operating performance of the CB issuers' basing on the observation of a statistical significance between the short-run announcement effect and the post issuance long-run operating performance in a linear regression model. Although we argue that this linear regression model suffices to give us useful implications, we suspect that improvements may be achieved by further exploring the validity of this linear model. For example, further research can try to identify whether some important explanatory variables have been omitted and whether some nonlinear model specifications are able to capture the reality better.

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Appendix I

Exact value of embedded call warrant in Convertible Bond

According to modified Black-Scholes model, the value of European call option is

$$C = S \cdot e^{-dT} \cdot N(d_1) - K \cdot e^{-rT} \cdot N(d_2)$$

where $d_1 = \dfrac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}$ and $d_2 = d_1 - \sigma\sqrt{T}$.

Assume first that each CB is composed of one unit of straight debt plus several units of warrants. Each unit of warrant is exercisable into one unit of new equity, and λ is the ratio of outstanding warrants to the number of outstanding shares. The number of outstanding equities increases as a result of the conversion, which creates dilution effect. Therefore, the value of one unit of call warrant is $C/(1+\lambda)$.

Since each unit of CB is convertible into several units of equities, the number of which equals to the *conversion ratio*, suppose the number of outstanding shares is n_S and the number of CBs offered is n_{CB}, therefore,

$$\lambda = \frac{conversion\,ratio \cdot n_{CB}}{n_S}.$$

The total value of warrants in each unit of CB equals to:

$$Value\ of\ call\ warrants = \frac{C}{1+\lambda} \cdot conversion\,ratio = \frac{C \cdot n_S}{n_S + conversion\,ratio \cdot n_{CB}}$$

Corrected conversion probability under true probability measure

Under the true probability measure, the returns that investors expect from investing in stocks are more than a risk free interest rate. Assuming that the underlying stock price of CB follows geometric Brownian motion, such that $dS_t / S_t = \mu dt + \sigma dW_t$, where μ is the drift, σ is the volatility, and W_t is a standard Brownian motion, the stock prices S_t are lognormally distributed. Thus, the log returns $ln(S_T / S_t)$ follow normal distribution with mean $(T\text{-}t)(\mu - \sigma^2 / 2)$ and standard deviation $\sigma\sqrt{T-t}$.

At time t, S_T, which is *T-t* period away in the future, is not observable. The conversion probability of CBs is approximated by the probability that the embedded call option in CB expires in-the-money (or at-the-money) by the time of maturity *T*.

By standardization, $\frac{\ln(S_T / S_t) - (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}}$ follows N (0, 1) asymptotically, so the estimated probability of conversion is:

$$\text{Prob}\{ S_T \geq K \}$$

$$= \text{Prob}\ \{ \frac{\ln(S_T / S_t) - (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}} \geq \frac{\ln(K / S_t) - (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}} \}$$

$$= \text{Prob}\{ \frac{\ln(S_t / S_T) + (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}} \leq \frac{\ln(S_t / K) + (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}} \}$$

$$= \text{N}\{ \frac{\ln(S_t / K) + (T-t)(\mu - \sigma^2 / 2)}{\sigma\sqrt{T-t}} \}$$

This conversion probability is different from "*p*", the conversion probability used by Lewis, Rogalski and Seward (1999) in that the returns that investors require by investing in the underlying stock is assumed to be μ, which is higher than the risk free rate of return *r*.

Explicit derivation of hedge ratio (delta) from modified Black-Scholes model

The value for a European call option is:

$$C = S \cdot e^{-dT} \cdot N(d_1) - K \cdot e^{-rT} \cdot N(d_2)$$

where $d_1 = \dfrac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}$ and $d_2 = d_1 - \sigma\sqrt{T}$.

The sensitivity of the call option to the underlying stock price is:

$$\Delta = \frac{\partial C}{\partial S} = \frac{\partial(S \cdot e^{-dT} \cdot N(d_1) - K \cdot e^{-rT} \cdot N(d_2))}{\partial S}$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \varphi(d_2)\right]$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \varphi(d_1 - \sigma\sqrt{T})\right]$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \frac{1}{\sqrt{2\pi}} e^{\frac{-(d_1 - \sigma\sqrt{T})^2}{2}}\right]$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \varphi(d_1) \cdot e^{\frac{2d_1\sigma\sqrt{T} - \sigma^2 T}{2}}\right]$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \varphi(d_1) \cdot e^{\frac{2\frac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}\sigma\sqrt{T} - \sigma^2 T}{2}}\right]$$

$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - K \cdot e^{-rT} \cdot \varphi(d_1) \cdot S/K \cdot e^{rT - dT}\right]$$

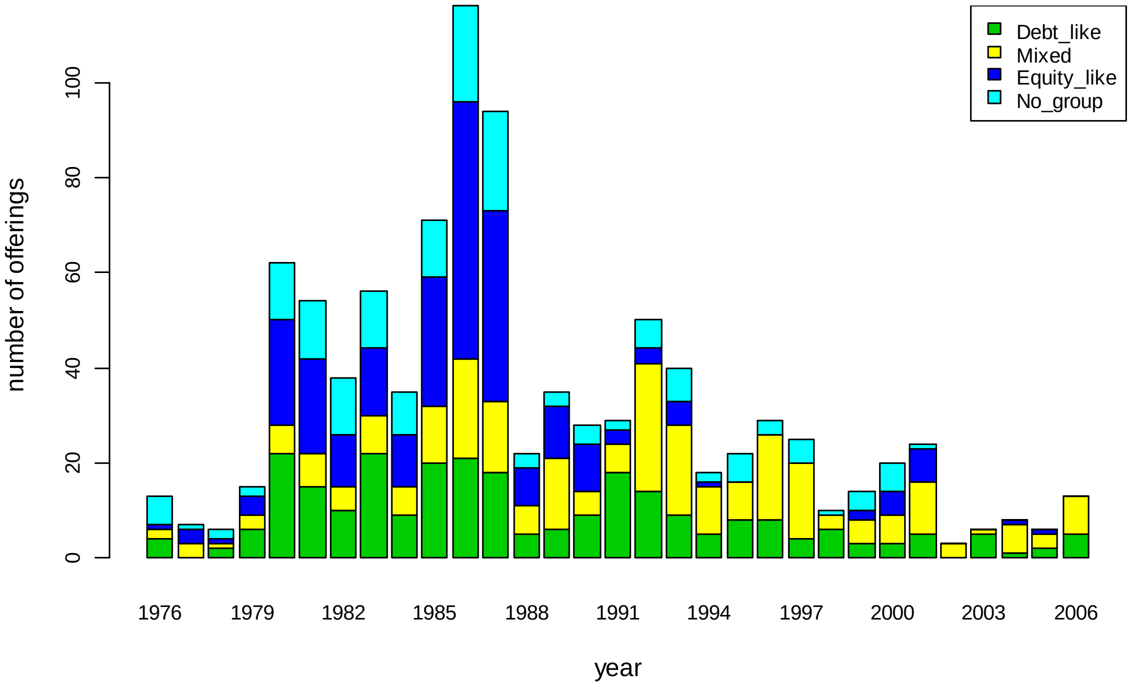
$$= e^{-dT} \cdot N(d_1) + \frac{1}{S \cdot \sigma\sqrt{T}}\left[S \cdot e^{-dT} \cdot \varphi(d_1) - S \cdot e^{-dT} \cdot \varphi(d_1)\right]$$

$$= e^{-dT} \cdot N(d_1)$$

Appendix II

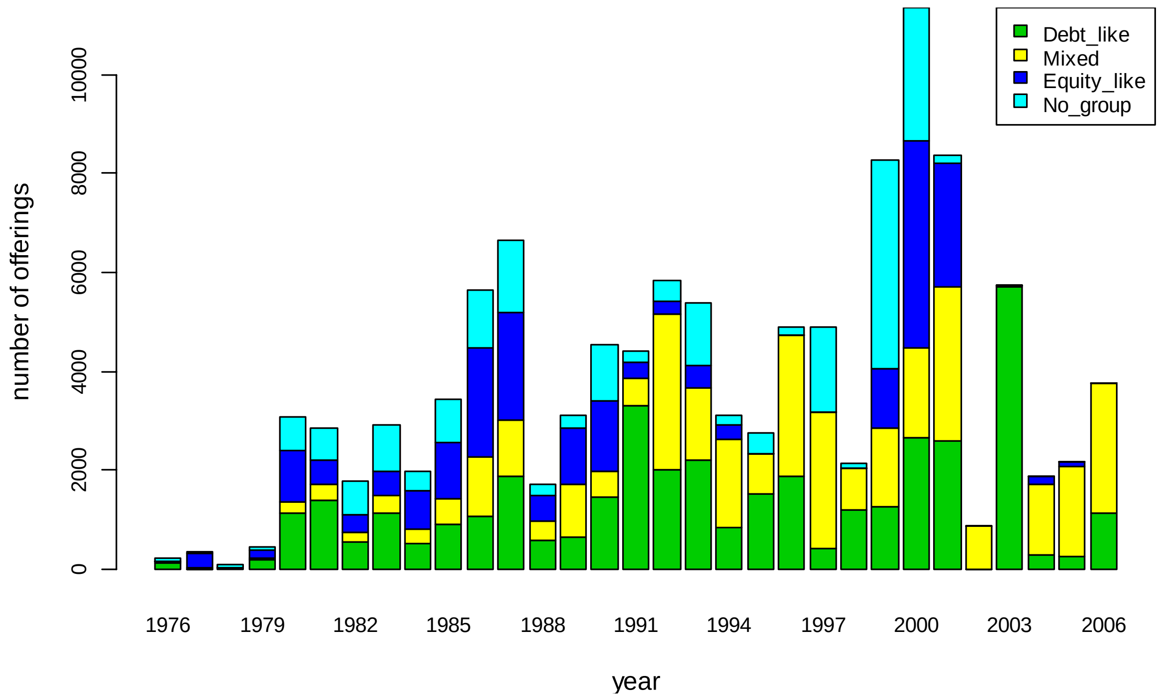
Figure 1
Annual Distribution of Sample CB Issuances (1976-2006)

Figure 1.1 Annual Distribution of Sample CB Issuances by Frequency



Note: The sample contains 969 CB offering observations, which is used for the short-run event study. Some of the observations are subject to further elimination for the purpose of long-run analysis.

Figure 1.2 – Annual distribution of sample CB offerings by issue size



Note: The sample contains 969 CB offering observations, which is used for the short-run event study. Some of the observations are subject to further elimination for the purpose of long-run analysis. The issue sizes are measured by gross proceeds (in millions of dollars), which are reported by SDC.

Figure 2
Industry distribution of sample CB issuances (1976-2006)

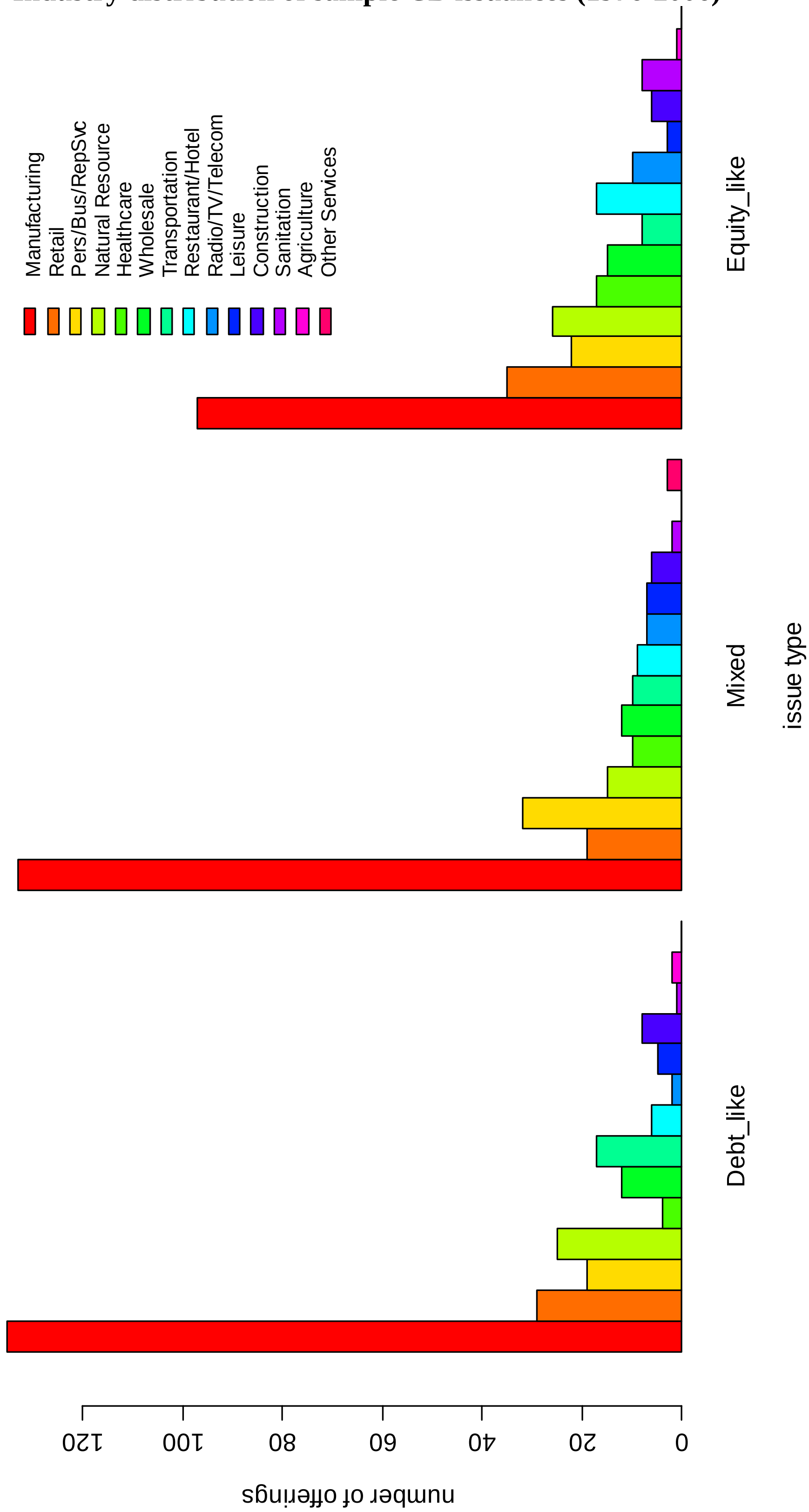
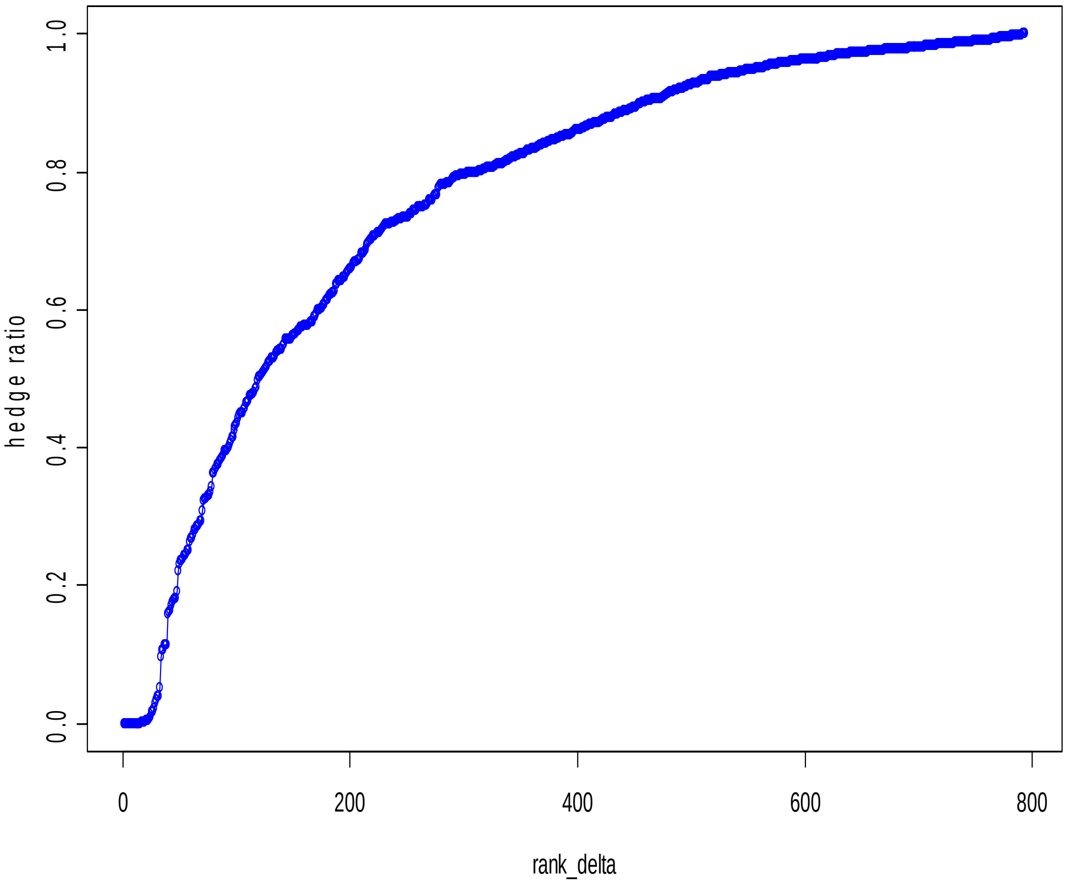


Figure 3
Plots of Estimated Values for Measurements of Equity Components

Figure 3.1 Distribution of hedge ratio

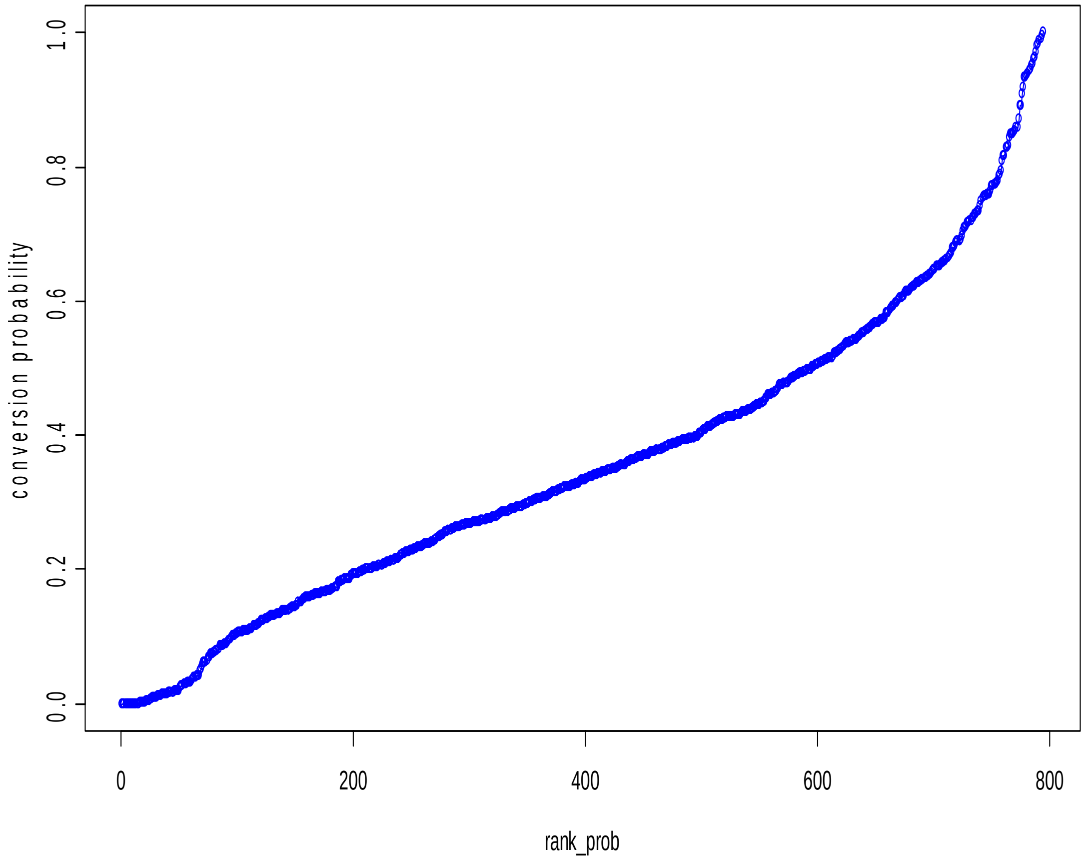


Note: 1. Hedge ratio is derived from the modified Black-Scholes model, such that

$$\Delta = e^{-dT} N\{\frac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}}\}$$

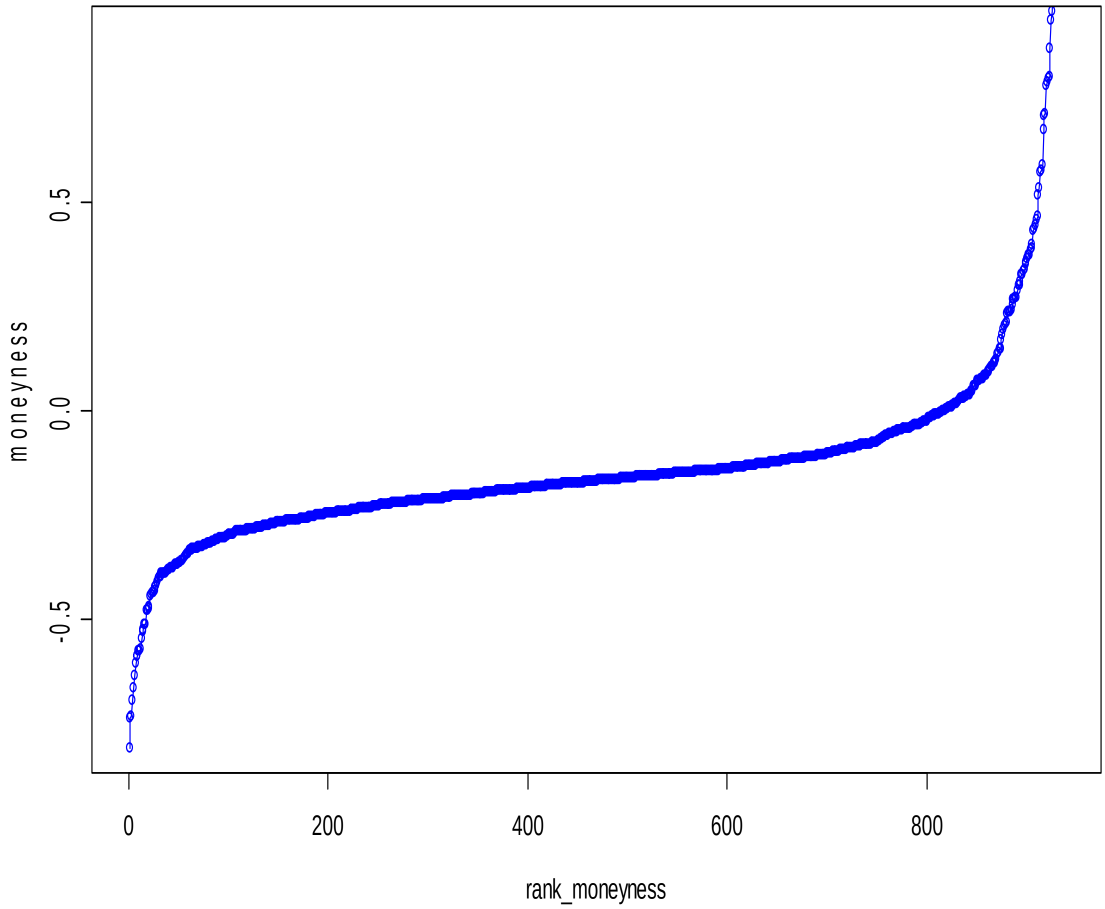
2. There are 795 CB issuance observations that have non-missing values of Δ, which are then ranked in an ascending order. The higher the ranking in Δ is, the more equity like the CB is. According to the rankings in Δ, a CB issuance is grouped into the debt-like portfolio if its rankings falls into [1, 265], the mixed portfolio if its ranking falls into [266, 530], and the equity-like portfolio if its ranking falls into [531, 795].

Figure 3.2 – Estimated conversion probability



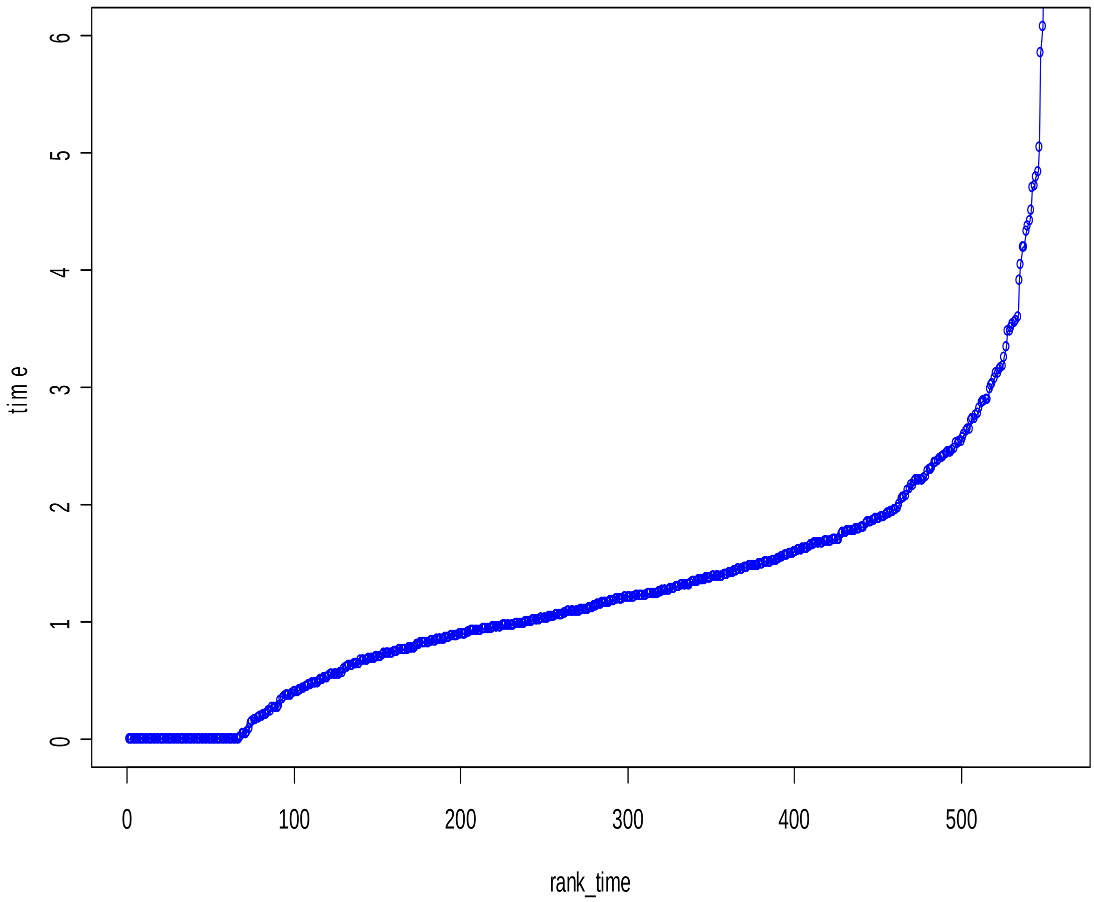
Note: Conversion probability Pr=N($\frac{\ln(S_t / K) + T(\mu - \sigma^2 / 2)}{\sigma\sqrt{T}}$). There are 795 CB issuance observations with non-missing values of Conversion probability, which are then ranked in an ascending order. The higher the conversion probability the more equity-like the CB is.

Figure 3.3 - Estimated moneyness



Note: *moneyness*= (*S*-*K*)/*K*. The higher the value in moneyness, the more equity-like the CB is designed.

Figure 3.4 – Estimated time to becoming at-the-money



Note: $Time = [ln(K)-ln(S)]/\mu$, with μ equals to the anticipated rate of stock price appreciation. The shorter the estimated time to becoming at-the-money, the more equity-like the CB is designed to be.

Appendix III

Table 1
Annual distribution of whole sample CB issuances observations over 1976 to 2006

Table 1.1 Annual distributions of whole sample CB issuances

The sample contains 969 CB issuance observations, which is used for the short-run event study. Some of the observations are subject to further elimination for the purpose of long-run analysis. The sample satisfying the criteria of our long-run analysis consists of 619 issuance observations, which has essentially the same pattern as the sample for short-run study, and thus is not reported.

Year	Frequency	Percent %	Cumulative Frequency
1976	13	1.34	13
1977	7	0.72	20
1978	6	0.62	26
1979	15	1.55	41
1980	62	6.40	103
1981	54	5.57	157
1982	38	3.92	195
1983	56	5.78	251
1984	35	3.61	286
1985	71	7.33	357
1986	116	11.97	473
1987	94	9.70	567
1988	22	2.27	589
1989	35	3.61	624
1990	28	2.89	652
1991	29	2.99	681
1992	50	5.16	731
1993	40	4.13	771
1994	18	1.86	789
1995	22	2.27	811
1996	29	2.99	840
1997	25	2.58	865
1998	10	1.03	875
1999	14	1.44	889
2000	20	2.06	909
2001	24	2.48	933
2002	3	0.31	936
2003	6	0.62	942
2004	8	0.83	950
2005	6	0.62	956
2006	13	1.34	969

Table 1.2 Annual distributions of whole sample CB issuances

	Debt-like		Mixed		Equity-like	
Year	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %
1976	4	1.51	2	0.75	1	0.38
1977	2	0.75	3	1.13	3	1.13
1978	6	2.26	1	0.38	1	0.38
1979	22	8.30	3	1.13	4	1.51
1980	15	5.66	6	2.26	22	8.30
1981	10	3.77	7	2.64	20	7.55
1982	22	8.30	5	1.89	11	4.15
1983	9	3.40	8	3.02	14	5.28
1984	20	7.55	6	2.26	11	4.15
1985	21	7.92	12	4.53	27	10.19
1986	18	6.79	21	7.92	54	20.38
1987	5	1.89	15	5.66	40	15.09
1988	6	2.26	6	2.26	8	3.02
1989	9	3.40	15	5.66	11	4.15
1990	18	6.79	5	1.89	10	3.77
1991	14	5.28	6	2.26	3	1.13
1992	9	3.40	27	10.19	3	1.13
1993	5	1.89	19	7.17	5	1.89
1994	8	3.02	10	3.77	1	0.38
1995	8	3.02	8	3.02	2	0.75
1996	4	1.51	18	6.79	5	1.89
1997	6	2.26	16	6.04	7	2.64
1998	3	1.13	3	1.13	1	0.38
1999	3	1.13	5	1.89	1	0.38
2000	5	1.89	6	2.26	1	0.38
2001	5	1.89	11	4.15	3	1.13
2002	1	0.38	3	1.13	1	0.38
2003	2	0.75	1	0.38	4	1.51
2004	5	1.89	6	2.26	22	8.30
2005	4	1.51	3	1.13	20	7.55
2006	2	0.75	8	3.02	0	0

Table 2
Industry distribution of sample CB issuances over 1976 to 2006

Table 2.1 Industry distribution of sample CB issuances over 1976 to 2006

Industry	Frequency	Percent %	Cumulative Frequency
Manufacturing	427	44.20	427
Retail	96	9.94	523
Pers/Bus/RepSvc	92	9.52	615
Natural Resource	73	7.56	688
Healthcare	49	5.07	737
Wholesale	48	4.97	785
Transportation	43	4.45	828
Restaurant/Hotel	39	4.04	867
Radio/TV/Telecom	32	3.31	899
Leisure	25	2.59	924
Construction	24	2.48	948
Sanitation	11	1.14	959
Agriculture	3	0.31	962
Other Services	3	0.31	965
Mortgage Securities	1	0.10	966

Note: The industry information for 3 observations is missing.

Table 2.2 Industry distribution of sample CB issuances over 1976 to 2006

Debt-like			Mixed			Equity-like		
Industry	Frequency	%	Industry	Frequency	%	Industry	Frequency	%
Manufacturing	135	50.94	Manufacturing	133	50.19	Manufacturing	97	36.6
Retail	29	10.94	Pers/Bus/Rep Svc	32	12.08	Retail	35	13.21
Natural Resource	25	9.43	Retail	19	7.17	Natural Resource	26	9.81
Pers/Bus/Rep	19	7.17	Natural Resource	15	5.66	Pers/Bus/Rep Svc	22	8.3
Transportation	17	6.42	Wholesale	12	4.53	Healthcare	17	6.42
Wholesale	12	4.53	Healthcare	10	3.77	Restaurant/Hotel	17	6.42
Construction	8	3.02	Transportation	10	3.77	Wholesale	15	5.66
Restaurant/Hotel	6	2.26	Restaurant/Hotel	9	3.4	Radio/TV/Telecom	10	3.77
Leisure	5	1.89	Leisure	7	2.64	Sanitation	8	3.02
Healthcare	4	1.51	Radio/TV/Telecom	7	2.64	Transportation	8	3.02
Agriculture	2	0.75	Construction	6	2.26	Construction	6	2.26
Radio/TV/Telecom	2	0.75	Other Services	3	1.13	Leisure	3	1.13
Sanitation	1	0.38	Sanitation	2	0.75	Agriculture	1	0.38

Table 3
Summary statistics for measurement of equity components in CBs

Table 3.1 Summary statistics of whole sample of CB issuances

Variable	Number of obs.	Std.	Mean	Min	Median	Max
Hedge Ratio Δ	795	0.263	0.763	0.000	0.858	1.000
conversion probability *Pr*	795	0.228	0.358	0.000	0.332	1.000
moneyness	938	0.523	-0.108	-0.845	-0.169	11.373
Time	556	10.435	1.816	0.000	1.111	243.394
Volatility σ	969	0.264	0.500	0.143	0.433	3.480
Dividend Yield *d*	818	0.105	0.025	0.000	0.000	1.742
Risk Free Rate *r*	969	0.023	0.083	0.032	0.077	0.140
Current Price *S*	968	19.004	26.383	0.635	22.861	272.542
Conversion Price *K*	939	21.566	30.868	0.500	27.250	327.92
Maturity *T*	966	7.14	17.91	3.00	20.00	36.00

Note: Hedge ratio $\Delta = e^{-dT} N(\frac{\ln(S/K)+(r-d+\sigma^2/2)T}{\sigma\sqrt{T}})$,

Conversion probability *Pr*=N($\frac{\ln(S_t/K)+T(\mu-\sigma^2/2)}{\sigma\sqrt{T}}$,

moneyness = (*S*-*K*)/*K*,

Time = [*ln*(*K*)-*ln*(*S*)]/ μ , with μ equals to the anticipated rate of stock price appreciation.

Table 3.2 Summary statistics of subsamples of CB issuances

Panel 1. Debt-like portfolio

Variable	Number of obs.	Std.	Mean	Min	Median	Max
Hedge Ratio Δ	265	0.239	0.457	0.000	0.530	0.750
conversion probability *Pr*	265	0.222	0.339	0.000	0.340	0.997
moneyness	265	0.761	-0.100	-0.845	-0.171	11.373
Time	169	18.806	3.315	0.000	1.373	243.394
Volatility σ	265	0.192	0.401	0.196	0.358	1.876
Dividend Yield *d*	265	0.174	0.073	0.000	0.029	1.742
Risk Free Rate *r*	265	0.023	0.084	0.031	0.079	0.138
Current Price *S*	265	21.834	31.113	2.319	28.042	272.542
Conversion Price *K*	265	20.132	36.533	2.630	33.000	129.130
Maturity *T*	265	7.48	18.22	3.00	20.00	31.00

Panel 2. Mixed portfolio

Variable	Number of obs.	Std.	Mean	Min	Median	Max
Hedge Ratio Δ	265	0.052	0.857	0.751	0.858	0.941
conversion probability *Pr*	265	0.211	0.358	0.006	0.314	0.999
moneyness	265	0.244	-0.139	-0.811	-0.175	2.548
Time	175	1.390	1.277	0.000	1.102	14.343
Volatility σ	265	0.210	0.530	0.168	0.506	1.188
Dividend Yield *d*	265	0.006	0.003	0.000	0.000	0.081
Risk Free Rate *r*	265	0.021	0.073	0.038	0.069	0.138
Current Price *S*	265	17.175	24.783	1.399	20.750	134.383
Conversion Price *K*	265	26.310	30.347	1.130	26.250	327.920
Maturity *T*	265	6.93	14.03	3.00	10.00	30.00

Panel 3. Equity-like portfolio

Variable	Number of obs.	Std.	Mean	Min	Median	Max
Hedge Ratio Δ	265	0.016	0.974	0.941	0.976	1.000
conversion probability *Pr*	265	0.250	0 .376	0.001	0.342	0.991
moneyness	265	0.482	-0.079	-0.512	-0.162	5.834
Time	144	0.782	1.013	0.000	0.959	4.424
Volatility σ	265	0.266	0.561	0.174	0.503	1.715
Dividend Yield *d*	265	0.000	0.000	0.000	0.000	0.002
Risk Free Rate *r*	265	0.022	0.089	0.042	0.085	0.140
Current Price *S*	265	16.248	22.732	0.635	18.785	95.681
Conversion Price *K*	265	18.706	26.172	0.500	21.750	127.660
Maturity *T*	265	4.67	21.13	5.00	20.00	30.00

Table 3.3 Pearson correlation coefficients of measurement of equity components

	Δ	*moneyness*	*Time*	*Pr*
Δ	1	0.0253	-0.0253	0.1816
moneyness	0.0253	1	-0.0534	0.2156
Time	-0.0253	-0.0534	1	-0.0324
Pr	0.1816	0.2156	-0.0324	1

Note: Basing on the whole sample of 969 CB issuance observations.

Hedge ratio $\Delta = e^{-dT} N(\frac{\ln(S/K) + (r - d + \sigma^2/2)T}{\sigma\sqrt{T}})$,

Conversion probability Pr=N$(\frac{\ln(S_t/K) + T(\mu - \sigma^2/2)}{\sigma\sqrt{T}}$,

moneyness = (*S*-*K*)/*K*,

Time = [*ln*(*K*)-*ln*(*S*)]/ μ , with μ equals to the anticipated rate of stock price appreciation.

Table 4
Characteristics of different portfolios at the time of CB issuances

MVE is market value of the issuer's outstanding equities, calculated as the product of Common Shares (#54) and Fiscal year end closing price (#199). Financial leverage is computed to be the sum of Total Long-Term Debt (#9), Debt in Current Liabilities (#34), carrying value of Preferred Stock (#130), Dividends of Preferred stocks In Arrears (#242), subtracting Cash and Short- Term Investments (#1) and divided by MVE. CE+RD/ASSETS is defined as the sum of Capital Expenditures (#128) and Research and Development Expense (#46) divided by Total assets (#6). M/B is the ratio of the equity's market value (MVE) over its book value (#60). Tobin's Q is defined by summing MVE, the liquidating value of Preferred Stock (#10), Total Long-Term Debt (#9) and Debt in Current Liabilities (#34), subtracting Cash and Short- Term Investments (#1), and scaling by Total Assets (#6). *, **, and *** correspond to significant difference under 10%, 5%, and 1% levels. The t-statistics are from T-test of the null of no difference in the means of the debt-like and equity-like portfolios.

	All	Debt-like	Mixed	Equity-like	D-E		t- stat.
Measures of equity components							
Hedge ratio Δ	0.76	0.46	0.86	0.97	-0.52	***	-35.11
Conversion Probability *Pr*	0.36	0.34	0.36	0.38	-0.04		1.01
Moneyness	-0.11	-0.09	-0.15	-0.08	-0.01		-0.38
Time	1.82	3.32	1.28	1.01	2.31		1.59
Characteristics of CB issuances							
Conversion Price *K*	30.88	35.97	30.32	26.08	10.33	***	6.14
Conversion Premium	22.19	22.46	22.46	21.35	1.11	**	1.99
Conversion Ratio	57.51	35.36	35.36	81.26	-45.90	***	5.23
Current Price *S*	26.39	30.75	24.45	22.54	8.33	***	5.01
Dividend Yield *d*	0.03	0.07	0.00	0.00	0.07	***	6.84
Volatility σ	0.50	0.40	0.53	0.56	-0.16	***	-7.96
Maturity *T*	17.90	18.36	14.06	21.19	-2.91	***	-5.38
Coupon (%)	7.70	7.46	6.83	8.43	-0.97	***	-3.93
Issue Size (mil$)	120.52	152.56	128.23	81.79	70.78	***	3.03
Characteristics of CB issuers							
Total Assets (mil$)	2343.57	4745.99	1540.75	366.57	4379.42	**	1.96
MVE	1618.12	2250.45	1683.13	474.67	1775.78	***	4.43
Common Shares Outstanding (mil$)	50.43	66.11	59.67	19.18	46.93	***	3.77
Debt in Current Liabilities (mil$)	204.21	531.58	55.29	10.56	521.01		1.31
Financial Leverage	0.53	0.62	0.56	0.45	0.16		1.58
Net Sales (mil $)	1903.22	3778.01	1330.15	379.10	3398.90	***	3.50
EPS ($)	0.81	1.31	0.43	0.70	0.60	***	2.94
Net Income (Loss) (mil$)	49.58	97.28	15.08	13.17	84.11	***	2.86
R & D Expense (mil$)	83.30	165.94	70.83	20.31	145.63	**	2.51
Capital Expenditures (mil$)	157.41	297.46	113.60	34.31	263.15	**	2.63
CE+RD/ASSETS	14.71	12.43	15.45	16.85	-4.42	***	-3.29
Median Estimate μ	19.90	14.64	21.26	23.99	-9.35	***	-9.59
M/B	2.93	2.33	3.76	2.95	-0.62		-1.24
Tobin's Q (%)	1.41	1.12	1.66	1.48	-0.36	***	-3.92

Table 5
Announcement effects of CB issuances
Table 5.1 Announcement period abnormal stock returns

Panel A. Test of ordinary cross-sectional t statistics

AAR is the cross-sectional average of daily abnormal returns and ACAR is the cumulative sum of AAR around issuance announcements. The t-statistics are the ordinary cross-sectional t statistics, testing the null hypothesis of no announcement effects. As the number of observations in a portfolio, *n*, increases to infinity,

$$t = \frac{\sum_{i=1}^{n} AR_i / n}{\sqrt{\sum_{i=1}^{n} (AR_i - \sum_{i=1}^{n} AR_i / n)^2} / \sqrt{n(n-1)}} \sim N(0, 1).$$

Event window	Whole sample		Debt-like		Mixed		Equity-like	
	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.
-5	-0.0013	-1.35	0.0008	0.58	-0.0032	-1.69	-0.0015	-0.68
-4	0.0000	-0.01	0.0030	2.13	-0.0015	-0.88	0.0003	0.22
-3	0.0000	0.02	0.0038	2.54	-0.0012	-0.65	-0.0027	-1.66
-2	-0.0008	-0.91	-0.0011	-0.81	0.0004	0.23	-0.0027	-1.37
-1	-0.0019	-2.09	-0.0024	-1.67	0.0000	-0.03	-0.0031	-1.59
0	-0.0101	-9.12	-0.0077	-5.09	-0.0129	-5.50	-0.0110	-4.43
1	-0.0051	-4.97	-0.0025	-1.58	-0.0074	-3.41	-0.0075	-3.57
2	-0.0015	-1.67	0.0001	0.09	-0.0025	-1.42	-0.0026	-1.39
3	-0.0006	-0.70	-0.0007	-0.44	-0.0001	-0.07	-0.0020	-1.08
4	0.0005	0.57	0.0002	0.13	0.0030	1.63	-0.0011	-0.66
5	-0.0013	-1.54	0.0000	-0.03	-0.0022	-1.35	-0.0018	-0.95
	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.
(0, 1)	-0.0152	-9.93	-0.0102	-4.94	-0.0202	-5.98	-0.0185	-5.85
(-1,0)	-0.0121	-8.21	-0.0102	-4.54	-0.0129	-4.37	-0.0141	-4.21
(-1,1)	-0.0171	-9.64	-0.0126	-5.11	-0.0203	-5.21	-0.0216	-5.62
(-2,2)	-0.0195	-8.92	-0.0136	-4.43	-0.0224	-5.03	-0.0269	-5.50
(-3,3)	-0.0201	-7.97	-0.0105	-2.75	-0.0237	-4.58	-0.0316	-6.19
(-4,4)	-0.0196	-7.01	-0.0074	-1.66	-0.0222	-3.89	-0.0324	-5.87
(-5,5)	-0.0222	-7.23	-0.0067	-1.44	-0.0275	-4.42	-0.0357	-5.70

Table 5.1 Announcement period abnormal stock returns

Panel B. Test of standardized cross-sectional t statistics

AAR is the cross sectional average of daily abnormal returns and ACAR is the cumulative sum of AAR around issuance announcements. The t-statistics are the standardized cross-sectional t statistics testing the null hypothesis of no announcement effects. As the number of observations in a portfolio, *n*, increases to infinity,

$$t=\frac{\sum_{i=1}^{n} SR_i / n}{\sqrt{\sum_{i=1}^{n}(SR_i - \sum_{i=1}^{n} SR_i / n)^2} / \sqrt{n(n-1)}} \sim t_{n-1}, \text{ where } SR_i = CAR_i(t_1,t_2) / \sqrt{(t_2 - t_1)\sigma^2_{\varepsilon_{i,t}}}.$$

Event window	Whole sample		Debt-like		Mixed		Equity-like	
	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.
-5	-0.0013	-0.68	0.0008	0.59	-0.0032	-1.67	-0.0015	-0.09
-4	0.0000	0.39	0.0030	2.00	-0.0015	-1.32	0.0003	0.11
-3	0.0000	0.39	0.0038	2.36	-0.0012	-0.90	-0.0027	-1.36
-2	-0.0008	-0.62	-0.0011	-0.72	0.0004	0.18	-0.0027	-0.89
-1	-0.0019	-2.01	-0.0024	-1.83	0.0000	-0.20	-0.0031	-0.96
0	-0.0101	-10.23	-0.0077	-5.46	-0.0129	-5.66	-0.0110	-5.12
1	-0.0051	-3.79	-0.0025	-1.31	-0.0074	-2.93	-0.0075	-2.30
2	-0.0015	-1.44	0.0001	-0.29	-0.0025	-0.86	-0.0026	-1.33
3	-0.0006	-0.76	-0.0007	-0.75	-0.0001	0.13	-0.0020	-1.04
4	0.0005	0.48	0.0002	0.06	0.0030	1.01	-0.0011	-0.66
5	-0.0013	-1.50	0.0000	-0.27	-0.0022	-1.21	-0.0018	-0.99
	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.
(0, 1)	-0.0152	-9.90	-0.0102	-5.27	-0.0202	-5.71	-0.0185	-5.26
(-1,0)	-0.0121	-9.00	-0.0102	-5.15	-0.0129	-4.55	-0.0141	-4.27
(-1,1)	-0.0171	-9.65	-0.0126	-5.60	-0.0203	-5.08	-0.0216	-4.80
(-2,2)	-0.0195	-8.73	-0.0136	-4.71	-0.0224	-4.67	-0.0269	-4.91
(-3,3)	-0.0201	-7.59	-0.0105	-3.14	-0.0237	-4.48	-0.0316	-5.30
(-4,4)	-0.0196	-6.57	-0.0074	-2.09	-0.0222	-4.15	-0.0324	-5.11
(-5,5)	-0.0222	-6.76	-0.0067	-1.91	-0.0275	-4.60	-0.0357	-5.21

Table 5.1 Announcement period abnormal stock returns

Panel C. Test of nonparametric sign-test statistics

AAR is the cross sectional average of daily abnormal returns and ACAR is the cumulative sum of AAR around issuance announcements. The t-statistics are nonparametric sign-test statistics, testing the null hypothesis of no announcement effects (half of the abnormal returns are positive). As the number of observations in a portfolio, *n*, increases to infinity,

t= $\frac{(n^+/n-0.5)}{0.25/\sqrt{n}}$ ~ N (0, 1), where n^+ is the number of observations with positive abnormal stock return.

Event window	Whole sample		Debt-like		Mixed		Equity-like	
	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.
-5	-0.0013	-2.96	0.0008	-1.29	-0.0032	-3.13	-0.0015	-0.92
-4	0.0000	-2.51	0.0030	0.31	-0.0015	-2.03	0.0003	-1.90
-3	0.0000	-1.80	0.0038	1.66	-0.0012	-2.27	-0.0027	-1.66
-2	-0.0008	-2.57	-0.0011	-1.78	0.0004	-0.80	-0.0027	-1.17
-1	-0.0019	-4.38	-0.0024	-3.38	0.0000	-0.92	-0.0031	-2.52
0	-0.0101	-10.04	-0.0077	-5.22	-0.0129	-5.10	-0.0110	-6.20
1	-0.0051	-5.92	-0.0025	-1.78	-0.0074	-4.12	-0.0075	-4.48
2	-0.0015	-3.28	0.0001	-1.29	-0.0025	-2.40	-0.0026	-1.29
3	-0.0006	-3.28	-0.0007	-1.90	-0.0001	-1.04	-0.0020	-2.40
4	0.0005	-2.77	0.0002	-0.43	0.0030	-1.29	-0.0011	-2.27
5	-0.0013	-1.93	0.0000	0.18	-0.0022	-1.29	-0.0018	-0.92
	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.
(0, 1)	-0.0152	-10.42	-0.0102	-4.36	-0.0202	-5.71	-0.0185	-6.82
(-1,0)	-0.0121	-8.75	-0.0102	-5.47	-0.0129	-3.99	-0.0141	-4.61
(-1,1)	-0.0171	-9.97	-0.0126	-5.22	-0.0203	-5.34	-0.0216	-5.84
(-2,2)	-0.0195	-8.95	-0.0136	-4.36	-0.0224	-4.98	-0.0269	-4.73
(-3,3)	-0.0201	-7.79	-0.0105	-3.87	-0.0237	-3.50	-0.0316	-5.34
(-4,4)	-0.0196	-7.59	-0.0074	-3.62	-0.0222	-3.87	-0.0324	-5.47
(-5,5)	-0.0222	-8.11	-0.0067	-3.38	-0.0275	-4.48	-0.0357	-5.10

Table 5.1 Announcement period abnormal stock returns

Panel D. Test of GARCH-based statistics

AAR is the cross sectional average of daily abnormal returns and ACAR is the cumulative sum of AAR around issuance announcements. The t-statistics are GARCH-based test statistics for the null hypothesis of no announcement effects. As the number of observations in a portfolio, *n*, increases to infinity,

$$t = \frac{\sum_{i=1}^{n} S_i / n}{\sqrt{\sum_{i=1}^{n}(S_i - \sum_{i=1}^{n} S_i / n)^2} / \sqrt{n(n-1)}} \sim t_{n-1}$$, where $S_i = \hat{\gamma}_i / \sqrt{\hat{h}_{i,t}}$, and $\hat{\gamma}_i$ and $\hat{h}_{i,t}$ are estimated from the GARCH (1,1) model: $R_{i,t} = \alpha_i + \beta_i \cdot R_{m,t} + \gamma_i \cdot D_t + \eta_{i,t}$, $\eta_{i,t} | \Omega_t \sim N(0, h_{i,t})$, and $h_{i,t} = a_i + b_i \cdot h_{i,t-1} + c_i \cdot \eta_{i,t-1}^2 + d_i \cdot D_t$.

Event window	Whole sample		Debt-like		Mixed		Equity-like	
	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.	AAR	t- stat.
-5	-0.0013	1.33	0.0008	2.25	-0.0032	-0.11	-0.0015	0.64
-4	0.0000	0.53	0.0030	0.17	-0.0015	-1.29	0.0003	1.08
-3	0.0000	-0.64	0.0038	1.24	-0.0012	-1.04	-0.0027	-1.11
-2	-0.0008	0.08	-0.0011	-0.82	0.0004	1.63	-0.0027	-0.79
-1	-0.0019	-1.32	-0.0024	-1.69	0.0000	-0.16	-0.0031	-0.15
0	-0.0101	-7.33	-0.0077	-4.74	-0.0129	-3.93	-0.0110	-2.97
1	-0.0051	-2.18	-0.0025	-0.13	-0.0074	-2.47	-0.0075	-1.82
2	-0.0015	1.46	0.0001	1.79	-0.0025	0.59	-0.0026	-0.52
3	-0.0006	0.11	-0.0007	-0.59	-0.0001	1.30	-0.0020	-0.10
4	0.0005	-1.44	0.0002	-1.07	0.0030	-1.50	-0.0011	-0.31
5	-0.0013	-1.79	0.0000	0.17	-0.0022	-1.61	-0.0018	-1.45
	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.	ACAR	t- stat.
(0, 1)	-0.0152	-8.29	-0.0102	-4.07	-0.0202	-5.23	-0.0185	-4.16
(-1,0)	-0.0121	-8.68	-0.0102	-5.88	-0.0129	-4.54	-0.0141	-3.92
(-1,1)	-0.0171	-9.32	-0.0126	-4.99	-0.0203	-5.37	-0.0216	-4.96
(-2,2)	-0.0195	-6.85	-0.0136	-3.77	-0.0224	-4.02	-0.0269	-3.97
(-3,3)	-0.0201	-6.29	-0.0105	-3.21	-0.0237	-3.23	-0.0316	-3.97
(-4,4)	-0.0196	-5.85	-0.0074	-3.32	-0.0222	-3.29	-0.0324	-3.60
(-5,5)	-0.0222	-5.68	-0.0067	-2.30	-0.0275	-3.75	-0.0357	-3.86

Table 5.2 Comparison of announcement effect among subsample portfolios

Panel A. Differences in CAR among stock returns among subsample portfolios

	ACAR(-2,2)	ACAR(-1,1)	ACAR(-1,0)	ACAR(0,1)
Debt-like	-0.0136	-0.0126	-0.0102	-0.0102
Mixed	-0.0224	-0.0203	-0.0129	-0.0202
Equity-like	-0.0269	-0.0216	-0.0141	-0.0185
D–E	0.0133	0.0089	0.0039	0.0083
	(2.30)	(1.96)	(0.97)	(2.19)
D-M	0.0088	0.0076	0.0027	0.0100
	(1.62)	(1.66)	(0.74)	(2.53)
M-E	0.0045	0.0013	0.0012	-0.0018
	(0.68)	(0.23)	(0.26)	(-0.38)

Panel B. Differences in CAR (-2, 2) among subsample portfolios

	Difference Between Means	Simultaneous 90% Confidence Limits
D-M	0.008798	(-0.005499, 0.023095)
D-E	0.013276**	(-0.001008, 0.027559)
M-E	0.004478	(-0.009819, 0.018775)

Note: D-E = (ACAR of the Debt-like portfolio) – (ACAR of the Equity-like portfolio),
D-M = (ACAR of the Debt-like portfolio) – (ACAR of the Mixed portfolio),
M-E = (ACAR of the Mixed portfolio) – (ACAR of the Equity-like portfolio).
T-test statistics for null hypothesis of no differences in ACAR between the debt-like portfolio and the equity-like portfolio are reported in Panel A in parentheses.

Table 5.3 Regression of announcement effect on hedge ratio Δ

CAR (-2, 2) = $\alpha + \beta\Delta + \varepsilon$
Adjusted R-Square =0.0023

Variable	Parameter estimate	Standard Error	t stat.	P > |t|
Constant	-0.0091	0.0054	-1.69	0.091
β	-0.0156	0.0077	-2.03	0.043

Note: t statistics are White (1980) heteroskedasticity consistent.

Table 6
Long-run buy and hold returns
Table 6.1 – Long-run BHR

The buy and hold return (BHR) of portfolio j with n component equities through T_1 to T_2 is defined by:
$BHR_j \equiv \sum_{i=1}^{n} \omega_i [\prod_{t=T_1}^{T_2} (1+R_{i,t}) - 1]$, where $\omega_i = MVE_i / \sum_{i=1}^{n} MVE_i$ for a value-weighted (V.W.) portfolio, and $\omega_i = 1/n$ for an equal-weighed (E.W.) portfolio.
diff. = (average BHR of CB issuers) – (average BHR of matching firms or market index benchmarks)
P>| t| is the p value from 2 sided T-test of the null hypothesis that D-E is indifferent from 0.

	Whole sample n=619			Debt-like portfolio n=209			Mixed portfolio n=187			Equity-like portfolio n=180		
[-3, 3] years												
V.W.	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|
Issuer	1.639			1.282			2.484			2.545		
Match	0.519	1.120	0.192	0.684	0.598	0.506	0.250	2.234	0.148	0.664	1.295	0.084
Index	1.129	0.510	0.196	1.249	0.033	0.862	1.150	1.334	0.236	1.025	1.520	0.071
E.W.												
Issuer	1.554			1.622			1.902			1.345		
Match	1.146	0.408	0.009	1.593	0.029	0.717	1.144	0.758	0.039	0.859	0.486	0.060
Index	1.216	0.338	0.014	1.449	0.173	0.244	1.231	0.671	0.047	1.047	0.298	0.239
Pre issuances [-3, 0] years												
V.W.	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|
Issuer	1.577			0.706			2.303			3.830		
Match	0.265	1.312	0.017	0.218	0.488	0.172	0.327	1.976	0.459	0.347	3.483	0.039
Index	0.496	1.081	0.009	0.543	0.163	0.305	0.489	1.814	0.116	0.479	3.351	0.041
E.W.												
Issuer	1.321			1.058			1.457			1.544		
Match	0.741	0.580	<.001	0.838	0.220	0.114	0.639	0.818	<.001	0.741	0.803	0.000
Index	0.558	0.763	<.001	0.656	0.402	<.001	0.561	0.896	<.001	0.501	1.043	<.001
Post issuances [0, 3] years												
V.W.	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|	BHR	*diff.*	P>|t|
Issuer	0.171			0.358			0.188			0.053		
Match	0.230	-0.059	0.707	0.373	-0.015	0.784	0.000	0.188	0.257	0.309	-0.256	0.066
Index	0.404	-0.233	0.026	0.442	-0.084	0.602	0.420	-0.232	0.253	0.351	-0.298	0.101
E.W.												
Issuer	0.147			0.350			0.179			-0.05		
Match	0.306	-0.159	0.011	0.418	-0.068	0.798	0.346	-0.167	0.149	0.229	-0.280	0.001
Index	0.374	-0.227	<.001	0.439	-0.089	0.322	0.390	-0.211	0.005	0.301	-0.352	<.001

Table 6.2 - Comparison of long-run buy and hold returns between Debt-like portfolio and Equity-like portfolio

	D–E	t-stat.	P > |t|
[-3, 3] years			
V.W.	-1.263	-1.63	0.105
E.W.	0.277	0.92	0.359
Pre issuances [-3, 0] years			
V.W.	-3.124	-1.97	0.051
E.W.	-0.486	-2.36	0.019
Post issuances [0, 3] years			
V.W.	0.305	1.12	0.263
E.W.	0.401	3.63	0.000

Note: 1. D–E = (average BHR of the Debt-like portfolio) – (average BHR of the Equity-like portfolio).
2. P>| t| is the p value from 2 sided T-test of the null hypothesis that D–E is indifferent from 0.

Table 7
Long-run stock return performance by Fama French three factor model
Table 7.1 Whole sample long-run stock returns

There are 383 monthly portfolios, from February, 1976 to December, 2007, with a maximum of 170 companies per portfolio to a minimum of 1 company in each portfolio. White Heteroskedasticity-Consistent t statistics are reported in parentheses.

$$R(t) - RF(t) = \alpha + \beta[RM(t) - RF(t)] + sSMB(t) + hHML(t) + \varepsilon(t)$$

	α	β	s	h	Adj-R2
E.W. /OLS	-0.005	1.272	0.843	-0.153	0.7937
	(-2.74)	(22.59)	(10.14)	(-1.83)	
E.W. /WLS	-0.007	1.149	0.809	-0.179	0.9219
	(-6.16)	(34.81)	(14.17)	(-2.44)	
V.W. /OLS	0.002	1.223	0.402	-0.301	0.7136
	(1.10)	(18.68)	(4.66)	(-3.31)	
V.W. /WLS	0.001	1.133	0.348	-0.314	0.8659
	(0.81)	(29.70)	(5.28)	(-4.45)	

Table 7.2 Sub- sample long-run stock returns

There are 383 monthly bond-like portfolios, from February, 1976 to December, 2007, with a maximum of 45 companies per portfolio to a minimum of 1 company in each portfolio. There are 382 monthly mixed portfolios, from March, 1976 to December, 2007, with a maximum of 38 companies per portfolio to a minimum of 1 company in each portfolio. There are 342 discontinuous monthly equity-like portfolios, from June, 1976 to December, 2007, with a maximum of 84 companies per portfolio to a minimum of 1 company in each portfolio. White Heteroskedasticity-Consistent t statistics are reported in parentheses.

$$R(t) - RF(t) = \alpha + \beta[RM(t) - RF(t)] + sSMB(t) + hHML(t) + \varepsilon(t)$$

Panel A. Debt-like portfolio

	α	β	s	h	Adj-R2
E.W. /OLS	-0.006	1.141	0.546	0.213	0.6545
	(-2.75)	(20.18)	(7.30)	(2.63)	
E.W. /WLS	-0.003	1.084	0.449	0.036	0.8339
	(-2.17)	(27.89)	(5.68)	(0.55)	
V.W. /OLS	-0.001	1.148	0.148	0.289	0.4854
	(-0.37)	(12.51)	(1.65)	(2.55)	
V.W. /WLS	0.002	1.044	0.090	-0.037	0.7343
	(1.20)	(19.08)	(1.05)	(-0.41)	

Panel B. Mixed portfolio

	α	β	s	h	Adj-R2
E.W. /OLS	-0.0001	1.289	1.009	-0.267	0.6133
	(-0.06)	(13.97)	(6.75)	(-1.85)	
E.W. /WLS	-0.008	1.174	0.886	-0.227	0.7167
	(-3.22)	(18.02)	(8.00)	(-1.88)	
V.W. /OLS	0.008	1.304	0.663	-0.775	0.5810
	(2.33)	(13.30)	(4.10)	(-4.63)	
V.W. /WLS	0.001	1.144	0.530	-0.822	0.6390
	(0.16)	(13.97)	(3.12)	(-5.01)	

Panel C. Equity-like portfolio

	α	β	s	h	Adj-R2
E.W. /OLS	-0.009	1.189	2.000	-0.923	0.5219
	(-1.46)	(5.41)	(3.39)	(-2.63)	
E.W. /WLS	-0.008	1.122	1.045	-0.405	0.9167
	(-4.06)	(15.84)	(12.15)	(-2.35)	
V.W. /OLS	-0.004	1.118	1.780	-1.082	0.4720
	(-0.60)	(5.01)	(2.90)	(-2.93)	
V.W. /WLS	-0.001	1.132	0.784	-0.694	0.7925
	(-0.11)	(12.27)	(4.68)	(-3.43)	

Table 7
Long-run operating performance
Table 8.1 – Raw operating performance

OIBD/Assets= Operating Income before depreciation (#13) + Interest income (#62)/ total assets (#6). Values in () under the columns of means are the statistics testing the null hypothesis that there is difference between the pre and post average operating performances using t test. The values in the columns of medians over the [-3, 3], [-3, -1], and [1, 3] years' windows are calculated as the medians of each CB issuer's average performance in the [-3, 3], [-3, -1], and [1, 3] years' windows. Values in <> are the test statistics of difference between the pre and post medians using Wilcoxon rank signed test. The z-statistic from the Wilcoxon-signed-rank test for the null hypothesis of no difference in the issuers' median operating performances from pre issuance period to post issuance period using is computed as:

$Z = \frac{\sum_{i=1}^{n} r_i^+ - n(n+1)/4}{\sqrt{n(n+1)(2n+1)/2}}$ ~N(0,1) for large sample size n, where $\sum_{i=1}^{n} r_i^+ = \sum_{i=1}^{n} V_i \, I(r_i > 0)$ and $V_i = V_i^{post} - V_i^{pre}$ is the difference in the operating performance (measured by OIBD/Assets) between pre CB issuance period and the post CB issuance period, and r_i is the ranking of V_i in an ascending order.

	Whole sample		Debt-like		Mixed		Equity-like	
Relative year	Mean	Median	Mean	Median	Mean	Median	Mean	Median
-3	13.553	15.005	14.182	14.709	10.939	12.793	15.536	17.455
-2	12.285	14.605	15.094	14.971	8.627	12.848	13.152	16.079
-1	12.515	14.312	14.358	14.884	10.343	13.930	12.870	15.623
0	11.634	13.183	13.527	14.128	8.423	12.269	12.912	13.746
1	11.392	13.37	14.242	14.523	11.360	13.604	8.382	11.911
2	9.323	12.667	14.107	14.708	8.221	10.866	5.261	11.424
3	11.390	13.029	13.601	13.940	10.507	11.310	9.676	12.356
[-3,3]	11.651	13.141	14.114	14.194	9.727	12.343	11.249	13.525
Pre issuance [-3,-1]	12.312	14.429	14.256	14.485	9.941	13.180	13.734	16.155
Post issuance [1, 3]	10.559	12.271	13.988	14.207	9.539	11.441	9.186	11.649
Post - Pre	-1.753	-2.158	-0.269	-0.277	-0.401	-1.739	-4.548	-4.505
	(-2.43)	<-4.91>	(-0.42)	<-2.49>	(-0.27)	<-2.20>	(-3.14)	<-2.20>

Table 8.2 – Abnormal operating performance

OIBD/Assets= Operating Income before depreciation (#13) + Interest income (#62)/ total assets (#6). Values in () under the columns of means are the statistics testing the null hypothesis that there is difference between the pre and post average operating performances using t test. The values in the columns of medians over the [-3, 3], [-3, -1], and [1, 3] years' windows are calculated as the medians of each CB issuer's average performance in the [-3, 3], [-3, -1], and [1, 3] years' windows. Values in <> are the test statistics of difference between the pre and post medians using Wilcoxon rank signed test. The z-statistic from the Wilcoxon-signed-rank test for the null hypothesis of no difference in the issuers' median operating performances from pre issuance period to post issuance period using is computed as:

$Z = \frac{\sum_{i=1}^{n} r_i^{+} - n(n+1)/4}{\sqrt{n(n+1)(2n+1)/2}}$ ~N(0,1) for large sample size n, where $\sum_{i=1}^{n} r_i^{+} = \sum_{i=1}^{n} V_i \, I(r_i > 0)$ and $V_i = V_i^{post} - V_i^{pre}$ is the difference in the operating performance (measured by OIBD/Assets) between pre CB issuance period and the post CB issuance period, and r_i is the ranking of V_i in an ascending order.

	Whole sample		Debt-like		Mixed		Equity-like	
Relative year	Mean	Median	Mean	Median	Mean	Median	Mean	Median
-3	-1.937	0.158	-0.545	0.402	-3.947	-2.063	-1.127	4.369
-2	-2.924	-1.214	0.151	0.070	-6.686	-3.789	-1.940	-1.424
-1	-2.721	-0.595	-0.451	-0.610	-5.139	-1.014	-2.481	0.245
0	-3.752	-1.549	-1.019	-0.622	-7.692	-3.650	-2.003	-2.784
1	-2.697	-1.742	-0.843	-1.377	-2.210	-1.315	-4.827	-4.082
2	-7.993	-2.542	-1.999	-1.255	-6.847	-4.714	-14.161	-2.540
3	-5.315	-2.415	-2.098	-1.897	-4.817	-3.256	-8.533	-6.609
[-3, 3]	-3.786	-1.939	-0.917	-1.194	-5.454	-3.312	-4.939	-0.519
Pre issuance [-3,-1]	-2.639	-0.438	-0.281	-0.023	-5.294	-2.355	-1.913	0.237
Post issuance [1, 3]	-5.390	-2.542	-1.443	-1.416	-5.605	-3.210	-7.158	-3.875
Post - Pre	-2.751	-2.104	-1.161	-1.394	-0.311	-0.856	-5.245	-4.112
	(-2.05)	<-4.02>	(-1.22)	<-1.93>	(-0.13)	<-2.61>	(-1.79)	<-2.26>

Table 8.3 - Comparison of operating performance between Debt-like portfolio and Equity-like portfolio

	D–E	t-stat.	P > |t|
[-3, 3] years			
Raw	2.865	-2.1995	0.07
Abnormal	4.022	-2.4559	0.03
Pre issuances [-3, -1] years			
Raw	0.522	-0.4347	0.71
Abnormal	1.632	-2.2059	0.08
Post issuances [1, 3] years			
Raw	4.802	-4.5568	0.04
Abnormal	5.716	-2.0108	0.10

Note: 1. D–E = (average operating performance of the Debt-like portfolio) – (average operating performance of the Equity-like portfolio)
2. P>| t| is the p value from 2 sided T-test of the null hypothesis that D-E is indifferent from 0.

Table 8.4- Comparison of operating performance between issuers and matching firms

diff. = (median operating performance of the CB issuers) – (median operating performance of the matching firms). The z-statistic is the test statistic of the null hypothesis that there is no difference between the issuers' and the industry matchers' median operating performance using Wilcoxon-signed-rank test.

$Z = \frac{\sum_{i=1}^{n} r_i^+ - n(n+1)/4}{\sqrt{n(n+1)(2n+1)/2}}$ ~ N (0,1) for large sample size n, $\sum_{i=1}^{n} r_i^+ = \sum_{i=1}^{n} V_i \, I(r_i > 0)$, $V_i = V_i^{issuer} - V_i^{match}$ is the difference in operating performance (measured by OIBD/Assets) between issuer-i's and its industry matching firm's, and r_i is the ranking of V_i in an ascending order.

	Whole sample		Debt-like		Mixed		Equity-like	
Relative year	*diff.*	z- stat.	*diff.*	z- stat.	*diff.*	z-stat.	*diff.*	z- stat.
-3	0.158	-0.40	0.402	-0.57	-2.063	-0.52	4.369	-0.04
-2	-1.214	-1.00	0.070	0.15	-3.789	-1.72	-1.424	-0.11
-1	-0.595	-1.52	-0.610	-0.46	-1.014	-1.25	0.245	-0.53
0	-1.549	-3.18	-0.622	-0.79	-3.650	-2.71	-2.784	-1.29
1	-1.742	-2.40	-1.377	-0.83	-1.315	-0.72	-4.082	-1.78
2	-2.542	-3.47	-1.255	-1.23	-4.714	-1.94	-2.540	-2.17
3	-2.415	-3.58	-1.897	-1.05	-3.256	-1.95	-6.609	-2.53

Table 9
Long-run equity risks

Table 9.1- Pre and post issuances comparison of equity risks

Under the columns of means, the values reported in ( ) are t-statistics using T-test for the null hypothesis of no difference between the pre issuance and post issuance average risks. Under the columns of medians, the values reported in <> are z-statistics using Wilcoxon signed rank test for the null hypothesis of no difference between the pre issuance and post issuance median risks.

	Whole sample		Debt-like		Mixed		Equity-like	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Systematic Risk								
[-3,3]	1.012	0.975	0.926	0.893	1.065	1.051	1.088	1.012
Pre issuance [-3,0]	1.043	1.000	0.954	0.895	1.100	1.056	1.118	1.045
Post issuance [0,3]	0.981	0.921	0.896	0.867	1.029	1.013	1.061	1.023
Post-pre	-0.062	-0.079	-0.059	-0.028	-0.071	-0.042	-0.058	-0.022
	(-2.44)	<-2.68>	(-2.02)	<-2.07>	(-1.20)	<-0.65>	(-1.21)	<-1.90>
Idiosyncratic Risk								
[-3,3]	0.114	0.077	0.056	0.043	0.141	0.101	0.140	0.101
Pre issuance [-3,0]	0.096	0.067	0.051	0.040	0.120	0.086	0.115	0.090
Post issuance [0,3]	0.131	0.074	0.061	0.043	0.163	0.087	0.162	0.098
Post-pre	0.035	0.007	0.010	0.003	0.042	0.001	0.048	0.008
	(4.85)	<3.32>	(2.46)	<1.78>	(2.50)	<0.47>	(3.55)	<2.92>
Total Equity Risk								
[-3,3]	0.126	0.088	0.064	0.050	0.155	0.110	0.156	0.118
Pre issuance [-3,0]	0.107	0.078	0.059	0.049	0.132	0.099	0.132	0.098
Post issuance [0,3]	0.144	0.085	0.069	0.050	0.178	0.099	0.178	0.117
Post-pre	0.037	0.007	0.010	0.001	0.047	-0.001	0.046	0.018
	(4.87)	<3.84>	(2.48)	<1.64>	(2.63)	<0.82>	(3.26)	<3.32>

Table 9.2- Comparison of equity risks with non-issuing matching firms

The values reported are the mean and median of the abnormal risks (risks of the CB issuers – risks of the matching firms). The values reported under the columns of means are t-statistics from T-test of the null hypothesis of no difference in average risks between the issuers and the matching firms. The values reported under the columns of medians are z-statistics from Wilcoxon-signed-rank test.

		Whole Sample		Debt-like		Mixed		Equity-like	
	Relative day	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Systematic Risk	[-756, -504)	0.115	0.115	-0.002	0.029	0.078	0.068	0.363	0.315
		(-1.18)	<1.48>	(-0.58)	<-0.32>	(-0.06)	<0.25>	(-3.54)	<3.40>
	[-504, -252)	0.147	0.135	0.043	0.037	0.182	0.138	0.281	0.321
		(-3.33)	<3.34>	(-0.04)	<0.00>	(-2.08)	<2.20>	(-3.13)	<3.48>
	[-252, 0)	0.208	0.272	0.07	0.167	0.277	0.383	0.349	0.334
		(-4.62)	<5.63>	(-0.66)	<1.43>	(-3.20)	<4.15>	(-3.62)	<3.77>
	(0, 252]	0.289	0.301	0.148	0.173	0.37	0.369	0.404	0.43
		(-7.54)	<7.37>	(-2.07)	<2.45>	(-5.14)	<4.75>	(-6.28)	<5.65>
	(252, 504]	0.224	0.221	(0.04)	0.031	0.335	0.369	0.341	0.357
		(-4.63)	<4.97>	(-0.02)	<0.67>	(-4.32)	<4.04>	(-3.30)	<3.57>
	(504, 756]	0.121	0.257	-0.011	0.098	0.178	0.452	0.227	0.318
		(-3.73)	<3.64>	(-0.59)	<-0.32>	(-2.80)	<2.62>	(-3.48)	<3.45>
Idiosyncratic Risk	[-756, -504)	0.000	0.004	-0.014	-0.002	0.011	0.011	0.007	0.012
		(-0.20)	<-0.25>	(-3.02)	<-2.56>	(-0.40)	<0.35>	(-1.78)	<1.94>
	[-504, -252)	-0.019	0.001	-0.016	-0.002	-0.017	0.002	-0.021	0.009
		(-2.41)	<-0.77>	(-3.53)	<-3.11>	(-1.40)	<0.42>	(-0.07)	<1.17>
	[-252, 0)	-0.023	-0.003	-0.027	-0.006	-0.038	0.005	-0.021	0.009
		(-3.45)	<-1.83>	(-3.54)	<-3.63>	(-1.96)	<0.23>	(-0.63)	<0.54>
	(0, 252]	-0.035	-0.011	-0.048	-0.016	-0.027	0.005	-0.021	-0.019
		(-3.64)	<-4.16>	(-3.52)	<-4.61>	(-1.41)	<-0.56>	(-0.89)	<-1.08>
	(252, 504]	-0.021	0.000	-0.046	-0.015	-0.005	0.017	-0.015	-0.012
		(-1.68)	<-1.37>	(-3.08)	<-3.76>	(-0.36)	<1.26>	(-0.43)	<-0.57>
	(504, 756]	-0.011	-0.004	-0.045	-0.009	0.048	0.008	-0.038	-0.011
		(-0.21)	<0.05>	(-2.13)	<-2.60>	(-1.13)	<1.46>	(-0.27)	<0.41>
Total Equity Risk	[-756, -504)	0.000	0.003	-0.016	-0.004	0.01	0.012	0.011	0.013
		(-0.21)	<-0.10>	(-3.06)	<-2.52>	(-0.38)	<0.59>	(-2.04)	<2.10>
	[-504, -252)	-0.012	0.006	-0.016	-0.001	-0.035	0.004	-0.005	0.01
		(-1.28)	<-0.27>	(-3.42)	<-2.99>	(-1.30)	<0.68>	(-0.98)	<1.59>
	[-252, 0)	-0.02	0.000	-0.026	-0.007	-0.015	0.017	-0.017	0.012
		(-3.11)	<-1.24>	(-3.48)	<-3.25>	(-1.79)	<0.44>	(-0.26)	<1.00>
	(0, 252]	-0.03	-0.013	-0.047	-0.015	-0.02	0.007	-0.013	-0.009
		(-3.25)	<-3.16>	(-3.41)	<-4.32>	(-1.19)	<-0.18>	(-0.49)	<-0.16>
	(252, 504]	-0.017	0.003	-0.047	-0.013	0.002	0.019	-0.01	-0.016
		(-1.31)	<-0.88>	(-3.07)	<-3.62>	(-0.64)	<1.52>	(-0.09)	<-0.20>
	(504, 756]	-0.007	-0.004	-0.044	-0.007	0.058	0.011	-0.035	-0.006
		(-0.27)	<0.38>	(-2.10)	<-2.37>	(-1.18)	<1.63>	(-0.30)	<0.61>

Table 9.3- Comparison between Debt-like portfolio and Equity-like portfolio

	D-E	t -stat.	P > |t|
[-3, 3] years			
Systematic risk	-0.162	-5.80	<.0001
Idiosyncratic risk	-0.084	-11.63	<.0001
Total equity risk	-0.093	-12.20	<.0001
Pre issuances [-3, 0] years			
Systematic risk	-0.164	-3.86	0.0001
Idiosyncratic risk	-0.064	-12.27	<.0001
Total equity risk	-0.073	-10.86	<.0001
Post issuances [0, 3] years			
Systematic risk	-0.165	-4.48	<.0001
Idiosyncratic risk	-0.102	-7.86	<.0001
Total equity risk	-0.109	-8.34	<.0001

Note: 1. D–E = (average risk of Debt-like portfolio) – (average risk of Equity-like portfolio)
2. P>| t| is the p value from 2 sided T-test of the null hypothesis that D–E is indifferent from 0.

Table 10
Regressions of announcement effect on long-run operating performance

CAR (-2, 2) = $\alpha + \beta$ * pre-issuance operating performance + ε
Adjusted R-Square = -0.0006s

Variable	Parameter estimate	Standard Error	t stat.	P > |t|
Constant	-0.027755	0.006023	-4.607939	0.0000
β	0.000186	0.000315	0.590479	0.5552

CAR (-2, 2) = $\alpha + \beta$ * post-issuance operating performance + ε
Adjusted R-Square = 0.0095

Variable	Parameter estimate	Standard Error	t stat.	P > |t|
Constant	-0.029182	0.004174	-6.991290	0.0000
β	0.000403	0.000164	2.454455	0.0146

Note: t statistics are White (1980) heteroskedasticity consistent.

Table 11

Regressions of announcement effect on long-run operating performance conditional on equity risks

Table- 11.1 Regression of announcement effect on pre issuance long-run variables

	Constant	Operating performance	Equity beta	Residual variance	Total Risk	Adj-R2	Number of obs.
Pre issuance variables							
	-0.0277	0.0002				-0.092	427
	(-4.61)	(0.59)					
	-0.0125		-0.0114			0.0069	601
	(-1.98)		(-1.99)				
	-0.0206			-0.0363		0.0044	601
	(-5.35)			(-0.98)			
	-0.0191				-0.0455	0.0066	601
	(-4.69)				(-1.28)		
	-0.0176	0.0002	-0.0097	0.0002		0.0009	427
	(-1.81)	(0.52)	(-1.50)	(0.01)			
	-0.0239	0.0001			-0.0221	-0.0010	427
	(-3.12)	(0.27)			(-0.63)		

Note: 1. The dependent variable is the short-run announcement effect, measured by CAR (-2, 2).
2. White (1980) heteroskedasticity consistent t statistics are reported in parentheses below the estimated OLS coefficients.

Table- 11.2 Regression of announcement effect on post issuance long-run variables

	Constant	Operating performance	Equity beta	Residual variance	Total Risk	Adj-R2	Number of obs.
Post issuance variables							
	-0.0292	0.0004				0.0095	372
	(-6.99)	(2.45)					
	-0.0226		-0.0017			-0.0015	601
	(-4.47)		(-0.39)				
	-0.0203			-0.0289		0.0054	601
	(-6.04)			(-1.42)			
	-0.0200				-0.0282	0.0056	601
	(-5.78)				(-1.44)		
	-0.0259	0.0004	-0.0023	-0.0065		0.0047	372
	(-3.36)	(2.53)	(-0.39)	(-0.36)			
	-0.0285	0.0004			-0.0041	0.0070	372
	(-7.01)	(2.51)			(-0.27)		

Note: 1. The dependent variable is the short-run announcement effect, measured by CAR (-2, 2).
2. White (1980) heteroskedasticity consistent t statistics are reported in parentheses below the estimated OLS coefficients.