AN ANALYSIS OF CALL PROTECTION FEATURES IN CONVERTIBLE SECURITIES

by

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To My Family

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Introduction

Design of call protection terms of convertible securities is a relatively unexplored area of finance. This dissertation consists of two studies, both striving to fill the gap in the literature. The first study, presented in Chapter 1, builds upon the sequential financing explanation of convertible issuance. If sequential financing plays a role in motivating firms to issue convertibles as suggested by Mayers (1998), firms with a long time until execution of expected investment outlays will offer strong call protection compared to firms with a short expected wait. In the sample of 913 convertible bonds issued during the period 1981-1998, I find evidence of such a relationship. Namely, the parameters of the optimal investment timing model by McDonald and Siegel (1986) are related to the call protection terms of convertible bonds in the manner suggested by the sequential financing theory. This finding is robust to controlling for other theories related to the roles of call feature and call protection.

Examining call protection terms offered by convertible bond issuers from countries with varying levels of shareholder protection and creditor protection provides an interesting previously unexplored method to observe whether firms adjust the design of their financing contracts depending on the nature of local law. Possibility of a forced conversion instituted by an early call is more threatening to investors in an economy where local laws provide less protection to shareholders. Likewise, in an economy where the legal infrastructure makes creditorship appealing, investors will prefer more "debt-like" contracts. Since convertibles issued by firms from "shareholder friendly" countries should be more equity-like, and convertibles from "creditor friendly" countries should be more debt-like, the level of shareholder protection should be inversely related to call protection strength, and creditor protection should be positively related to it. In the study presented in Chapter 2, I find strong evidence supportive of my hypothesis in a sample of 1,480 convertible bonds from 27 countries. These findings remain intact when I control for other explanations of call protection strength. They are also robust to several different proxies of "shareholder/creditor friendliness".

Chapter 1
Convertible Securities in Sequential Financing: Matching the Timing of Real Options with Financial Options

1.1. Introduction

Convertible securities have been part of the U.S. financial markets since the first issues by railroad companies in the 1860s. Historically, they have played a particularly important role in financing growth during economic expansions (Calamos, 1998). Today, convertibles represent a substantial source of financing for U.S. corporations. At the end of 1997, there were about 600 actively traded convertible bonds and preferreds with market value of about $130 billion (Noddings, et al., 1998). Essig (1992) reports convertible usage in about 31% of the companies included in COMPUSTAT database.

Call provisions are standard features in most convertible issues. By calling a convertible, a firm can induce either a conversion to common equity (conversion-forcing call) or redemption for cash, depending on the firm's stock price relative to the conversion price of the convertible at the time of the call. Several convertible issues were called before even one coupon payment in the early 1980s, hence most convertibles issued since that time include call protection that sets limits on when (and by what terms) the issuer can call the convertible. Call protection can either prohibit calling under any circumstances (hard call protection), or allow calling only when the value of the underlying stock exceeds certain levels relative to the conversion price (soft call protection). An example of the latter is Compaq Computer Corporation's 25-year convertible subordinated debenture that was issued in 1988 with three-year call protection. The issuer retained the right to call the bond early in case the company's stock price exceeded the conversion price by 50% during the call protection period.[1]

While call features of straight bonds have attracted some interest among financial economists, their role in convertible securities remains relatively unexplored. In this study, I use results from the literature on optimal timing of the firm's growth option to estimate the optimal time for the issuing firm to recontract by calling its convertible. Provided that firms use convertible financing to accommodate their sequential financing needs as suggested by Mayers (1998), optimal call protection is related to the optimal exercise time of the firm's growth options. Accordingly, firms with longer time until optimal exercise are expected to offer stronger or more valuable call protection.

Convertibles, due to their state contingent payoffs, are ideal vehicles for signaling, as pointed out by Brennan and Kraus (1987), Constantinides and Grundy (1989) and Chemmanur and Fulghieri (1997), among others. The theory of optimal timing of investment implies that expected growth and the variance of future cash flows are positively related to the length of delay (McDonald and Siegel, 1986). If information asymmetry concerning these implications exists, firms may use call protection terms in their convertible issues as signals of private information. Since both high growth and high variability of future cash flows would be viewed positively

[1] The conversion price of this issue was $65. Compaq called it during the soft call protection period in May 1990 when the company's common stock was selling at $112.

by stockholders, such information transmission would result in a positive relationship between call protection strength and the market reaction to financing announcements.

My sample includes 913 convertible bonds issued between 1981 and 1998. Out of these bonds, five percent offer no call protection, 39 percent have soft protection, 54 come with hard protection, and two percent are non-callable (absolute call protection). An ordered probit model with strength of call protection as the dependent variable provides support for a connection between the choice of call protection terms and optimal timing of the issuers' marginal investment. Estimation of a regression model, where a measure based on the expected maturity of each bond given their contract terms is used as the dependent variable, confirms this finding. I find no consistent evidence of information transmission through setting of call protection terms by the issuing firms.

This study makes several contributions to the literature. First, this is the first effort that I am aware of to make a connection between two prominent lines of literature, study of sequential investments and their financing, and theoretical work on the optimal time of exercise of the firm's growth options. Second, I identify and test a potential method for convertible issuers to signal the quality of their future prospects that has not been previously considered. Third, my data set spans nineteen years of varying market conditions and is quite large by the standards of previous empirical work in convertible securities. Finally, I provide extensive discussion on the role of factors other than optimal investment timing in affecting call provisions of convertible securities. My findings add to the literature on the role of call provisions in convertible issues.

1.2. Literature Review

1.2.1. Motives for issuing convertibles

The literature provides several motivations for issuance of convertible securities. First, hybrid securities such as convertibles can help decrease ex post risk-shifting problems (Green (1984), Mikkelson (1980)). Since the payoffs on a convertible contract depend on the firm's stock performance, they provide better incentive alignment among security holders than straight debt. The call option on the issuing firm's equity that is embedded in a convertible bond also offsets to some extent the short put option implicit in a risky bond, thus making the value of a convertible more robust to the risk (volatility) assessed by firms and investors (Brennan and Schwartz, 1988). Second, Stein (1992) suggests use of convertibles as backdoor equity. According to the backdoor equity theory, firms use the backdoor provided by convertibles to add the desired equity to their capital structures when adverse selection problems make common equity a prohibitively expensive source of financing for them. Finally, convertibles have been offered as an ideal vehicle for financing projects (or operations of companies) with sequential funding needs. The sequential financing motivation of convertible issuance suggests that due to agency costs between management and investors, financing is obtained gradually (Mayers, 1998, Schultz, 1993).[2,3] Eventual conversion of convertibles to equity restores some of the firm's

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[2] The use of convertibles in sequential financing can also be motivated by investors' limited ability to verify firm performance (see Cornelli and Yosha, 2000).

[3] Theoretical motivations for use of convertibles as a vehicle for raising venture capital build upon a similar setting (see e.g. Gompers, 1995, Sahlman, 1990).

borrowing capacity, and therefore a conversion-forcing call will be mounted at the point when the firm is ready to move to the next stage in its overall financing plan.

Mayers (1998) provides empirical evidence in support of the sequential financing motive among companies that call their convertible bonds. He reports high levels of capital expenditures and straight debt refinancing around the time that firms call convertibles. Affleck-Graves and Miller (1999) further support the sequential financing motive with evidence of long-run overperformance following calls of convertible debt. Consistent with Mayers, their finding suggests that firms mount a conversion-forcing call on their convertible securities when they are optimistic about the future.

In this study, I assume that sequential financing plays a role in motivating firms to issue convertibles. My tests of call protection terms are thus tests of joint hypotheses. The method used in this study provides an important extension in studying sequentiality of investments among convertible issuers. Unlike Mayers (1998) and Affleck-Graves and Miller (1999), whose findings are based only on firms that call their convertibles, I am able to consider the entire universe of convertible issuers at the time of issuance.[4] While determining motives for issuance of convertibles is beyond the scope of this study, the method I apply to determine optimal timing of the firm's next financing sequence opens a new avenue of evaluating validity of the sequential financing theory in cross-section of convertible issuers.

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[4] Studying only the calling firms may introduce a systematic selection bias. Bhabra and Patel (1996) find that at the time of issuance, firms that eventually call their convertibles are significantly different from the firms that do not.

1.2.2. Signaling with convertibles

A long line of literature considers security issues as signals of firm quality. Miller and Rock (1985) suggest that unanticipated net financing, regardless of the vehicle used, implies an expected cash flow shortage and therefore produces a negative stock price reaction. It has been widely documented that security choice affects the market's reaction to the financing announcement, suggesting that information transmitted through financing decisions varies among security types. Equity issues consistently result in more severe stock price reactions than debt announcements. As expected, previous studies have found a negative average stock price reaction to convertible financing announcements, of a magnitude between that of equity and debt announcements (e.g. Dann and Mikkelson (1984), and Mikkelson and Partch (1986)).

In Stein's (1992) backdoor equity model, a firm's choice of financing vehicle signals the firm quality. He predicts that medium quality firms choose convertible financing, while low quality firms issue equity and high quality firms issue straight debt. Lee (2000) develops a sequential signaling model that links the contract terms of a convertible to the call policy. He shows that convertibles deviate from conventional forms of financing only when their issuance is followed by a certain call policy. In his separating equilibrium, those firms whose existing assets have low productivity, and whose level of unsystematic risk is low, issue convertibles. Kim and Stulz (1992) consider information contained in international convertible issues offered by U.S. companies. They suggest that by their ability to issue abroad, the firms signal their quality.

Several signaling theories suggest ways for firms to signal their value among convertible issuers. Constantinides and Grundy (1989) consider covenants of convertible securities as signals conveying private information. They show how, compared to straight debt, convertible debt provides more feasible ways of signaling management's information through covenants. Chemmanur and Fulghieri (1997) focus on unit IPOs[5], but their findings can be applied to convertible offerings as well. They also suggest use of contract parameters and issuer characteristics such as conversion price and dilution as signals of quality of the issuing firm.

Brennan and Kraus (1987) and Kim (1990) show how the conversion ratio can be used as a signal of the quality of the firm's future prospects. Kim's model builds on the motive of insiders to reduce dilution when future prospects are good, whereas Brennan and Kraus (1987) motivate signaling based on a relationship between the riskiness of a firm's prospects and conversion premium of its convertible offerings. Kim and Stulz (1992) test the relationship between conversion premium and stock price reaction and find support for the Brennan and Kraus (1987) model among U.S. domestic issues. However, they also find a negative relationship between conversion premium and stock price reaction among convertible Eurobond issuers. Kim and Stulz view their findings as evidence of market segmentation.

Lewis, et al. (1998a) find evidence of an inverse relationship between the length of the call protection period and the quality of private information, and suggest that if call provisions are used for signaling purposes, growth opportunities are a significant source of the private information to be signaled. Abhyankar and Dunning

[5] Unit IPOs are packaged offerings where warrants are attached to shares of common stock.

(1999) find the time to first call to be positively related to announcement period abnormal returns among convertible issues in the U.K., which is inconsistent with Stein (1992). In Section 1.4., I will describe a way for companies to transmit private information through selection of call protection terms of convertibles.

1.2.3. Call protection and agency costs

Early studies on straight debt call provisions and their value propose uncertainty about future interest rates as the main reason why issuing firms retain the call option. However, Kraus (1973) shows that in an efficient capital market, interest rate uncertainty should not affect the firms' decisions on call provisions. Barnea, et al. (1980), Bodie and Taggart (1978), and Thatcher (1985) suggest reduction in agency costs between stockholders and bondholders as an alternative explanation for use of call provisions in straight debt. In the spirit of Myers (1977), shortened effective maturity of debt controls agency costs as the ability of the firm to call its debt prevents transfer of stockholder wealth to bondholders. Therefore, according to the agency cost argument, the optimal expiration date for the call privilege is related to the anticipated timing of future information releases.

Bodie and Taggart (1978) focus on future investment opportunities as a source of value for call provisions. They show formally how a firm with callable debt will accept a future investment that it would pass up if its debt were non-callable. Management will not exercise growth options in the absence of call provisions, since the shareholders will not gain from such action. The existence of call provisions allows management to adjust the debt contract to fairly compensate each security holder group, based on the realized state of the world. Bodie and Taggart also point out the role of default risk in making call provisions valuable for the investors. The exercise of growth options is more important to bondholders when the expected bankruptcy costs are high. Therefore, they suggest that high default risk would lead to weaker call protection. In a recent study, Mann and Powers (2000) provide support for this linkage between default risk and call provisions. They find that firms with low credit ratings issue bonds with weaker call protection.

Like Bodie and Taggart (1978), Crabbe and Helwege (1994) emphasize the recontracting feature provided by callability of a bond, which indirectly supports the use of callable bonds in sequential financing. They point out the empirical challenges in determining the time when management expects the information release that will allow them to recontract. Interestingly, their empirical evidence counters some of the earlier theoretical work. They fail to find a connection between issuance of callable debt and subsequent revelation of favorable information. Also, use of call provisions and investment activity are unrelated in their data set. Crabbe and Helwege suggest that the additional contracting costs of deviating from "standard" call provisions may keep the issuers from setting their call provisions optimally when those costs exceed the gains in reduction of agency costs.

It is questionable whether the agency cost motivations for use of call provisions apply to convertible securities. Kahan and Yermack (1998) suggest that the conversion feature alone provides the desired control for a firm suffering from high agency costs. Among convertible issues, they find very infrequent usage of covenants that are commonly used in straight debt issues to control agency costs of debt. While

Kahan and Yermack do not consider call provisions in their analysis, their findings support the idea that the conversion feature substitutes for other forms of agency cost control.

However, the evidence presented by McLaughlin, et al. (1998) contradicts Kahan and Yermack's substitution hypothesis. They observe the long-run operating performance of convertible debt issuers and find higher post-issue operating performance among firms whose convertibles are callable within 3 years of the issue. Their evidence thus suggests that shortened effective maturity provides an additional reduction in agency costs for convertible issuers.

Lewis, et al. (1998a) also consider the role of the length of the call protection period in controlling agency conflicts and information problems among convertible bond issuers. Their evidence supports the backdoor equity hypothesis, as they find length of call protection to be negatively related to both convertible investors' post-conversion equity share and the issuers' growth opportunities. Stein (1992), along with Thatcher's (1985) work on straight debt issues, would also suggest an inverse relationship between call protection and financial leverage of the issuer. For firms with high leverage, the agency costs of debt are magnified, calling for shorter effective debt maturity. However, Lewis, et al. (1998a) find financial leverage and length of call protection to be unrelated.

1.3. Optimal timing of investment options

Growth opportunities represent call options to the firm. As the value of those options change through time, firms can maximize the value of their growth opportunities by optimizing the timing of investment. McDonald and Siegel (1986) derive the optimal time for a firm to commence exercise of an investment option. Under certainty concerning the constant growth rate of the value of an investment opportunity,[6] the firm should undertake investment when the ratio of the present value of future cash flows from the investment over the investment outlay[7] equals

$$\frac{r}{r-g}, \tag{1.1}$$

where r represents the cost of capital (cost of waiting) and g denotes the growth rate in the value of the investment opportunity (benefit of waiting) (Moore, 2000). With value of future cash flows (V) growing in time, PVI_t of a project is given by

$$\frac{Ve^{gt}}{I}, \tag{1.2}$$

where V is the present value of the project and I is the required investment outlay. The net present value of the project assessed as of t = 0 is

$$NPV_0 = (Ve^{gt} - I)e^{-rt}. \tag{1.3}$$

It can be shown that NPV_0 is maximized when $PVI_t = r/(r-g)$. Figure 1.1. illustrates an example of how the optimal time to invest is determined with parameter values g = 0.04, r = 0.12, V = 120, and I = 100. Since the present value of this investment (V) is greater than the investment required (I), the simple NPV rule would indicate immediate investment. However, as Figure 1.1. shows, NPV of the project will increase until PVI_t equals 1.5, which is the value of r/(r-g) in this case. PVI_t of the

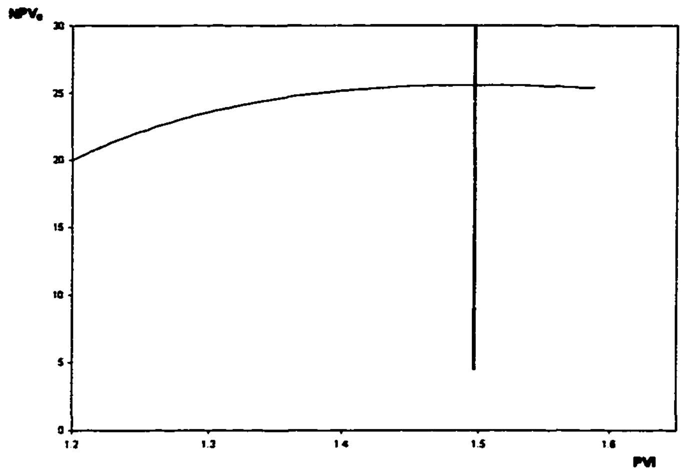
[6] This is a special case of the McDonald and Siegel (1986) model.

[7] Moore (2000) points out that this ratio V_t/I is equivalent to the present value index or profitability index in finance textbooks. I will hereafter denote it PVI_t.

project grows linearly in time as indicated by Equation (1.2), but the marginal cost of waiting will exceed the marginal benefit when $PVI_t > r/(r\text{-}g)$.

Figure 1.1.
Optimal investment timing as a function of PVI in deterministic case

$NPV_0 = (Ve^{gt} - I)\, e^{-rt}$ Parameter values used in this illustration are: g = 0.04, r = 0.12, V = 120, and I = 100



Maximizing NPV in Equation (1.3) with respect to t gives the optimal time to invest, t^* as follows:

$$t^* = \max\left\{\frac{1}{g}\ln\left[\frac{rI}{(r-g)V}\right], 0\right\} \tag{1.4}$$

Using the parameter values above, the optimal time to invest is approximately 5 years and 7 months.

Uncertainty about the growth in the future value of the project is introduced by McDonald and Siegel (1986) by allowing value (V) to follow geometric Brownian motion as given in equation (1.5):

$$\frac{dV}{V} = g\,dt + \sigma dz. \tag{1.5}$$

In equation (1.5), *dz* is an increment of a Wiener process, and σ represents the instantaneous standard deviation of the project value. If $\sigma = 0$ we obtain the deterministic case of equation (1.1). Equation (1.5) implies that the future value of the project at time *t* is lognormally distributed (Dixit and Pindyck, 1994). Current value of the project is known but future value is uncertain. While stochastic growth makes it impossible to solve for optimal time (t*) of investment, McDonald and Siegel (1986) show that under these conditions, the firm should delay investment until PVI_t equals the barrier C^*, such that

$$C^* = \frac{\varepsilon}{\varepsilon - 1}, \qquad (1.6)$$

$$\text{where } \varepsilon = \left(\frac{1}{2} - \frac{g}{\sigma^2}\right) + \sqrt{\left(\frac{g}{\sigma^2} - \frac{1}{2}\right)^2 + \frac{2r}{\sigma^2}}. \qquad (1.7)$$

The investment timing problem under uncertainty is analogous to the problem of optimal timing to exercise an American call option on a dividend-paying stock. Therefore, equation (1.7), and consequently equation (1.6) have comparative statics similar to those of financial call options. It is evident that both growth (g) and uncertainty (σ) increase the value of waiting. Dixit and Pindyck (1994) derive comparative statics for ε. From their results, the following results can be obtained for the PVI_t value that triggers investment (PVI_t*):

$$\frac{\partial PVI_t^*}{\partial \sigma} > 0 \qquad (1.8)$$

$$\frac{\partial PVI_t^*}{\partial r} < 0 \qquad (1.9)$$

$$\frac{\partial PVI_t^*}{\partial g} > 0. \qquad (1.10)$$

McDonald and Siegel (1986) point out that from a theoretical standpoint, comparative statics for the drift terms (r) and (g) alone are uninteresting, since the optimal investment timing for each project is determined by the difference between the two.[8] However, the comparative static results above are interesting when the model of optimal time to invest is considered in an empirical setting.

Calculation of the appropriate discount rate to be used in the model of optimal time to invest deserves some additional attention. Dixit and Pindyck (1994) obtain qualitatively identical results for the optimal timing rule both through dynamic programming and contingent claims analysis. Use of contingent claims analysis allows omission of risk preferences, and the discount rate is replaced by the risk-free rate in the model. However, contingent claims analysis can only be applied to situations where the capital markets are spanned to the extent that it is possible to construct a dynamic portfolio for which the value changes mirror those of the project under consideration. The assumption of spanning is less likely to hold for projects that involve unique business development efforts.

Assuming risk-averse investors, when the spanning assumption is not valid, investor risk aversion has to be considered. McDonald and Siegel (1986) motivate the use of the firm's opportunity cost of capital as the discount rate by assuming that projects are held by publicly owned corporations, and therefore investors are well diversified and only systematic risk of the project needs to be considered.

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[8] In Dixit and Pindyck's (1994) notation, the difference between the two drift terms is represented by δ.

The McDonald and Siegel (1986) model assumes constant interest rates and a flat yield curve. Ingersoll and Ross (1992) focus on the effects of interest rate uncertainty and the term structure on the optimal time to delay investment. In their model, the cash flows of the project are non-stochastic. They point out that when interest rates are expected to fall (rise), investment is expected to be delayed (accelerated). Ingersoll and Ross further derive comparative statics for their investment model. In their model, higher interest rates induce longer waiting time, since with high interest rates the firm is further away from the optimal interest rate level that triggers the investment. This result contrasts with the implications of the McDonald and Siegel (1986) model.

1.4. Connection between optimal investment and call protection

The method of maximizing the value of the investment opportunities presented in the previous section provides an opportunity to view the sequential financing proposition in a new light. Provided that firms are using convertibles to overcome such market imperfections that sequential financing can overcome, McDonald and Siegel's (1986) work allows consideration of the timing aspect of the call option on equity that is embedded in the convertible from the issuer's perspective. This may reduce the previous empirical problems in the call provision literature involved with estimating the desired time to recontract.

In presence of market imperfections such as information asymmetry, investors have preference for long call protection, ceteris paribus.[9] Management therefore has an incentive to provide as long a call protection period as possible. By providing stronger call protection, a firm can decrease its immediate financing costs. Under the assumption that firms use convertibles to finance sequential investments, firms want to force conversion when they are ready for their next investment sequence. For firms that expect to delay their investment for long periods, the cost of providing lengthy call protection is relatively low, since they can delay forcing conversion without destruction of value of their growth options due to sub-optimally long delay of investment. The upper limit of call protection length is affected by the model of optimal time to invest. As Figure 1.1. shows, delaying investment beyond the optimal time to invest destroys investment value. A firm with short time to optimal investment will therefore have an incentive to provide weaker call protection on its convertibles than a firm with long time until optimal growth option exercise.

The strength, and consequently the value of call protection can also be adjusted by the issuer through the design of the contract. As mentioned above, hard call protection does not allow for call under any circumstances until expiration of the protection period, while soft call protection dictates the terms under which firm can call the issue prior to the expiration of the protection period. When the optimal timing of investment varies among companies, the firms with longer optimal delays would be

[9] Ingersoll (1977) shows that a non-callable convertible is always more valuable than a callable convertible. Ramanlal, et al. (1996) show that with lengthening call protection, the value of a callable security approaches that of a non-callable security. Kish and Livingston (1993) provide evidence of an inverse relationship between the value of call feature and call protection length among straight bond issues.

expected to use stronger forms of call protection, since this feature is valued by investors while being a relatively low cost way of decreasing immediate financing costs for the issuer.

By observing the call provisions of convertible issues, the following hypothesis can be tested:

Hypothesis 1: *Convertible issuers with longer time until optimal exercise of future investment options provide stronger (more valuable) call protection.*

Given the comparative statics on C^*, one would expect the optimal time until exercise to be longer for firms whose investment options exhibit high growth rates and high volatilities. High cost of capital decreases the optimal waiting time. Ceteris paribus, we would also expect low current PVI to lead to a longer optimal waiting period since such projects are "further" from reaching the optimal PVI level (Moore, 2000).

Prior literature on convertible securities suggests several linkages between the growth rate in firm's investments and length of call protection periods. In contrast to the implications arising from the theory of optimal timing of future investments, Stein's (1992) backdoor equity framework predicts *short* call protection periods for firms with high growth rates. Firms that ultimately want equity in their capital structures issue convertibles due to current underpricing of their common stock. Firms that are more confident about the future would provide shorter call protection because in Stein's model the threat of bankruptcy motivates all firms to force conversion as quickly as possible. In support of Stein (1992), Lewis, et al. (1998a) find evidence of shorter call protection for firms with high market-to-book ratios.

Myers' (1977) underinvestment problems are more severe for firms with high-valued growth options. Green (1984) and Thatcher (1985) predict that firms with valuable growth options will control their underinvestment problems with shorter effective debt maturity. Therefore, a high growth rate would imply a short call protection period. Gompers (1995) finds both the market-to-book ratio and R&D intensity to be inversely related to funding duration among venture capital investments, suggesting that high growth induces firms to use shorter call protection.

Convertibles with strong call protection may provide better long-run incentive alignment since the debt-induced overinvestment control is guaranteed to exist for a longer period. However, growth options by themselves align management's incentives with those of the firm's security holders, and thus reduce agency costs.[10] Therefore, high-growth issuers may not need the added alignment effect of longer call protection.

Jung, Kim, and Stultz (1996) study the choice between straight debt and equity financing. While pointing out the importance of growth options in aligning management's incentives with those of investors, they claim that firms with high growth rates prefer equity financing to maintain flexibility and ability to exercise future growth options. Among convertible issuers, ones desiring more flexibility would provide less call protection. Kahan and Yermack (1998) also indicate the value of flexibility to high growth firms. Maintenance of flexibility provides yet another incentive for convertible issuers to shorten the call protection from the optimal value suggested by the theory of optimal investment timing.

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[10] Jensen (1986) gives oil industry as an example of a sector where stagnant growth may exacerbate free cash flow problems.

In contrast, Harris and Raviv (1985) predict a positive relationship between expected growth and call protection. They suggest that the ability to force conversion is less valuable to firms with high growth, since for such firms conversion is more likely to take place voluntarily. Providing call protection is less costly for them, and therefore the prediction is that higher (expected) growth leads to stronger call protection.

Thatcher (1985) motivates a positive relationship between agency costs of straight debt and financial risk that is explained by higher probability of bankruptcy of firms with high financial risk. Thatcher suggests shortened effective maturity as a method of controlling agency costs. Since she claims that both financial leverage and growth are positively related to agency problems, high expected stock volatility that typically follows from both also appears to imply short call protection.[11] Given her empirical implications, we may be able to observe indirect evidence of the efficiency of the conversion feature in alleviating the agency costs of debt. Evidence in support of Hypothesis 1 among convertible issuers would suggest that the conversion feature decreases the agency costs of debt to the level where the call provisions can be set to the optimal level with respect to the firm's investment schedule, with consideration for agency cost control being only secondary. This finding would support Green (1984) and Brennan and Schwartz (1988). It would also be consistent with Kahan and Yermack's (1998) findings of conversion feature substituting for other forms of agency cost control. Future research could strengthen this support if the role of call provisions

[11] Bodie and Taggart (1978) identify another motivation for firms with high leverage to offer short call protection. Short call protection makes a firm more likely to exercise its growth options. The increased likelihood of exercise is more important to bondholders when the firm is highly levered.

in straight callable debt was found to differ from that of call provisions in convertible bonds in this respect.

As mentioned above, Ingersoll and Ross (1992) study the effects of interest rate uncertainty and the term structure of interest rates on the optimal time to delay investment. Their work provides an interesting perspective on optimal call protection, given that the early studies motivating call provisions on straight bonds emphasized interest rate uncertainty. Ingersoll and Ross' findings suggest the need to control for the shape of the yield curve in my empirical model. Ingersoll and Ross also show that an increase in size of the project to be implemented will decrease the value of the growth option, ceteris paribus, which suggests that the relative issue size also needs to be controlled for when studying call provisions among convertible issuers.

1.4.1. Transferring private information through call feature design

Under information asymmetry, the theoretical framework discussed in the previous section may be used to evaluate the role of call protection as a signaling device. Assuming that it is economical for issuers to adjust the terms of convertible contracts to accommodate their anticipated sequential financing schedules, call provisions can provide a way for them to signal the values of their future prospects. In the context of McDonald and Siegel's (1986) predictions discussed above, two parameters that are most subject to information asymmetry are expected growth and expected variance of the firm's growth options. High expected growth and high future variance increase the optimal delay for the firm's investments. Therefore, when a convertible issuer provides strong call protection, the market can infer that the firm expects high growth and/or high variance. Firms with low expected growth and/or low future variance will find it uneconomical to mimic this signal since offering strong call protection will be costly for them. Both high growth and high variance increase the value of the firm's common stock. Therefore, if call protection is used to signal the nature of the firm's future prospects, one would expect a positive reaction in the issuer's common stock price at the announcement of convertible financing with strong call protection.

Hypothesis 2: *Convertible issuers who provide stronger (or more valuable) call protection experience less severe stock market reactions to the announcement of convertible financing than those issuers who provide weak call protection.*

Mitchell (1991) points out that information asymmetry can potentially lead to two very different covenant choices among bond issuers. Hypothesis 2 above builds upon the view that firms choose call protection terms to signal the true quality of their prospects, which will allow them to sell their convertible securities at a price that reflects that information. Alternatively, firms may choose call protection terms that allow them to rush recontracting once information becomes symmetric, consistent with Stein's (1992) backdoor equity hypothesis. Mitchell describes the latter as "The damage containment view". Potential dominance of the damage containment view as a response to information asymmetry among convertible issuers will lead to rejection of Hypothesis 2.

1.5. Data and Empirical Methods

Most of the issue-specific data used in this study come from Securities Data Corporation's (SDC) New Issues database. All together, SDC reports 4,262 convertible bond issues between 1981 and 1998. All issues with the following characteristics were excluded from the sample: (1) original maturity of two years or less, (2) variable coupon rate (including reset issues), (3) issues exchangeable or convertible to a security other than the issuing company's common stock, (4) issues that were combined with other types of securities, and (5) puttable securities.[12] Also, issues for which neither SDC, issuance announcements on Lexis-Nexis Academic Universe, SEC's Edgar database nor *Moody's* industrial manuals provide call protection terms were rejected. For the remaining sample, primary SIC codes were obtained from Standard & Poor's COMPUSTAT database. After elimination of issuers with primary SIC codes between 6000 and 7000 (financial institutions), the final sample consists of 913 convertible bond issues.

To proxy for growth of investment opportunity value following issuance, I calculate the issuer's one-year growth in market value of equity as reported by the Center for Research into Security Prices (CRSP). This is denoted by GROW. The standard deviation of the value of investment opportunity (SIGMA) is proxied by unlevered annualized standard deviation[13] of the daily common stock returns during the year following the issue. I proxy the value of growth options at issuance (Q) by:

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[12] However, issues containing either a put or a call feature conditional on a change of control event were retained.

[13] Calculated by multiplying common stock annualized standard deviation by 1/(1+Debt/Equity).

$$Q = \frac{ta - seq + pstk + cap}{ta}, \qquad (1.11)$$

where *ta* represents total assets, *seq* stands for book value of stockholders' equity, *pstk* measures book value of preferred stock, and *cap* represents the market value of common stock. All these values are measured at year-end preceding the issue. Finally, many of the issuers in the sample lack a sufficient history of stock returns to calculate the equity portion of the cost of capital reliably. Therefore, I use the CAPM-based weighted average cost of capital measure reported in Ibbotson Associates' *Cost of Capital Quarterly 1998 Yearbook*. This measure is industry-specific and it is calculated as a weighted average of equity capital, debt capital, and preferred stock capital, using the proportions of each financing source as weights. The cost of equity capital is measured using the CAPM. In the CAPM, Ibbotson Associates (1998) use the estimated expected equity risk premium of 7.8 percent and a risk-free rate of 6.01 percent to arrive at the 1998 equity cost estimates. The cost of debt is calculated in Ibbotson Associates (1998) by using the COMPUSTAT data on debt maturity for each company and using the yield information indicated by Moody's BIDSPLUS, depending on the debt rating of each firm (Ibbotson Associates, 1998). I arrive at my cost of capital proxy (WACC) by multiplying the 1998 cost for each issuer's industry (determined by their four digit SIC code) by the ratio of one-year T-bill rate in the month of the issue over the one-year T-bill rate at the end of 1998.[14]

Besides comparing descriptive statistics of the test variables among different call protection types, I test the relationship between call protection terms and optimal

[14] Ibbotson's WACC measure is only available from 1995 forward. Using a similar measure based on the industry cost of capital reported in different volumes of the book does not affect the findings.

investment timing with an ordered probit model with the type of call protection as the dependent variable. The dependent variable (PROT) represents a 4-part scale of call protection: no protection - soft protection - hard protection - no call provisions (= absolute call protection). To avoid problems caused by collinearity in the variables indicated by McDonald and Siegel (1986) as determinants of optimal time to invest, I use a composite empirical proxy for the optimal time to invest. The first choice for such variable would be C* defined in Equation (1.6). Unfortunately it is apparent from Equation (1.6) that C* becomes unstable when ε takes on values close to one. In my sample, the average ε-value is 24.735 with standard deviation of 54.377, which causes numerous observations to produce unreliable values for C*. Therefore, I choose to use EPSILON as the main test variable. EPSILON is measured as:

$$EPSILON = \left(\frac{1}{2} - \frac{GROW}{(sigma)^2}\right) + \sqrt{\left(\frac{GROW}{(sigma)^2} - \frac{1}{2}\right)^2 + \frac{2(WACC)}{(sigma)^2}} \quad (1.12)$$

EPSILON takes on extreme values for issuers who have very low unlevered volatility and extreme negative growth rates. A few observations in the sample exhibit such characteristics, where low unlevered volatility is explained by extreme leverage in the year preceding the issue, and high negative growth is explained by the company ending in or near bankruptcy during the issue year. To ensure that extreme values resulting from such observations do not bias the empirical analysis, firms within the top one percentile of EPSILON values are excluded from the analysis.[15]

[15] Excluding influential observations identified following the criteria by Besley, Kuh, and Welsch (1980) leads to practically identical results.

Issuer leverage in the year following issuance (LEV) is included in the analysis to control for agency cost of debt. Bodie and Taggart (1978) and Thatcher (1985) suggest that increasing agency cost of debt motivates weaker call protection. I also calculate the slope of the yield curve at issuance (CURVE) by dividing the 30-year T-bond yield in the issue month by the corresponding one-year T-bill rate. Ingersoll and Ross (1992) point out that the expected increase of short term rates, and therefore a steeper slope in the yield curve would motivate shorter optimal wait to invest. Ingersoll and Ross (1992) also indicate an inverse relationship between project size and optimal wait, which is why I control for the relative issue size (proceeds/total assets, PROCEED) in the empirical tests.

A large proportion of convertible bonds in the sample (16.5%) were first issued as private placements. An indicator variable PRIVATE for those issues controls for the possibility that call protection terms for those issues are set in a different manner. Such a difference could be motivated for example by lower levels of information asymmetry leading to a reduction in agency problems. The indicator variable FOREIGN controls for international issuers in the sample, whose choice of call protection terms may depend on their respective domestic institutional and legal frameworks. Furthermore, Kim and Stulz (1988, 1992) report self-selection among U.S. convertible issuers. Large and low-risk firms are more likely to issue offshore. The indicator variable EURO should capture effects of such differences on call protection terms.

In the presence of transaction costs, short time to maturity should decrease the likelihood of an early call by the issuer, and therefore could be viewed as implicit call protection. The variable MAT is calculated as the natural logarithm of the original time to maturity in years. Finally, to account for the structural shift in the structure of call provisions that occurred in late 1980s (see Table 1.3. below), I use the indicator variable BF88 that takes on value of one for all issues that were issued in years 1981-1987, and zero otherwise.

The qualitative dependent variable described above may inadequately represent the strength of the call protection of a convertible issue. For example, ten-year soft call protection with 150% strike price will provide much stronger protection than two-year hard call protection if the likelihood that the firm's stock price will increase sufficiently is low. Furthermore, the issuing firm can also adjust the likelihood that it ends up calling its convertible through several other forms of "virtual call protection", such as call prices and conversion premium. The ultimate measure of strength of call protection in a convertible issue should assess the value of call protection terms of each convertible as a component of the total value of each bond. However, the "virtual call protection" makes systematic valuation of call protection terms challenging.

Binomial models provide a method to value contingent claims. Ho and Lee (1986), and Black, et al. (1990) among others explore valuation methods for interest rate contingent claims that are based on an interest rate tree that models the future interest rate distribution. Practical applicability of the tree-based approach to convertible security valuation has been limited in the past due to complexity of these securities. Since convertible value is contingent on both interest rates and the value of the underlying stock, two inter-dependent tree structures are needed.[16] In recent years,

[16] Nelken (1997) refers to this as quadro-tree approach.

advances in computer technology have allowed development of software products that employ such tree structures in estimating values of convertible securities.

I use one such product, called *ConvB++*, developed by Supercomputing Consultants, Inc., to price each convertible in the sample both under their actual protection terms and under the assumption that each bond is only callable at maturity at par (i.e. absolute call protection). *ConvB++* gives not only the price of each bond, but also its expected life given the contract terms, interest rates, and the stock market environment at the time the bond is priced. I obtain the expected maturity of each bond under actual protection and absolute protection. The ratio between the two (MATMEAS) is then used as a measure of the strength of the call protection terms. This ratio will vary between the minimum of zero in case the actual protection terms will lead to immediate call (or voluntary conversion), and one in case the actual terms provide absolute call protection. Using the case of absolute call protection as a reference point gives a clean and easy-to-define measure across the sample, unlike the no protection case, which is complicated by "virtual call protection".

1.6. Results

Table 1.1. shows descriptive statistics for issues and issuers by issue year. Most notably, convertible issues have increased in size over the years, while their original maturity has markedly decreased. Table 1.2. reports the same descriptive statistics by different call protection types. It appears that larger issuers tend to provide stronger call protection terms. Assuming that large issuers are more established firms with more developed corporate governance, this is consistent with the agency cost

explanation of call provisions. Consistent with the connection between optimal investment timing and call protection proposed in this essay, issuers with higher growth rates, higher volatilities, and lower costs of capital seem to offer stronger call protection.[17] Finally, Table 1.3. shows the breakdown among the call protection types by the issue year. It is evident from Table 1.3. that a structural shift occurred in convertible issues in the late 1980s. While the overall popularity of convertibles decreased significantly in 1988, the most popular call protection type shifted from soft to hard protection.

[17] Differences in means of these variables between the two most frequent call protection types, hard protection and soft protection, are statistically significant at the five percent level.

Table 1.1.
Comparison of Means (and Medians) of convertible issue and issuer characteristics during the period 1981-1998 by issue year

	N	Total Assets	Original Maturity	Proceeds	Leverage	Equity Growth	Unlev. Std. Dev.	q	WACC
1981	49	968.7	21.4	56.1	0.357	-0.082	0.309	2.201	35.939
		(215.7)	(20.0)	(35.0)	(0.319)	(-0.183)	(0.296)	(1.636)	(36.027)
1982	50	1046.2	21.0	45.0	0.395	0.937	0.289	1.903	28.259
		(207.9)	(20.0)	(27.5)	(0.400)	(0.476)	(0.278)	(1.479)	(26.235)
1983	63	771.8	20.6	58.4	0.406	-0.122	0.303	2.078	23.839
		(246.6)	(20.0)	(39.8)	(0.394)	(-0.117)	(0.262)	(1.492)	(23.936)
1984	33	1532.2	21.5	70.4	0.385	0.181	0.257	1.789	27.163
		(274.5)	(25.0)	(50.0)	(0.375)	(0.163)	(0.217)	(1.403)	(27.202)
1985	85	509.3	20.6	46.4	0.394	0.205	0.289	1.916	22.209
		(215.2)	(20.0)	(35.0)	(0.396)	(0.129)	(0.256)	(1.655)	(21.857)
1986	123	427.0	21.2	46.8	0.434	0.198	0.342	2.848	16.917
		(169.7)	(25.0)	(32.5)	(0.426)	(0.124)	(0.301)	(1.777)	(16.615)
1987	118	1340.7	20.6	81.6	0.386	-0.097	0.456	2.320	17.002
		(276.2)	(25.0)	(60.0)	(0.363)	(-0.169)	(0.427)	(1.700)	(17.043)
1988	16	1146.6	21.8	89.8	0.368	0.119	0.280	2.421	19.625
		(478.8)	(25.0)	(75.0)	(0.378)	(0.034)	(0.238)	(1.313)	(19.951)
1989	37	817.1	21.5	75.8	0.356	0.067	0.348	2.074	21.527
		(295.8)	(25.0)	(50.0)	(0.340)	(0.073)	(0.329)	(1.646)	(20.125)
1990	14	539.0	17.5	72.9	0.415	0.214	0.312	2.356	20.421
		(404.3)	(17.5)	(60.0)	(0.343)	(0.078)	(0.307)	(1.641)	(18.898)
1991	35	1922.3	12.0	92.6	0.340	0.132	0.293	2.582	15.880
		(739.1)	(10.0)	(100.0)	(0.294)	(0.037)	(0.298)	(1.813)	(15.968)
1992	46	930.3	9.8	104.5	0.375	0.209	0.330	2.180	10.404
		(391.7)	(10.0)	(66.0)	(0.375)	(0.199)	(0.307)	(1.676)	(9.909)
1993	56	1092.0	9.2	92.2	0.387	0.276	0.348	2.701	9.331
		(259.0)	(10.0)	(60.0)	(0.365)	(0.146)	(0.342)	(2.103)	(9.354)
1994	21	3354.4	8.5	110.5	0.363	0.211	0.363	2.448	12.213
		(427.0)	(9.8)	(90.0)	(0.398)	(-0.120)	(0.304)	(1.881)	(11.266)
1995	29	2579.1	7.6	131.6	0.364	0.447	0.471	4.000	16.024
		(468.2)	(7.0)	(100.0)	(0.407)	(0.161)	(0.502)	(2.583)	(16.294)
1996	43	1053.2	7.7	131.2	0.389	0.274	0.432	2.865	14.771
		(479.2)	(7.0)	(85.0)	(0.385)	(0.132)	(0.420)	(2.470)	(15.013)
1997	61	902.6	6.9	141.8	0.370	-0.064	0.591	3.804	15.466
		(335.3)	(7.0)	(100.0)	(0.388)	(-0.249)	(0.597)	(2.350)	(15.140)
1998	34	1351.4	9.1	197.8	0.467	0.071	0.634	4.343	15.223
		(551.3)	(7.0)	(152.5)	(0.419)	(-0.148)	(0.614)	(3.144)	(15.976)
Overall	913	1238.0	15.5	91.4	0.386	0.176	0.369	2.602	19.012
		(288.9)	(19.9)	(54.0)	(0.381)	(0.018)	(0.335)	(1.824)	(17.483)

Total Assets = Total Assets in Millions in the year preceding the issue, as reported by COMPUSTAT. Original Maturity = Time in years from issue date to the maturity date, as reported by SDC. Proceeds = Proceeds in Millions of $, as reported by COMPUSTAT. Leverage = Total Debt/Total Assets in the year preceding the issue, as reported by COMPUSTAT. Equity Growth = Growth in market capitalization of issuer stock from the issue date to one year from the issue date, as reported by CRSP. Unlevered Standard Deviation = annualized standard deviation of issuing companies' daily common stock returns multiplied by 1/(1+Debt/Equity), where stock returns are obtained from CRSP, while the accounting variables used to account for issuer leverage come from COMPUSTAT. Q = total assets - book value of equity + book value of preferred stock + market capitalization divided by total assets, where data on market capitalization are obtained from CRSP, while all other data come from COMPUSTAT. Each variable is measured at the accounting year-end preceding the issue. WACC = CAPM-based weighted average cost of capital measure reported in Ibbotson Associates' Cost of Capital Quarterly 1998 Yearbook multiplied by the ratio of one-year T-bill rate in the month of the issue over the one-year T-bill rate at the end of 1998.

Table 1.2.

Comparison of Means (and Medians) of convertible issue and issuer characteristics during the period 1981-1998 by call protection type

	Non-Callable	Hard Call Protection	Soft Call Protection	No Call Protection
N	15	492	350	47
Total Assets	2447.7	1262.2	786.3	765.9
	(420.0)	(389.2)	(217.5)	(222.9)
Original Maturity	7.8	13.6	20.5	21.1
	(7.0)	(10.0)	(20.0)	(25.0)
Proceeds	66.4	102.4	63.1	47.8
	(55.0)	(75.0)	(40.0)	(35.0)
Leverage	0.372	0.385	0.400	0.380
	(0.371)	(0.375)	(0.393)	(0.338)
Equity Growth	0.318	0.2	0.114	-0.154
	(0.254)	(0.037)	(0.014)	(-0.204)
Unlevered σ	0.272	0.396	0.362	0.298
	(0.200)	(0.346)	(0.326)	(0.282)
Q	2.062	2.777	2.399	1.986
	(1.875)	(1.865)	(1.781)	(1.795)
WACC	17.925	17.151	20.063	30.366
	(16.496)	(16.142)	(19.291)	(31.771)

Total Assets = Total Assets in Millions in the year preceding the issue, as reported by COMPUSTAT. Original Maturity = Time in years from issue date to the maturity date, as reported by SDC. Proceeds = Proceeds in Millions of $, as reported by COMPUSTAT. Leverage = Total Debt/Total Assets in the year preceding the issue, as reported by COMPUSTAT. Equity Growth = Growth in market capitalization of issuer stock from the issue date to one year from the issue date, as reported by CRSP. Unlevered σ = annualized standard deviation of issuing companies' daily common stock returns multiplied by 1/(1+Debt/Equity), where stock returns are obtained from CRSP, while the accounting variables used to account for issuer leverage come from COMPUSTAT. Q = total assets - book value of equity + book value of preferred stock + market capitalization divided by total assets, where data on market capitalization are obtained from CRSP, while all other data come from COMPUSTAT. Each variable is measured at the accounting year-end preceding the issue. WACC = CAPM-based weighted average cost of capital measure reported in Ibbotson Associates' Cost of Capital Quarterly 1998 Yearbook multiplied by the ratio of one-year T-bill rate in the month of the issue over the one-year T-bill rate at the end of 1998.

Table 1.3.
Distribution of convertible bond issues during the period 1981-1998 by call protection type and by issue year

	No Protection	Soft Protection	Hard Protection	Non-callable	Total
1981	26	2	21	0	49
1982	1	15	34	0	50
1983	2	36	23	1	62
1984	5	20	6	1	32
1985	1	60	23	1	85
1986	6	101	14	0	121
1987	3	78	33	0	114
1988	0	7	8	1	16
1989	1	11	25	0	37
1990	0	3	10	1	14
1991	1	3	28	3	35
1992	0	2	42	2	46
1993	0	2	53	0	55
1994	0	2	18	1	21
1995	1	2	26	0	29
1996	0	4	35	4	43
1997	0	2	59	0	61
1998	0	0	34	0	34
Total	47	350	492	15	904

Bonds with Soft Protection have a call protection period during which the bonds are callable if the issuer's stock price exceeds a certain pre-determined level relative to the conversion price. Hard Protection does not allow the issuer to call the issue under any circumstances. Bonds with initial period of hard protection that is followed by soft protection are classified as having hard call protection.

Ordered probit results are reported in Table 1.4. Standard errors used to calculate the t-statistics (in parentheses) are calculated using the method by Berndt, Hall, Hall, and Hausman (1974) to account for heteroskedasticity. The full model in column (a) is specified as follows:

$$PROT_i = \alpha_i + \beta_1 EPSILON_i + \beta_2 q_i + \beta_3 LEV_i + \beta_4 CURVE_i + \beta_5 PROCEED_i + \beta_6 PRIVATE_i + \beta_7 FOREIGN_i + \beta_8 MAT_i + \beta_9 EURO_I + \beta_{10} BF88_I + \varepsilon_i \quad (1.13)$$

In support of the connection between optimal investment timing and selection of call protection type, EPSILON is negative and highly significant with a t-statistic of -2.595. When EPSILON is replaced by the proxies used to calculate the variable in column (b), both growth (GROW) and cost of capital (WACC) variables have expected signs, significant at .03 level or better, while the proxy for variability in project value (SIGMA) is statistically insignificant.

Table 1.4.
Determinants of call protection strength

The table provides ordered probit estimates.The dependent variable is a 4-part scale of call protection: no protection - soft protection - hard protection - absolute call protection. EPSILON is a measure related to the optimal investment timing suggested by McDonald and Siegel (1986), Q is a proxy of issuer's market value over book value, calculated at the year-end preceding the issue. LEV is the leverage of the issuer at the accounting year-end following the issue. CURVE is the ratio of 30-year T-bond yield over one-year T-bill yield in issue month. PROCEED is the issue proceeds divided by total assets of the issuer. PRIVATE is an indicator variable that takes value of one for private placement issues, zero otherwise. FOREIGN is an indicator variable with value of one for international issuers, zero otherwise. MAT is the natural logarithm of time to maturity in years. EURO is an indicator variable with value of one for U.S. firms' issues overseas, zero otherwise. BF88 equals one for issues between 1981 and 1987, zero Otherwise. EPSRF is similar to EPSILON, except that it uses risk-free rate as a discount rate. In Panel B, column (c) includes only bonds with larger than medium proceeds, and column (d) includes bonds with smaller than medium proceeds. T-statistics that are reported in parantheses are calculated using heteroskedasticity-consistent standard errors.

Panel A	(a)	(b)	(c)	(d)	(e)	(f)
C	3.758***	4.204***	4.440***	2.046***	2.132***	5.952***
	(6.602)	(6.244)	(8.265)	(6.096)	(6.890)	(17.572)
EPSILON	-0.008***		-0.008***	-0.008***	-0.007***	-0.009***
	(-2.595)		(-2.581)	(-2.620)	(-2.320)	(-3.378)
GROW		0.198***				
		(2.564)				
WACC		-0.016**				
		(-2.222)				
SIGMA		-0.082				
		(-0.252)				
Q	0.009	0.018	0.019	-0.015		
	(0.373)	(0.687)	(0.742)	(-0.710)		
LEV	0.287	-0.012	-0.030	0.340		
	(0.947)	(-0.040)	(-0.096)	(1.226)		
CURVE	0.695***	0.502*	0.887***	0.742***	0.709***	
	(2.923)	(1.756)	(3.878)	(3.182)	(3.214)	
PROCEED	-1.108***	-0.915***	-1.275***			-0.834***
	(-3.528)	(-2.845)	(-4.200)			(-4.541)
PRIVATE	0.104	0.135	0.234			0.141
	(0.634)	(0.807)	(1.473)			(0.896)
FOREIGN	-0.097	-0.105	-0.203			-0.077
	(-0.328)	(-0.348)	(-0.796)			(-0.308)
MAT	-0.591***	-0.599***	-1.191***			-1.330***
	(-4.246)	(-4.301)	(-9.870)			(-12.446)
EURO	-0.191	-0.155	-0.387***			-0.441
	(-1.314)	(-1.074)	(-2.857)			(-3.359)
BF88	-1.168***	-1.102***		-1.539***	-1.522***	
	(-10.718)	(-9.193)		(-15.748)	(-15.662)	
Scaled R^2	0.397	0.401	0.312	0.363	0.358	0.282
N	871	866	871	871	879	879

*** indicates statistical significance at one-percent level, ** indicates statistical significance at five percent level, and * indicates statistical significance at ten percent level.

Table 1.4. - continued
Determinants of call protection strength

Panel B	(a)	(b)	(c)
C	3.552***	4.190***	3.016***
	(6.266)	(4.919)	(3.098)
EPSILON		-0.012**	-0.007*
		(-2.128)	(-1.784)
EPSRF	-0.015***		
	(-3.533)		
Q	0.011	-0.035	0.036
	(0.457)	(-0.650)	(0.967)
LEV	0.197	0.526	0.358
	(0.683)	(0.998)	(0.829)
CURVE	0.759***	1.056***	0.497
	(3.213)	(2.768)	(1.278)
PROCEED	-0.987***	-1.334**	-0.994**
	(-3.154)	(-2.119)	(-2.239)
PRIVATE	0.145	0.018	0.137
	(0.878)	(0.055)	(0.553)
FOREIGN	-0.104	-0.37	0.058
	(-0.344)	(-0.961)	(0.106)
MAT	-0.589***	-0.726***	-0.425*
	(-4.221)	(-2.858)	(-1.941)
EURO	-0.166	-0.238	-0.182
	(-1.140)	(-1.113)	(-0.659)
BF88	-1.177***	-1.476***	-0.813***
	(-10.822)	(-6.380)	(-5.373)
Scaled R^2	0.398	0.501	0.203
N	872	444	427

*** indicates statistical significance at one-percent level, ** indicates statistical significance at five percent level, and * indicates statistical significance at ten percent level.

The optimal timing theory appears to dominate the effects of both the backdoor equity theory and the agency cost theory as a determinant of firms' protection type choice since both of those theories predict an inverse relationship between strength of call protection and growth. Also, while the finding of issuers with high cost of capital providing weaker call protection is consistent with the McDonald and Siegel (1986) model, it is not consistent with the Ingersoll and Ross (1992) model of optimal investment timing.

Interestingly, the yield curve variable (CURVE) is positive and statistically significant at the .01 level. Ingersoll and Ross (1992) suggest a shorter optimal wait when the yield curve has a steep upward slope. Therefore, assuming that convertibles are issued for sequential financing purposes, we would expect to observe *weaker* call protection at times when the yield curve is steeper. A positive relationship between call protection strength and yield curve slope may be explained by issuers' expectations of rate increases when the yield curve is upward sloping. In such an environment, issuers may be less concerned about their ability to call their convertibles and therefore offer stronger call protection than what would be suggested by the theory of optimal timing.

Both time to maturity (MAT) and relative size of the issue (PROCEED) enter the ordered probit model with negative and significant coefficient estimates. Evidence of large issues offering weaker call protection is consistent with the agency cost motivation of call provisions. A negative coefficient for time to maturity may also be explained by longer time to maturity leading to higher agency costs of debt. The negative sign on MAT contradicts the idea that short maturity works as implicit call protection. Finally, as earlier analysis suggested, the convertibles issued prior to 1988 (BF88) have weaker call protection terms.

Columns (c) through (f) in Panel A of Table 1.4. test the robustness of the findings reported in column (a) by leaving various control variables out of the model. First, excluding the indicator variable for bonds issued prior to 1988 in column (c) has no effect on the estimated coefficient of EPSILON. The dummy for Eurodollar issues (EURO) appears to capture some of the time effect. The scaled R^2 of the model decreases as expected, given tendency of indicator variables capturing structural shifts to generate high R^2s (Kennedy, 1998). The model in column (c) still explains over 31% of issuers' call protection type choice. In column (d) all issue-specific control variables are removed from the model. This has a surprisingly small effect on the explanatory power of the model, and again leaves all findings intact when compared to column (a). Leaving out both issue and issuer specific control variables in column (e) gives further support for most of the explanatory power in the full model coming from the test variable EPSILON and the market-environment variables CURVE and BF88. However, using only issue specific control variables in column (f) still explains over 28% of the choice of call protection type with all the coefficients being consistent with column (a).

Dixit and Pindyck (1994) show how the optimal investment timing model can be obtained both through dynamic programming and through contingent claims analysis. The only difference between the results of the two methods is that the latter uses the risk free rate instead of the issuer cost of capital. In column (a) of Panel B in Table 1.4., I report the results of the full model ordered probit specification, where 30-year Treasury yield in the month of issuance is used in place of WACC in Equation (1.12) to estimate EPSILON. The resulting variable is called EPSRF. The results are very similar to those reported in Panel A with the investment timing proxy only gaining statistical significance.

To explore the possibility that size of the issue affects the connection between call protection strength and optional investment timing, I next re-estimate the full model in two sub-samples divided by the size of the issue. These results are also reported in Panel B of Table 1.4. Column (b) analyzes the sub-sample with larger than median proceeds, and column (c) reports the results in the small proceeds sub-sample. Again, the findings in both sub-samples are practically identical to those reported earlier. In the small issue sub-sample, the model loses quite a bit of its explanatory power, and evidence based on the coefficient estimates is also statistically weaker, which may be caused by more "noise" in this sub-sample.

Greene (1997) cautions against interpreting the magnitude of coefficients estimated using ordered probit. To obtain a more meaningful measure of the effect that each regressor has on the dependent variable, he suggests calculating the marginal effects of changes in the regressors, as follows

$$\begin{aligned}
\frac{\partial P[y=0]}{\partial x} &= -\phi(\beta' x)\beta \\
\frac{\partial P[y=1]}{\partial x} &= [\phi(-\beta' x)-\phi(\mu_1-\beta' x)]\beta \\
\frac{\partial P[y=2]}{\partial x} &= [\phi(\mu_2-\beta' x)-\phi(\mu_1-\beta' x)](-\beta), \\
\frac{\partial P[y=3]}{\partial x} &= -\phi(\mu_2-\beta' x)\beta
\end{aligned} \tag{1.14}$$

where P[.] stands for the probability of each outcome of the dependent variable, μ_1 and μ_2 represent the values of the threshold parameters estimated by the model, and ϕ is the standard normal density. Calculating the marginal effect of EPSILON on the choice of protection type in the full model [Panel A, column (a)] this way indicates that it has a .0003 effect on no protection choice, .0028 effect on soft protection choice, -.003 effect on hard protection choice, and -.000 effect on absolute protection choice. The probability of weaker protection types, soft protection in particular, increases with EPSILON, and stronger protection types become less likely choices when EPSILON increases. While the effect of EPSILON on protection choice is small in magnitude, it is consistent as evidenced by t-statistics of the ordered probit coefficients.

Most of the findings based on the ordered probit model remain intact in the alternative tests with an OLS model in Table 1.5. The dependent variable in column (a) is MATMEAS that proxies for call protection strength by dividing the expected maturity of each bond under actual protection terms over the expected maturity under absolute call protection. Both values are obtained using *ConvB++* convertible valuation software. While the coefficient of the variable EPSILON is small in column (a), it provides statistically even stronger evidence than in the ordered probit estimation with a t-statistic of -4.315. Independent variable Q enters the OLS model with the expected negative sign, but the coefficient is not statistically significant. In contrast to the ordered probit evidence, high issuer leverage (LEV) seems to be connected with stronger call protection. This finding is difficult to explain in light of existing literature. Agency cost explanations of call provisions predict an inverse relationship between leverage and call protection. Also, unlike in ordered probit model, the relative issue size (PROCEED) does not affect the strength of call protection terms according to the OLS specification.

For a few of the sample bonds, none of the data sources used (SDC, *Moody's*, *Lexis-Nexis*, *Edgar*) include the call price schedule. When pricing the bonds using *ConvB++* software, I assumed that those bonds were callable at par at their respective first call dates. To ensure that this assumption did not cause a systematic bias in the results reported in column (a), I re-estimate the OLS model in a sub-sample of bonds for which all call terms were available. As column (b) of Table 1.5. shows, the test variable EPSILON actually gains statistical significant in this sub-sample, when compared to the full sample.

Table 1.5.
Alternative tests of determinants of call protection strength

The table reports ordinary least squares estimates.The dependent variable in columns (a) and (b) is the ratio of expected maturity of a bond given actual call protection terms over the expected maturity of the bond given absolute call protection. The dependent variable in column (c) is the ratio of the bond price given actual protection minus the bond price given no protection divided by the bond price given actual Protection minus the bond price given absolute protection. Values for both dependent variables are obtained using *ConvB++* software. Column (b) analyzes only those bonds for which complete information on call schedules and protection terms is available. EPSILON is a measure related to the optimal investment timing suggested by McDonald and Siegel (1986). Q is a proxy of issuer's market value over book value, calculated at the year-end preceding the issue. LEV is the leverage of the issuer at the accounting year-end following the issue. CURVE is the ratio of 30-year T-bond yield over one-year T-bill yield in issue month. PROCEED is the issue proceeds divided by total assets of the issuer. PRIVATE is an indicator variable that takes value of one for private placement issues, zero otherwise. FOREIGN is an indicator variable with value of one for international issuers, zero otherwise. MAT is the natural logarithm of time to maturity in years. EURO is an indicator variable with value of one for U.S. firms' issues overseas, zero otherwise. BF88 equals one for issues between 1981 and 1987, zero otherwise. T-statistics that are reported in parantheses are calculated using White standard errors.

	(a)	(b)	(c)
C	1.251***	1.219***	1.086***
	(20.136)	(18.744)	(12.866)
EPSILON	-0.001***	-0.001***	-0.002***
	(-4.315)	(-4.629)	(-2.974)
Q	-0.002	0.000	-0.005
	(-0.594)	(0.016)	(-1.458)
LEV	0.100***	0.082***	0.175***
	(3.413)	(2.763)	(4.029)
CURVE	0.066***	0.073***	0.072***
	(4.091)	(4.445)	(3.167)
PROCEED	-0.006	-0.013	0.053
	(-0.187)	(-0.425)	(1.213)
PRIVATE	0.008	0.020	0.032
	(0.457)	(0.976)	(1.017)
FOREIGN	0.017	-0.035	0.165***
	(0.330)	(-0.607)	(2.462)
MAT	-0.295***	-0.286***	-0.269***
	(-15.478)	(-14.413)	(-10.815)
EURO	0.028	0.013	-0.018
	(1.501)	(0.664)	(-0.744)
BF88	-0.094***	-0.091***	-0.091***
	(-5.633)	(-5.301)	(-4.753)
Adjusted R^2	0.764	0.765	0.619
N	826	781	783

*** indicates statistical significance at one-percent level, ** indicates statistical significance at five percent level, and * indicates statistical significance at ten percent level.

To verify that my OLS findings are not due to the particular way I measure the dependent variable, I next make an effort to account for "virtual call protection". I calculate an alternative measure of call protection strength by re-evaluating each bond as if it were callable at par immediately following issuance. My alternative dependent variable is defined as:

$$PROTVAL = \frac{(BP|\text{actual protection}) - (BP|\text{no protection})}{(BP|\text{absolute protection}) - (BP|\text{no protection})}, \quad (1.15)$$

where BP stands for the theoretical bond price indicated by *ConvB++*. Results in the full sample using PROTVAL as the dependent variable are reported in column (c) of Table 1.5. The results are practically identical to those reported in Table 1.4., with the exception of foreign issuers providing stronger call protection according to this specification.

Taken together, the multiple regression results confirm that while the effect of optimal timing on call protection terms is small in magnitude, consistent evidence of such a relationship exists. Interestingly, while both Stein's (1992) backdoor equity theory and the agency cost arguments by Green (1984) and Thatcher (1985) among others suggest an inverse relationship between growth and call protection strength, the coefficient on GROW is never negative in regressions where individual components of the optimal investment timing are used as independent variables (results on sub-samples not reported). In support of the hypothesis that conversion feature aligns the motives of management and bondholders, my evidence suggests that the conversion feature controls agency costs to the point where the issuers are able to set their call protection terms to match their investment schemes. Investigating this relationship among straight debt issuers is an interesting topic of future research.

1.7. Stock market reaction to financing announcements

To judge whether the stock market reaction to convertible issues varies by call protection terms, I estimate the cumulative abnormal announcement period stock return for each issuer by using market model, (-250, -10) estimation period, and (-1,0) event window. In cross sectional analysis of the announcement period returns, I control for the effects of issuer leverage (LEV), shape of the yield curve (CURVE), relative size of the issue (PROCEED), original maturity of the bond (MAT), and whether the bond was issued as a private placement (PRIVATE), by a non-U.S. issuer (FOREIGN), by a U.S. issuer outside the U.S. (EURO), or before 1988 (BF88). If firms transmit private information through call protection setting, the market response will vary by the type of call protection offered.

Original financing announcement dates are obtained from *Lexis-Nexis*. For convertible bonds whose financing announcements can not be found on *Lexis-Nexis*, I use the filing date reported by the *SDC's New Issues* database. I account for event-induced variance by calculating the standard deviations using the procedure by Boehmer, Musumeci, and Poulsen (1991).

The results of the event study are reported in Table 1.6. Overall, consistent with prior literature, I observe a negative average announcement period return of about 1.3%. Results in Panel A, column (a) of Table 1.6. suggest that the call protection terms offered by convertible issuers do not affect the market's valuation of the firm. I therefore fail to reject Hypothesis 2. This "non-finding" is also inconsistent with empirical evidence reported by Lewis, et al. (1998a), who find an inverse relationship between call protection strength (measured by time to first call) and stock reaction, and view their finding as supportive of Stein's (1992) backdoor equity hypothesis. Out of the control variables, only the indicator variable for bonds issued before 1988 (BF88) affects the stock market reaction. The explanatory power of the model is very low.

Including Q as an additional control variable in the analysis [column (b)], does not affect any of the coefficients reported in column (a). However, Q itself enters the regression with a positive and significant coefficient estimate, which is consistent with financing announcements of firms with good prospects experiencing more favorable market reactions. When I include a conversion premium measure (PREM) in the regression to capture the signal suggested by Brennan and Kraus (1987) and Kim and Stulz (1992) [column (c)], coefficients on both PROT and Q gain magnitude and statistical significance, with PROT now being marginally significant. In contrast to findings by Kim and Stulz (1992), the conversion premium is insignificant in a specification with or without PROT and Q, and in sub-samples with Eurobonds and non-Eurobonds (results not reported).

Table 1.6.

Analysis of abnormal returns associated with 904 announcements of convertible bond financings during the period of 1981-1998

Abnormal returns are calculated using market model, and account for event-induced variance as in Bohmer, et al. (1991). The Dependent variable in all columns of Panel A is the CAR during (-1,0) event window. The dependent variable in column (d) is the abnormal return on day -1, and the dependent variable in column (e) is the abnormal return on the event day. MATMEAS is the ratio of expected maturity of a bond given actual call protection terms over the expected maturity of the bond given absolute call protection. Both values are obtained using ConvB+ software. Q is a proxy of issuer's market value over book value, calculated at the year-end preceding the issue. LEV is the leverage of the issuer at the accounting year-end following the issue. CURVE is the ratio of 30-year T-bond yield over one-year T-bill yield in issue month. PROCEED is the issue proceeds divided by total assets of the issuer. PRIVATE is an indicator variable that takes value of one for private placement issues, zero otherwise. FOREIGN is an indicator variable with value of one for international issuers, zero otherwise. MAT is the natural logarithm of time to maturity in years. EURO is an indicator variable with value of one for U.S. firms' issues overseas, zero otherwise. PREM is conversion premium of the issue. BEFOR88 equals one for issues between 1981 and 1987, zero otherwise. T-statistics that are reported in parantheses are calculated using White standard errors.

	(a)	(b)	(c)	(d)	(e)
C	0.010	0.006	0.006	0.008	-0.003
	(0.484)	(0.292)	(0.218)	(0.537)	(-0.136)
PROT	0.001	0.001	0.004	0.001	0.003*
	(0.635)	(0.600)	(1.618)	(0.340)	(1.951)
Q		0.001*	0.003**	0.001*	0.002**
		(1.727)	(2.427)	(1.742)	(1.988)
LEV	-0.007	-0.006	-0.007	-0.015**	0.008
	(-0.640)	(-0.563)	(-0.608)	(-2.158)	(0.910)
CURVE	-0.006	-0.005	-0.012*	-0.005	-0.006
	(-0.980)	(-0.853)	(-1.793)	(-1.217)	(-1.216)
PROCEED	0.007	-0.002	0.004	-0.005	0.009
	(0.719)	(-0.208)	(0.361)	(-0.627)	(0.983)
PRIVATE	-0.003	-0.004	-0.001	0.015	-0.016
	(-0.578)	(-0.729)	(-0.039)	(1.488)	(-1.158)
FOREIGN	0.006	0.007	0.015	0.012*	0.002
	(0.822)	(0.917)	(1.479)	(1.949)	(0.360)
MAT	-0.009	-0.008	-0.008	-0.003	-0.006
	(-1.545)	(-1.469)	(-1.358)	(-0.687)	(-1.260)
PREM			0.003	0.001	0.002
			(0.556)	(0.402)	(0.489)
EURO	-0.003	-0.004	-0.007	-0.002	-0.005
	(-0.600)	(-0.767)	(-1.264)	(-0.623)	(-1.219)
BF88	0.013***	0.013***	0.013***	0.005*	0.008**
	(2.928)	(3.019)	(2.804)	(1.660)	(2.214)
Adjusted R^2	0.004	0.008	0.018	0.014	0.017
N	872	872	747	747	747

*** indicates statistical significance at one-percent level, ** indicates statistical significance at five percent level, and * indicates statistical significance at ten percent level.

Table 1.6. also reports average abnormal returns separately for the day prior to the announcement [column (d)] and the event day [column (e)]. Interestingly, most of

the negative overall stock reaction is concentrated on day -1, [18] the findings reported in column (c) also seem to be mostly attributable to the event day. Issuer leverage (LEV) has a negative and significant coefficient in day -1 returns, while it is not a significant factor explaining CARs in the (-1,0) event window. Issuer specific variables seem to explain more of day -1 returns, while contract terms explain more of day 0 returns. This could be explained by sequential release of information typical to many of the sample issues. Some of the contract terms may not be available until the event date, which is when the investment bank normally prices the issue. Results in column (d) suggest that prior to that, the stock market dislikes convertible issues by firms with high leverage.

1.8. Summary

The sequential financing hypothesis posits that firms issue convertible securities to finance projects requiring sequential investment injections. Issuers will call their convertibles to force conversion when they reach the next investment stage. This has implications for the firms' choice of call protection terms when they issue convertibles. If the issuer expects a long delay until the next investment stage, it will provide longer call protection, since inability to call will not cost it as much as the call protection is worth to investors.

The theory of optimal timing of investment offers a way to estimate the time of the firms' next investment stage, based on observable data. Firms whose investment options grow faster, exhibit higher variation in value, or are initially less valuable, are

[18] Average stock return is -0.004 for day -1 and -0.008 for day 0.

expected to face longer delays until optimal exercise of those options. Assuming a constant cost of capital during the delay, a higher cost of capital will also induce a firm to exercise its options earlier.

In this study, I provide evidence of a connection between optimal timing and call protection setting. Issuers for whom the optimal investment timing theory predicts a long wait tend to offer stronger call protection terms in their convertible issues. This finding is robust across different issue sizes. There is no consistent evidence of a connection between market reaction to the issuance announcement and the call protection offered.

Bibliography

Abhyankar, Abhay, and Alison Dunning, 1999, "Wealth effects of convertible bond and convertible preference share issues: An empirical analysis of the UK market", *Journal of Banking and Finance* 23, 1043-1065.

Affleck-Graves, John, and Robert E. Miller, 1999, "The information content of calls of convertible debt: Evidence from long-run stock returns", unpublished working paper, University of Notre Dame.

Barnea, Amir, Robert A. Haugen, and Lemma W. Senbet, 1980, "A rationale for debt maturity structure and call provisions in the agency theoretic framework", *Journal of Finance* 35, 1223-1234.

Berndt, E.K., B.H. Hall, R.E. Hall, and J.A. Hausman, 1974, "Estimation and inference in nonlinear structural models", *Annals of Economic and Social Measurement*, 653-665.

Belsley, David A., Edwin Kuh, and Roy E. Welsch, 1980, *Regression Diagnostics: Identifying Influential Data and Sources of Collinearity*, John Wiley & Sons, New York.

Bhabra, Harjeet S., and Ajay Patel, 1996, "Convertible bond financing: Are some issuers mimickers?", *Financial Management* 25, No. 4, 67-77.

Black, Fischer, Emanuel Derman, and William Toy, 1990, "A one-factor model of interest rates and its application to Treasury bond options", *Financial Analysts Journal*, January-February, 33-39.

Bodie, Zvi, and Robert A. Taggart, 1978, "Future investment opportunities and the value of the call provision on a bond", *Journal of Finance* 33, 1187-1200.

Boehmer Ekkehart, Jim Musumeci, and Annette B. Poulsen, 1991, "Event-study methodology under conditions of event-induced variance", *Journal of financial Economics* 30, 253-272.

Brennan, Michael, and Alan Kraus, 1987, "Efficient financing under asymmetric information", *Journal of Finance* 42, 1225-1243.

Brennan, Michael J., and Eduardo S. Schwartz, 1988, "The case for convertibles", *Journal of Applied Corporate Finance* 1, Summer, 55-64.

Calamos, John P., 1998, *Convertible Securities*, McGraw-Hill, New York, NY.

Chemmanur, Thomas J., and Paolo Fulghieri, 1997, "Why include warrants in new equity issues? A theory of unit IPOs", *Journal of Financial and Quantitative Analysis* 32, 1-24.

Constantinides, George M., and Bruce D. Grundy, 1989, "Optimal investment with stock repurchase and financing as signals", *Review of Financial Studies* 2, 445-465.

Cornelli, Francesca, and Oved Yosha, 2000, "Stage financing and the role of convertible debt", unpublished working paper, London Business School.

Crabbe, Leland E., and Jean Helwege, 1994, "Alternative tests of agency theories of callable corporate bonds", *Financial Management* 23, No. 4, 3-20.

Dann, Larry Y., and Wayne H. Mikkelson, 1984, "Convertible debt issuance, capital structure change and financing-related information: Some new evidence", *Journal of Financial Economics* 13, 157-186.

Dixit, Avinash K, and Robert S. Pindyck, 1994, *Investment under Uncertainty*, Princeton University Press, Princeton, NJ.

Essig, Stuart M., 1992, "Convertible securities and capital structure determinants", dissertation, University of Chicago.

Gompers, Paul A., 1995, "Optimal investment, monitoring, and the staging of venture capital", *Journal of Finance* 50, 1461-1489.

Green, Richard C., 1984, "Investment incentives, debt, and warrants", *Journal of Financial Economics* 13, 115-136.

Greene, William H., 1997, *Econometric Analysis*, Prentice-Hall, Upper Saddle River, NJ.

Harris, Milton, and Artur Raviv, 1985, "A sequential signalling model of convertible debt call policy", *Journal of Finance* 40, 1263-1281.

Ho, Thomas S., and Sang-Bin Lee, 1986, "Term structure movements and pricing interest rate contingent claims", *Journal of Finance* 41, 1011-1029.

Ibbotson Associates, 1998, *Cost of Capital Quarterly 1998 Yearbook*, Ibbotson Associates, Chicago, IL.

Ingersoll, Jonathan E., and Stephen A. Ross, 1992, "Waiting to invest: Investment and uncertainty", *Journal of Business* 65, 1-29.

Ingersoll, Jonathan E., 1977, "A contingent-claims valuation of convertible securities", *Journal of Financial Economics* 4, 289-322.

Jensen, Michael C., 1986, "Agency costs of free cash flow, corporate finance, and takeovers", *American Economic Review* 76, 323-329.

Jung, Kooyul, Yong-Cheol Kim, and René M. Stultz, 1996, "Timing, investment opportunities, managerial discretion, and the security decision", *Journal of Financial Economics* 42, 159-185.

Kahan, Marcel, and David Yermack, 1998, "Investment opportunities and the design of debt securities", *Journal of Law, Economics, and Organization* 14, 136-151.

Kennedy, Peter, 1998, *A Guide to Econometrics*, 4th edition, MIT Press, Cambridge, MA.

Kim, Yong-Cheol, and René M. Stulz, 1988, "The Eurobond market and corporate financial policy: A test of the clientele hypothesis", *Journal of Financial Economics* 22, 189-205.

Kim, Yong-Cheol, and René M. Stulz, 1992, "Is there a global market for convertible bonds?", *Journal of Business* 65, 75-91.

Kim, Yong O., 1990, "Informative conversion ratios: A signaling approach", *Journal of Financial and Quantitative Analysis* 25, 229-243.

Kish, Richard J., and Miles Livingston, 1993, "Estimating the value of call options on corporate bonds", *Journal of Applied Corporate Finance* 6, 95-99.

Korajczyk, Robert A., Deborah J. Lucas, and Robert L. McDonald, 1991, "The effect of information releases on the pricing and timing of equity issues", *Review Financial Studies* 4, 685-708.

Kraus, Alan, 1973, "The bond refunding decision in an efficient market", *Journal of Financial and Quantitative Analysis* 8, 793-806.

Lee, Yul W., 2000, "A sequential signaling model of convertible debt issue and call policies", *Journal of Financial Research* 23, 45-76.

Lewis, Craig M., Richard J. Rogalski, and James K. Seward, 1998a, "Agency problems, information asymmetries, and convertible debt security design", *Journal of Financial Intermediation* 7, 32-59.

Lewis, Craig M., Richard J. Rogalski, and James K. Seward, 1998b, "Understanding the design of convertible debt", *Journal of Applied Corporate Finance* 11, Spring, 45-53.

Mann, Steven V., and Eric A. Powers, 2000, "The advent of make-whole call provisions in the public bond market", unpublished working paper, University of South Carolina.

Mayers, David, 1998, "Why firms issue convertible bonds: the matching of financial and real investment options", *Journal of Financial Economics* 47, 83-102.

McDonald, Robert, and Daniel Siegel, 1986, "The value of waiting to invest", *Quarterly Journal of Economics* 101, 707-728.

McLaughlin, Robyn, Assem Safieddine, and Gopala K. Vasudevan, 1998, "The long-run performance of convertible debt issuers", *Journal of Financial Research* 21, 373-388.

Mikkelson, Wayne H., and Partch, Megan M., 1986, "Valuation effects of security offerings and the issuance process", *Journal of Financial Economics* 15, 30-60.

Mikkelson, Wayne H., 1980, "Convertible debt and warrant financing: a study of the agency cost motivation and the wealth effects of calls of convertible securities", dissertation, University of Rochester.

Miller, Merton H., and Kevin Rock, 1985, "Dividend policy under asymmetric information", *Journal of Finance* 40, 1031-1051.

Mitchell, Karlyn, 1991, "The call, sinking fund, and term-to-maturity features of corporate bonds: An empirical investigation", *Journal of Financial and Quantitative Analysis* 26, 201-222.

Moore, William T., 2000, "The present value index and optimal timing of investment", *Financial Practice and Education*, forthcoming.

Myers, Stewart C., 1977, "Determinants of corporate borrowing", *Journal of Financial Economics* 5, 147-175.

Nelken, Israel, 1997, "Convertible bonds and preferred shares" in *Option Embedded Bonds*, Israel Nelken, ed., Irwin, Chicago, IL.

Noddings, Thomas C., Susan C. Christoph, and John G. Noddings, 1998, *The International Handbook of Convertible Securities,* The Glenlake Publishing Company, Ltd., New York, NY.

Ramanlal, Pradipkumar, Steven V. Mann, and William T. Moore, 1996, "A simple approximation of the value of callable convertible preferred stock", *Financial Management* 25, Summer, 74-85.

Sahlman, William, 1990, "The structure and governance of venture-capital organizations", *Journal of Financial Economics* 27, 473-524.

Schultz, Paul, 1993, "Unit initial public offerings: A form of staged financing", *Journal of Financial Economics* 34, 199-229.

Stein, Jeremy C., 1992, "Convertible bonds as backdoor equity financing", *Journal of Financial Economics* 32, 3-21.

Thatcher, Janet S., 1985, "The choice of call provision terms: Evidence of the existence of agency costs of debt", *Journal of Finance* 40, 549-561.

Chapter 2
Effects of Law on Corporate Financing Practices - International Evidence from Convertible Bond Issues

2.1. Introduction

Convertible securities play an important role as a financing vehicle for corporations around the world. Both Morgan Stanley and Jefferies & Company estimate the combined global market value of convertibles at over $400 billion at the end of 1997 (Noddings, Christoph, and Noddings, 1998; Calamos, 1998). While interest among financial economist has focused almost exclusively on the U.S. convertible markets, the majority of the world's convertibles are issued outside the U.S. According to Noddings, et al. (1998) the U.S. share of the global convertible market is only 32%, which is overshadowed by the 44% of issues coming from Japan.[1]

To date, no theory exists to explain international differences in usage of convertible securities. Their well-known role as a venture capital instrument[2] builds upon well-functioning stock markets, which may explain large representation of the U.S. and the U.K. in the world convertibles market. Allen and Gale (2000) point out that when capital markets are dominated by large sophisticated investors, firms are able to use more

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[1] Within Japan, Miyajima (1998) reports that convertibles were the most popular external financing vehicle during the late 1980s.

[2] See e.g. Gompers (1995).

complicated financing instruments, which in turn could explain relatively large convertible markets in countries such as Switzerland and Hong Kong. Calamos (1998) emphasizes the apparent empirical regularity of a relationship between stock market growth cycles and convertible issuance. Regulatory controls may also affect firms' financing choices. In Japan, straight bonds were subject to regulatory interest ceilings until late 1980s, while convertible bonds did not face such regulation. This has most likely contributed to the dominant role convertibles play in financing Japanese firms.[3] Theoretical explanations of cross-country variation in popularity of convertibles is an interesting topic for future research.

The few empirical academic studies of convertibles using non-U.S. samples suggest that convertibles serve different functions in different countries. Kang and Stulz (1996) find that, in contrast to U.S. findings (e.g. Dann and Mikkelson (1984), and Mikkelson and Partch (1986)), Japanese convertible offerings are met by a positive average stock price reaction. They conclude that differences in managerial concerns, and more specifically Japanese managers' indifference towards wealth redistribution effects of new issues may explain the different empirical patterns.[4] Consistent with Kang and Stulz (1996), de Roon and Veld (1998) and Chang, Chen, and Liu (2001) find positive market responses to convertible financing announcements in the Netherlands and Taiwan, respectively. In contrast, Abhyankar and Dunning's (1999) event study evidence from the U.K. is consistent with the U.S. evidence of a negative stock price effect. Interestingly,

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[3] See Hoshi, Kashyap, and Scharfstein (1990a) for details on deregulation of Japanese financial markets.

[4] Kang, Kim, and Stulz (1999) find that the initial positive reaction is later reversed, resulting in long-term underperformance by Japanese convertible issuers. This is consistent with U.S. findings (e.g. Affleck-Graves and Spiess, 1999).

the U.K. and the U.S. share the English common law based legal system, whereas Japan, the Netherlands, and Taiwan are all characterized as German civil law countries (La Porta, Lopez-de Silanes, Shleifer, and Vishny (LLSV hereafter), 1998).

Prior research suggests that treatment of equity holders and creditors varies systematically across countries. Shleifer and Vishny (1997) point out differences in legal protection of investors across countries and emphasize the connection between quality of legal protection and the ability of corporations to raise external financing through different means. The fact that default on a loan is easy to define and observe makes a debt contract less ambiguous than an equity contract. Therefore, Shleifer and Vishny (1997) suggest that debt is the preferred mode of financing in countries with poor investor protection. LLSV (2000) also point out that debt is a stronger claim from an agency cost standpoint. To the extent that poor legal protection exacerbates agency problems between management and investors, weak investor protection seems to favor use of debt. LLSV (1997) further explore the effects of legal tradition on the structure of local financial markets, and find that in countries with strong minority shareholder protection, equity markets are more highly developed, and that strong creditor protection is connected with more highly developed debt markets.

In this study, I propose a new way of observing the effects of international legal system differences on corporate financing decisions. As hybrids between equity and bond contracts, convertible bonds offer an interesting testing ground to further analyze the effects of law on corporate financing practices. Convertible bond issuers can adjust their convertibles to be more debt-like or equity-like by use of several contract terms such as call protection, maturity, conversion price, and call price (Lewis, Rogalski, and Seward, 1998b). I focus on use of one of these contract terms, call protection, in an international sample from 27 different countries. In countries with weak shareholder protection, investors prefer more debt-like convertibles, and they may feel threatened by issuers' ability to force conversion. Strong creditor protection provided by the local law should have a similar effect on investors' call protection preferences. I therefore hypothesize that firms from countries with weaker shareholder protection and/or stronger creditor protection issue convertibles with stronger call protection. Since I do not attempt to explain the existence of convertibles in an economy, my findings are conditional on market conditions being such that companies choose to issue convertibles.

My data support the hypothesis above as I find evidence of issuers from more creditor-friendly countries offering stronger call protection and issuers from more shareholder-friendly countries offering weaker call protection. This finding is robust to several alternative measures of creditor and shareholder "friendliness", and a number of control variables. In section 2.2., I provide more extensive background on research in the effects of legal protection of investors and motivate a connection between legal protection and call protection terms of convertibles. Section 2.3. describes the sample used in this study, section 2.4. reports the results, and section 2.5. concludes.

2.2. Literature review

2.2.1. Effects of the legal system on corporate financing

A prominent line of literature advanced by LLSV (1997, 1998) focuses on the effects of law and legal tradition on development and structure of financial markets in an economy. LLSV (1998) observe the quality of protection provided by local laws to creditors and shareholders in 49 countries around the world. Their measure of shareholder rights focuses on variables describing minority voting rights. Similarly, they estimate creditor rights in different countries through various features of each country's bankruptcy law. LLSV (1998) find systematic differences in investor protection across different types of legal systems. Common law countries (countries whose commercial law is based on the English origin) tend to be more shareholder friendly and promote equity ownership by providing shareholders with more legal rights. In contrast, creditors have better rights in civil law countries (countries with German, French, or Scandinavian legal origin).

While some researchers doubt whether the letter of the law can directly affect corporate decision making,[5] empirical studies offer support for the idea that international differences in commercial law play a role in firms' financing decisions. In a study among G-7 countries, Rajan and Zingales (1995) find evidence of higher leverage among firms from countries with stronger creditor protection.[6] Demirguc-Kunt and Maksimovic (1998) report evidence of higher levels of both long term debt and equity financing in countries that score high on an index of respect for legal norms. Demirguc-Kunt and Maksimovic (1999) further find that firms' debt maturity choice depends on local legal institutions. In their sample, large firms in particular use longer maturity debt in countries with effective legal systems. LLSV (2000) find firms in countries with better shareholder protection paying higher dividends. Finally, findings by Reese and Weisbach (2000)

[5] See e.g. Easterbrook (1997).

[6] They classify countries based on features of bankruptcy law rather than by legal origin.

suggest that foreign firms cross-list in the U.S. to bond themselves to the U.S. legal protection system.

2.2.2. The role of call protection in convertible securities

Extant literature explaining the role of call protection in convertible securities is very limited. Lewis, Rogalski, and Seward (1998a) extend the work on the backdoor equity explanation of convertible issuance by Stein (1992). In Stein's model, firms that ultimately want equity in their capital structures issue convertibles due to current underpricing of their common stocks. Consequently, Lewis, et al. (1998a) suggest that firms that are more confident about their future prospects will provide shorter call protection since in Stein's model the threat of bankruptcy motivates all firms to force conversion as quickly as they can. In support of Stein (1992), Lewis, et al. (1998a) find that firms with higher market-to-book ratios issue convertibles with shorter call protection periods.

The agency cost motivation of the call feature forwarded by Myers (1977) receives only limited support among convertibles, possibly due to conversion features substituting for other agency cost control mechanisms found in straight debt (Kahan and Yermack, 1998). In Chapter 1 of this dissertation, I extend Mayers' (1998) sequential financing motivation for convertible usage. If convertibles are used as vehicles to finance sequential investment schemes, issuers will want to be able to call their convertibles at the time of their next investment sequence. In Chapter 1, I report support for Mayers (1998) by finding evidence of a connection between optimal investment timing and call protection terms.

2.3. The effects of legal systems on call protection

Convertible bonds provide a method that has not been previously considered to test whether firms adjust their financing vehicles to their local legal infrastructure and/or market conditions. As hybrid securities, convertibles contain both equity-like and bond-like features. Issuing firms can adjust the balance between the two features by setting contract terms such as coupon rate, maturity, conversion price, call price, and call protection on their convertibles.[7]

In this study, I focus on use of call protection as an adjustment mechanism between debt-like and equity-like features of convertibles. While several of the other contract features in convertible bonds can be used to adjust the balance between debt and equity portions of a convertible, call protection is probably the most intuitive one. A convertible with weak call protection can be called more easily by the issuer, ceteris paribus. Since call of a convertible bond typically induces investors to convert to equity, by calling a convertible bond, the issuer can "force" investors to switch from being bondholders to being equity holders. When issuers provide weak call protection, they are therefore more likely to force investors to the ranks of shareholders.

If world economies were divided into two groups, one that is more shareholder-friendly and another that is more creditor-friendly, I would expect to observe weaker call protection terms offered by firms in shareholder-friendly countries. In those countries, convertible bond investors will not suffer as much from the forced conversion as they

[7] See Lewis, Rogalski, and Seward (1998b).

would in creditor friendly economies. Therefore, increased likelihood of a call by the issuer, a consequence of weaker call protection, does not threaten them as much as it would in a country where equity ownership is not as appealing. Likewise, I expect firms from a creditor-friendly economy to offer stronger call protection. In creditor-friendly (and shareholder-unfriendly) countries investors find being creditors more attractive than being shareholders. Compared to shareholder-friendly countries, weak call protection on a convertible bond poses them much more of a threat. Thus, firms will find it difficult to float convertible bonds with weak call protection terms in creditor-friendly countries.

Demirguc-Kunt and Maksimovic (1999) provide an additional motive for firms from shareholder-friendly countries to provide weaker call protection terms for their convertibles. They point out that developed stock markets provide opportunities for diversification by entrepreneurs. They claim that this motivates firms to switch from long term debt to equity financing. Assuming that shareholder friendliness promotes stock market development, shareholder-friendly legal systems would then be accompanied by more equity-like convertibles.

As already mentioned, convertibles by Japanese companies account for a large part of the world convertible markets. During the sample period of this study, Japanese financial markets have gone through significant changes. Historically, corporate financing activities in Japan were under tight government regulation. Until the early 1980s, convertible issuance was limited to very few companies, due to collateral requirements and detailed accounting criteria (Miyajima, 1998). While gradual deregulation throughout the 1980s increased the number of firms eligible for convertible issuance to 500 by 1989, convertible issuers continued to face strict criteria on accounting measures such as net worth, dividends per share, and after-tax profits per share (Miyajima, 1998). Kang and Stulz (1996) report that a revision to the Commercial Code in April 1991 eased access to convertible issuance for most Japanese firms.

Government certification of convertible issuers could affect call protection features of convertible bonds through an agency cost consideration. Abolition of stringent regulation should lead to weaker call protection if the resulting shortened effective maturity controls the agency cost of debt as Myers (1984) suggests. Besides the direct effect of abolished governmental controls, Hoshi, Kashyap, and Scharfstein (1990a) point out another cause of increased agency costs of debt in Japan following deregulation. As a consequence of deregulation, many Japanese companies decided to use their new direct access to financing and consequently weakened their ties to bank controlled *keiretsu* systems. Hoshi, et al. (1990a) argue that decreased bank monitoring and increased costs of financial distress affected the cost of debt financing for Japanese firms, which gives a supply-side motivation for weaker call protection or more equity-like convertibles in post-deregulation era.

The late 1980s in Japan are often referred to as years of a bubble economy. Following tripling of Nikkei 225 index in the latter part of the 1980s, the early 1990s saw the index fall back to its pre-bubble levels. Very high growth rates in stock returns that were typical for Japanese companies during the bubble years may affect call protection choice of Japanese firms in two opposite ways. First, if investors expect stock market growth to continue, call protection terms may play less of a role for them since the fast growth rate of the stock market is likely to alleviate some of the concern they have towards a potential forced conversion. Secondly and perhaps more importantly, high growth rates make the stock price threshold of soft call protection less of a hindrance for issuers willing to call their bonds. If investors see this as a threat of a potential call at an inopportune time, they will prefer hard call protection in such environment.

The role of convertibles in corporate financing will almost certainly vary among countries not only due to regulatory issues such as those in Japan, but also due to different developmental stages that various economies represent. Prior research singles out growth financing as one of the most important functions for convertible securities. A cross section of countries, such as the sample used in this study, is likely to include economies in varying phases of economic development. This may introduce a bias in my empirical tests if different phases of economic growth affect the choice of call protection terms directly. While I attempt to control for this problem in my empirical model, it may be exacerbated by the effect that better financial systems induced by better legal infrastructure will have on economic growth.[8] Demirguc-Kunt and Maksimovic (1998) discuss this connection in depth, and point out that undeveloped financial markets may also introduce an industry bias to my sample, as in countries with undeveloped markets, new firms will find it harder to enter capital intensive industries.

2.4. Data

I investigate the relationship posited in the previous section in an international sample of convertible bonds. My sample comes from the *Securities Data Corporation's* (SDC) *New Issues* database, and covers time period from 1983 to 1998. After excluding

[8] See Levine (1997) for a survey on the connection between financial system development and economic growth.

issues by financial institutions, simultaneous issues,[9] issues with variable coupon rate or conversion price, issuers for whom neither *Center for Research in Security Prices* (CRSP) database nor *Datastream International* provides stock returns data, and issuers for whom *Datastream* reports negative market to book ratio in issue year, I am left with 1,480 convertible bonds from 27 different countries.

Call protection can either prohibit calling under any circumstances (hard call protection), or allow calling only when the value of the underlying stock exceeds certain levels relative to the conversion price (soft call protection). Types of call protection on convertible securities can therefore be divided into four distinct categories: (1) no protection, (2) soft protection, (3) hard protection, and (4) absolute protection (non-callable). The breakdown of my sample by issue year and call protection type is given in Table 2.1. There appears to be a structural break that occurred around 1988-1989. Until 1989, and in particular in years 1986-1988, soft protection was the most popular call protection type, whereas its popularity has significantly decreased since then.

[9] In cases where SDC reports multiple convertible bond issues by the same issuer on the same date, I have included the bond with the longest time to maturity or the highest coupon rate in my sample.

Table 2.1.
Distribution of convertible bond issues during the period 1983-1998 by call protection type and by issue year

	No Protection	Soft Protection	Hard Protection	Non-callable	Total
1983	2	36	28	5	71
1984	5	32	63	16	116
1985	1	71	71	2	145
1986	6	122	17	2	147
1987	3	108	33	1	145
1988	0	47	10	3	60
1989	1	27	66	3	97
1990	0	6	53	4	63
1991	1	14	45	9	69
1992	0	5	49	7	61
1993	0	16	74	10	100
1994	0	33	34	19	86
1995	1	5	44	8	58
1996	0	21	60	22	103
1997	0	9	82	9	100
1998	0	4	46	9	59
Total	20	556	775	129	1480

Bonds with Soft Protection have a call protection period during which the bonds are callable if the issuer's stock price exceeds a certain pre-determined level relative to the conversion price. Hard Protection does not allow the issuer to call the issue under any circumstances. Bonds with initial period of hard protection that is followed by soft protection are classified as having hard call protection.

Table 2.2. presents the distribution of my sample, along with means of various issue and issuer characteristics, by country. It is evident from Table 2.2. that Japan and the U.S. dominate my sample. Together, the two countries account for 84% of the total sample. The international distribution of the sample is consistent with the industry estimates of global convertible market shares reported in Noddings, et al. (1998) and Calamos (1998). Table 2.2. also summarizes means by countries' legal origins. Similar to LLSV (2000), small sample size in French and Scandinavian legal origin groups prompts a coarser classification to common law and civil law countries. In further analysis, I will classify countries with English legal origin as common law countries and countries with

either German, French, or Scandinavian legal origin as civil law countries. Comparison of means between common law and civil law groups reveals that issues from civil law countries are larger and have longer maturities. In support of my hypothesis that weaker shareholder protection and stronger creditor protection motivate stronger call protection, the average call protection strength for issues from the creditor-friendly civil law countries (1.892) is higher than that for issues from the shareholder-friendly common law countries (1.560).

Table 2.2.

Comparison of characteristics of convertible bond issuers and issues during the period 1983-1998 by issuer home country and legal system

English	N	Call Protection Type	Market to Book	Proceeds	Original Maturity
Australia	3	2	3.023	113.433	9.084
Canada	4	2.25	3.904	70.45	9.307
Hong Kong	33	1.909	1.632	114.848	6.278
India	5	1	2.132	81.02	5.237
Malaysia	7	1.571	5.907	180.057	9.798
Panama	1	2	2.305	100	5.006
South Africa	1	2	1.79	250	7.041
Thailand	22	1.682	4.34	86.614	8.154
UK	46	1.717	2.183	175.985	13.589
US	811	1.531	4.427	89.270	16.082
Common Law	933	1.56	4.204	95.205	15.247
French					
Belgium	1	1	4.34	107.7	20
Italy	3	1.667	2.67	199.567	6.01
Netherlands	10	1.9	5.114	76	7.139
Mexico	3	2.333	1.226	233.333	6.387
France	17	1.765	5.244	240.606	8.721
Philippines	2	1	1.53	80.8	8.5
German					
Switzerland	8	2.875	4.106	191.7	5.713
Austria	1	3	1.57	63.5	7.553
China	1	3	1.14	85	5.022
Germany	3	2.333	2.457	212.167	5.055
Japan	402	1.881	3.273	59.393	6
Poland	2	2.5	1.36	84	6.025
South Korea	64	2.015	1.218	38.845	8.718
Taiwan	26	1.538	2.245	103.481	7.308
Scandinavian					
Denmark	1	1	1.63	147.2	10.077
Sweden	2	2	0.751	106.1	15.36
Finland	1	2	0.8	300	5.019
Civil Law	547	1.892	3.046	70.522	6.559

Call protection type equals zero for bonds with no protection, one for bonds with soft protection, two for bonds with hard protection and three for bonds with absolute protection. Market to book ratio is obtained from *Datastream International* for non-U.S. issuers and calculated by dividing the market capitalization by total assets on the issue date for U.S. issuers. Proceeds measure the size of the issue in U.S. dollars. Original maturity is the time to maturity in years.

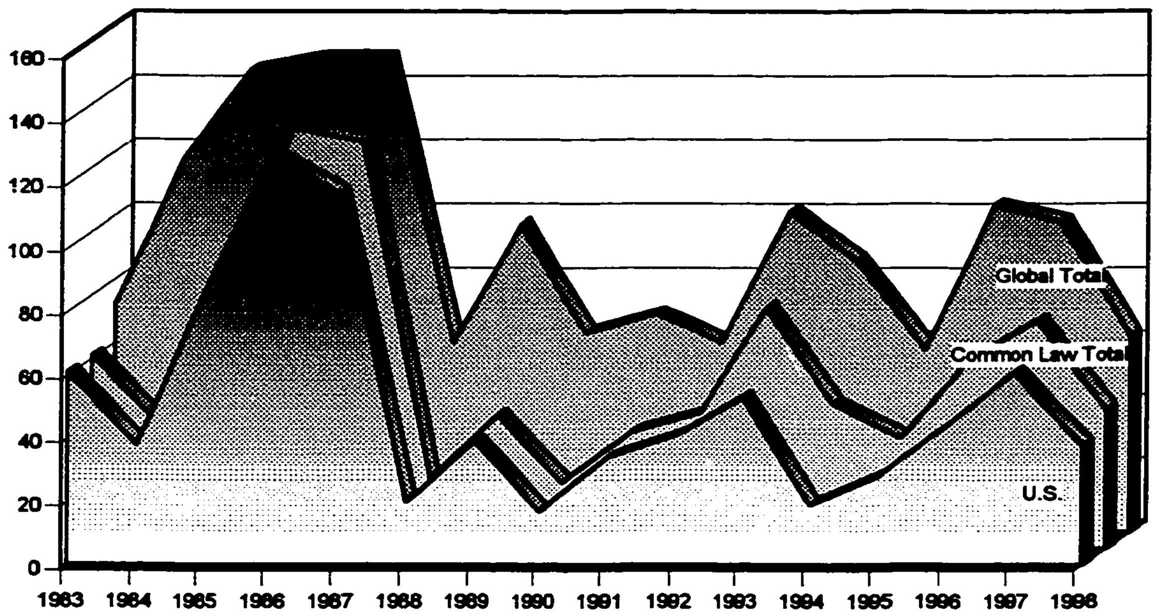
Table 2.3. reports issuance frequency by legal origin and issue year. To observe the dominance of the U.S. and Japan within their respective legal origin groups, issue frequency for each of the two countries is also indicated separately. While the U.S. is the

single country standing for most of the issue volume in the sample, Japanese firms issued over 50% of the sample issues in 1984 and again in the late 1980s. While my Japanese data set exhibits some clustering in the bubble years of the late 1980s, the most intense bubble years do not weigh nearly as heavily in my Japanese sample as in convertible samples of Kang and Stulz (1996) and Kang, Kim, and Stulz (1999), thanks to a longer time span of my sample. Proportions of the U.S. and common law countries in my sample are also illustrated in Figure 2.1.

Table 2.3.
Distribution of convertible bond issues during the period 1983-1998 by legal origin and by issue year

	U.S.	Other Common Law	Total Common Law	Japan	Other Civil Law	Total Civil Law	% Common Law
1983	60	0	60	11	0	11	84.5%
1984	37	1	38	77	1	78	32.8%
1985	85	2	87	58	0	58	60.0%
1986	127	3	130	16	1	17	88.4%
1987	113	11	124	20	1	21	85.5%
1988	20	2	22	34	4	38	36.7%
1989	39	3	42	55	0	55	43.3%
1990	17	4	21	40	2	42	33.3%
1991	34	3	37	23	9	32	53.6%
1992	41	3	44	11	6	17	72.1%
1993	52	23	75	18	7	25	75.0%
1994	19	27	46	12	28	40	53.5%
1995	28	7	35	5	18	23	60.3%
1996	44	16	60	12	31	43	58.3%
1997	60	11	71	5	24	29	71.0%
1998	35	6	41	5	13	18	69.5%
Total	811	122	933	402	145	547	63.0%

Figure 2.1.
U.S. and Common Law total proportions of 1460 convertible bonds issued in 1983-1998



2.5. Results and Analysis

I begin analyzing data by a comparison of frequency of call protection types in different legal systems. Table 2.4. breaks down the sample by call protection type and issuers' legal origin. Common law countries are divided almost equally between soft protection and hard protection, while in Civil law countries hard protection clearly dominates. Additionally, absolute call protection is much more prevalent in civil law countries. Given LLSV (1998) evidence that civil law countries exhibit stronger creditor protection, evidence in Table 2.4. supports the hypothesis that better creditor protection is related to stronger call protection terms. As Table 2.2. indicated, the average protection strength on scale of zero to three is 1.56 for common law countries and 1.89 for civil law countries.

Table 2.4.
Distribution of convertible bond issues during the period 1983-1998 by call protection type and legal origin

	No Protection	Soft Protection	Hard Protection	Non-callable
U.S.	20	355	421	15
Other Common Law	0	54	44	24
Common Law	**20**	**409**	**465**	**39**
Japan	0	100	250	52
Other Civil Law	0	47	60	38
Civil Law	**0**	**147**	**310**	**90**

Bonds with Soft Protection have a call protection period during which the bonds are callable if the issuer's stock price exceeds a certain pre-determined level relative to the conversion price. Hard Protection does not allow the issuer to call the issue under any circumstances. Bonds with initial period of hard protection that is followed by soft protection are classified as having hard call protection.

To account for correlation among factors affecting the choice of call protection type, I now turn to regression analysis. I use an ordered probit model with the type of call protection as the dependent variable. The dependent variable (PROT) represents a 4-part scale of call protection: no protection - soft protection - hard protection - no call provisions (= absolute call protection). In order to account for heteroskedasticity, the standard deviations used to obtain the t-statistics for all of the ordered probit specifications reported are calculated using the method by Berndt, Hall, Hall, and Hausman (1974).

My empirical model is specified as follows:[10]

$$\begin{aligned} PROT_i = \alpha + \beta_1 EPSILON_i + \beta_2 MTB_i + \beta_3 PROCEEDS_i + \beta_4 MAT_i \\ + \beta_5 PUT_i + \beta_6 COMMON_i + \beta_7 BF89_i + \beta_8 COUPON_i \\ + \beta_9 LOGGDP_i + \beta_{10} JAPAN80_i + \varepsilon_i \end{aligned} \quad (2.1)$$

EPSILON is set to capture the effects of Mayers' (1998) sequential financing motive on call protection setting. The variable is derived in McDonald and Siegel (1986),

[10] See Appendix 2.1. for measurement method and source of each variable.

and it is inversely related to a firm's optimal time to invest. Given Mayers' (1998) work and evidence reported in Chapter 1 of this dissertation, the expected sign of EPSILON is negative; in other words companies with long time until optimal investment are expected to offer stronger call protection terms.

Controlling for market to book ratio (MTB) is motivated both by the sequential financing motive and Stein's (1992) backdoor equity hypothesis. The two theories have opposite predictions on call protection strength, which is why the expected sign of MTB is ambiguous. If convertibles are used as vehicles for sequential financing, faster growth predicts stronger call protection due to increased time to optimal investment. According to the backdoor equity hypothesis, firms with more valuable growth options will want to switch to equity sooner, suggesting an inverse relationship between market to book and call protection strength.

Size (PROCEEDS) and original maturity (MAT) of an issue control for agency costs. Original maturity also controls for the direct effect that legal systems have on debt maturity, advanced by Demirguc-Kunt and Maksimovic (1999). In Chapter 1, I find both relative issue size and original maturity to be inversely related to call protection strength among U.S. convertible issues.[11] Systematic difference in both variables by legal system (see Table 2.2.) further motivates controlling for them.

Indicator variable BF89 takes on value of one for bonds that were issued prior to 1989, zero otherwise. The purpose of this variable is to control for the apparent shift in the overall market that occurred in late 1980s and is evident in Table 2.1. Furthermore, in

[11] Poor availability of accounting data within my sample disallows measurement of issue size relative to the issuer's total capital.

order to account for more stringent regulation and the bubble economy present in the Japanese markets in the 1980s, I include an indicator variable JAPAN80 that takes on value of one for Japanese bonds that were issued in 1983-1989, zero otherwise. As discussed above, tighter regulatory control during that period suggests lower agency costs of those bonds. If shortened effective maturity controls agency costs, bonds issued during the 1980s in Japan will have stronger call protection, predicting a positive sign for this variable. Furthermore, if investors see soft protection as an increased threat during a period of fast stock market growth, they will demand strong call protection during such periods, which again predicts a positive sign for JAPAN80.

Finally, following prior empirical work in international financial market development research, I include an independent variable LOGGDP that controls for the issuer's home country's per capita Gross Domestic Product. LLSV (1998) suggest that the quality of law enforcement is better in richer countries. Poor quality of law enforcement may decrease the credibility of strong call protection terms, therefore suggesting a positive sign on LOGGDP. Demirguc and Maksimovic (1999) find that firms based in more developed countries use longer term debt in financing, which supports the connection between quality of enforcement and effective debt maturity. LOGGDP is also set to capture some of the cross-country variation in the role of convertibles that depends on the developmental stage of the economy.[12]

Unfortunately poor availability of accounting data among my sample firms disallows controlling for issuer-specific factors such as leverage, which I find in Chapter

[12] Demirguc-Kunt and Maksimovic (1998) motivate inclusion of GDP per capita in their cross-sectional analysis as a proxy for institutional determinants not explicitly captured in their empirical model.

1 to affect call protection choice within the U.S. For example, *Worldscope* reports accounting information for issuers of only 42 out of the 881 Japanese issues in my original sample. Also, underdeveloped debt markets in most of the countries in my sample disallow controlling for the shape of the yield curve at issuance, which I find to affect call protection setting the U.S convertible issues (See Chapter 1).

Results in column (a) of Table 2.5. confirm that firms from common law countries provide weaker call protection, which again is consistent with weaker creditor protection and stronger shareholder protection exhibited by those countries (LLSV, 1998) leading to weaker call protection. Finding is robust to controlling for coupon rate (COUPON), which is indicated by Lewis, Rogalski, and Seward (1999) as an alternative adjustment mechanism between debt-like and equity-like features of convertibles. Among other control variables, original maturity is inversely related to call protection strength, which is consistent with my findings within the U.S. (see Chapter 1). The optimal timing variable (EPSILON) is negative and significant at the .10 level, lending support for the sequential financing hypothesis. Unlike in Chapter 1, size of the issue (PROCEEDS) does not affect the choice of call protection type, which may in part be due to my inability to control for the relative issue size as was done in Chapter 1.

If put feature and weaker call protection terms are viewed by issuers as two alternative contract term choices to control agency costs of debt, we would expect a positive coefficient on the dummy variable PUT. However, bonds containing a put feature appear to come with weaker protection terms, which suggests that call protection and put feature are used to compliment each other, rather than as substitutes, in controlling agency costs. Alternatively, the negative sign could be explained by the "guarantee not to call" and the put option being alternative forms of "sweetener" attached to convertible offerings. Consistent with the U.S. evidence, original maturity (MAT) is inversely related to call protection strength. The negative sign on MAT may be explained by longer time to maturity leading to higher agency costs of debt. Not surprisingly, given evidence reported in Table 2.1., bonds offered before 1989 have weaker call protection.[13]

[13] The findings reported in this study are not sensitive to the selection (or non-selection) of the time period controlled for.

Table 2.5.
Determinants of call protection strength

The table provides ordered probit estimates. The dependent variable is a 4-part scale of call protection: no protection - soft protection - hard protection - absolute call protection. EPSILON is a measure related to the optimal investment timing suggested by McDonald and Siegel (1986), MTB is issuer's market to book ratio, calculated at the year-end following the issue. PROCEEDS = ln (issue proceeds) in U.S. dollars. MAT = ln (time to maturity) in years. PUT is an indicator variable for puttable issues. COUPON is the coupon rate. COMMON is an indicator variable for issues from common law countries. BF89 equals one for issues between 1983 and 1988, zero otherwise. JAPAN and US are indicator variables for issues from Japan and the U.S., respectively. LOGGDP = ln (per capita GDP) in issuer's home country, measured in U.S. dollars. LOWSHP and LOWCRP are indicator variables for low shareholder and creditor protection following LLSV (1998). RULE and ACCT are legal enforcement and accounting rule variables from LLSV (1998). MKTCAP is country's stock market capitalization over GDP, and DOMCR is domestic credit to private sector over GDP, all measured in U.S. dollars. JAPAN80 is an indicator variable for Japanese issues before 1990. KEIRETSU is an indicator variable indicating *keiretsu* membership. Columns (g) and (h) contain only Japanese firms. T-statistics that are reported in parentheses are calculated using heteroskedasticity-consistent standard errors. * indicates statistical significance at one-percent level, ** indicates statistical significance at five percent level, and * indicates statistical significance at ten percent level.**

	(a)	(b)	(c)	(d)	(e)
C	5.262***	5.268***	6.517***	4.914***	4.909***
	(9.275)	(9.102)	(9.198)	(6.317)	(6.245)
EPSILON	-0.015*	-0.018*	-0.014	-0.006	-0.007
	(-1.694)	(-1.909)	(-1.464)	(-0.655)	(-0.688)
MTB	0.000	0.000	0.000	0.001	0.001
	(0.001)	(0.020)	(0.024)	(0.112)	(0.118)
PROCEEDS	-0.039	-0.042	-0.073**	-0.024	-0.024
	(-1.084)	(-1.112)	(-1.962)	(-0.644)	(-0.636)
MAT	-0.381***	-0.321***	-0.437***	-0.548***	-0.547***
	(-4.790)	(-3.826)	(-5.515)	(-6.756)	(-6.728)
PUT	-0.865***	-0.882***	-0.776***	-0.769***	-0.771***
	(-10.060)	(-10.257)	(-8.592)	(-8.171)	(-8.177)
COMMON	-0.492***	-0.282**			
	(-5.196)	(-2.409)			
MKTCAP				-0.791***	
				(-7.861)	
DOMCR				0.585***	
				(3.169)	
RULE*MKTCAP					-0.087***
					(-7.624)
RULE*DOMCR					0.063***
					(2.995)
LOWSHP			0.354***		
			(3.084)		
LOWCRP			-0.440***		
			(-3.627)		
RULE			0.569***	0.221***	0.201**
			(5.963)	(2.834)	(2.519)
ACCT			-0.038***	0.001	0.007
			(-2.990)	(0.619)	(0.590)
BF89	-1.105***	-1.163***	-1.198***	-1.388***	-1.390***
	(-11.440)	(-13.128)	(-11.522)	(-13.137)	(-13.147)
COUPON	-0.024	-0.022	-0.063***	-0.076***	-0.075***
	(-1.421)	(-1.323)	(-3.598)	(-4.315)	(-4.280)
JAPAN		0.304***			
		(2.632)			
US		-0.097			
		(-0.714)			
LOGGDP	-0.036	-0.061	-0.381***	-0.076**	-0.205**
	(-0.693)	(-1.067)	(-4.419)	(-2.525)	(-2.302)
JAPAN80	0.080		0.020	0.182	0.194
	(0.644)		(0.145)	(1.292)	(1.381)
Scaled R^2	0.320	0.324	0.321	0.346	0.346
N	1462	1462	1456	1426	1426

Table 2.5. - continued
Determinants of call protection strength

	(f)	(g)	(h)
C	5.520***	2.855***	2.869***
	(8.460)	(5.655)	(5.696)
EPSILON	-0.014	0.022	0.022
	(-1.520)	(1.334)	(1.335)
MTB	0.000	0.001	0.001
	(0.001)	(0.020)	(0.040)
PROCEEDS	-0.042	-0.349***	-0.347***
	(-1.176)	(-3.615)	(-3.656)
MAT	-0.376***	-0.026	-0.027
	(-4.718)	(-0.123)	(-0.127)
PUT	-0.870***	-1.044***	-1.050***
	(-10.065)	(-6.464)	(-6.519)
COMMON	-0.467***		
	(-4.876)		
BF89	-1.095***	-1.192***	-1.189***
	(-11.274)	(-7.234)	(-7.204)
COUPON	-0.025	0.180***	0.179***
	(-1.513)	(4.275)	(4.283)
GDPDEFL	-0.018		
	(-0.977)		
KEIRETSU		0.051	
		(0.388)	
LOGGDP	-0.058		
	(-0.973)		
JAPAN80	0.064		
	(0.499)		
Scaled R^2	0.321	0.307	0.306
N	1460	393	393

As shown above, the U.S. and Japan represent large market shares within common law and civil law sample, respectively. Findings reported in column (a) could thus be due to some country-specific factors other than legal origin related to the two countries. In an effort to control for such factors, I include a dummy variable for each country in column (b). Evidence of firms from common law countries providing weaker call protection is strong even when controlling for country specific factors of the two dominant countries in the sample. My test variable COMMON has a negative and significant coefficient also if either U.S. or Japan is left completely out of the analysis (the t-statistics on COMMON are -1.874 and -3.308, respectively, results not reported).

Next, I use more direct measures of stockholder and creditor protection to observe whether the empirical relationship found above is robust to more specific measures of investor protection. I proxy the quality of shareholder rights in a country by using the anti-directors rights index formed by LLSV (1998). The index takes on values from zero to five, five being the most friendly towards minority shareholders. LLSV (1998) also compile a creditors' rights measure for each country in their sample. This measure is based on various aspects of local bankruptcy laws, and varies in value from zero to four. In order to avoid obvious technical problems caused by an ordinal qualitative independent variable, I follow LLSV (2000) and use two indicator variables that take on value of one for low creditor protection (LOWCRP) and shareholder protection (LOWSHP), respectively, and zero otherwise. If the findings in column (a) of table 2.5. are explained by the common law countries being more shareholder-friendly and less creditor-friendly, low quality of creditor protection should be accompanied by stronger call protection terms and low quality of shareholder protection should be connected with weaker call protection terms.

I further include two additional independent variables used and provided by LLSV (1998). The first one proxies the quality of enforcement of law in a country (RULE). The variable is an index based on opinions of various country risk estimation services, and includes measures of efficiency of the judicial system, rule of law, corruption, risk of expropriation, and likelihood of contract repudiation by the government. LLSV (1998) discuss the possibility that weaker rules of law might be substituted by stronger enforcement and vice versa. Shleifer and Vishny (1997) predict that poor quality of law enforcement leads to preference for debt financing. Whether the quality of law enforcement has an effect on call protection setting is questionable since enforceability of a convertible contract may not depend on its call protection terms. However, when quality of law enforcement falls to a level where the likelihood of reneging on call protection increases, we might observe weaker call protection since strong call protection terms could be deemed incredible by the market in such an environment.[14] Following LLSV (1998), I also control for the quality of local accounting standards (ACCT). Relaxed accounting standards can make it easier for management to manipulate earnings and therefore make equity ownership less appealing. In particular, lower level of transparency, caused by weaker accounting standards, may allow management to induce the stock price to exceed a soft protection threshold, causing investors to shy away from issues with soft protection terms. Given these predictions, the expected sign for ACCT is negative.

As column (c) of Table 2.5. shows, the hypothesis of weaker shareholder rights leading to stronger call protection is again strongly supported. Compared to column (a), the control variables generally behave in a consistent manner. Interestingly, column (c) provides strong evidence of a positive relationship between legal enforcement mechanism and call protection strength, which is consistent with the idea that stronger call protection is used in countries where such contract feature is more credible, but inconsistent with better legal standards favoring equity financing.[15] Consistent with weaker accounting standards leading to increased agency costs between management and shareholders,

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[14] This argument is related to Diamond (1991, 1993) and Rajan (1992) findings that inefficient legal systems motivate shorter term debt.

[15] Coefficient estimate on RULE is positive and significant also in a specification without shareholder protection and creditor protection variables (results not reported).

accounting standards are inversely related to the call protection choice. An interesting difference between the results in columns (c) and (a) is that in column (c) the coefficient on COUPON is negative and significant. This suggests that issuers are more concerned about maintaining their ability to call bonds that have higher coupon rates.

It is questionable whether static measures such as the origin of a country's legal system can measure a dynamic process of evolvement of legal and financial systems in an economy. For example, Reese and Weisbach (2000) point out variation in legal rules among countries with same legal origins. I address these concerns and test robustness of my findings by introducing two dynamic, market-based measures of creditor friendliness and shareholder friendliness of an economy. Both LLSV (1998) and Modigliani and Perotti (2000) motivate a connection between the depth of financial markets and the legal infrastructure of a country. Consequently, assuming that shareholder-friendly legal system leads to more developed stock markets, such legal systems should lead to larger equity markets. I therefore obtain home country's stock market capitalization in the issue year for each bond, and divide it by the country's gross domestic product in respective year. I call this variable MKTCAP. For a measure on credit market development to be used as a proxy of creditor friendliness, I normalize total domestic private credit claims in issue year from the *International Financial Statistics* (item 32d) again by the country's GDP in the same year. Using these dynamic proxies only strengthens my empirical results as evidenced by column (d) of Table 2.5.

In column (e), I measure the marginal effect that stock market and credit market development have on the choice of call protection terms given the quality of each country's law enforcement. This is done by replacing the market development variables in column (d) with two interaction variables (RULE*MKTCAP and RULE*DOMCR). Even in this setting, more developed stock markets are related to weaker call protection terms and more developed credit markets lead to stronger call protection terms.

In Chapter 1, I find a positive relationship between the slope of the yield curve and call protection strength among U.S. convertible issues. In an attempt to control for country specific interest rate environment, I enter the average GDP deflator for the decade of issuance for each country, as calculated by the World Bank, as an additional control variable. This addition to the empirical model does not alter the results reported, and the variable itself is insignificantly different from zero (see column (f) of Table 2.5.). While Demirguc-Kunt and Maksimovic (1999) find an inverse relationship between inflation and debt maturity, the existence of conversion option may alleviate investors' concern with inflation, which could explain my non-finding.

Also in my domestic study presented in Chapter 1, I control for issuer leverage. As I am unable to control for the effects of leverage-induced agency costs of debt due to poor data availability, there is a risk that my findings are plagued by omitted variable bias. I therefore obtained information on *keiretsu* ties of my Japanese sample firms from *Industrial Groupings in Japan* (1999) to be used as an alternative proxy for leverage within Japan. This is motivated by Hoshi, Kashyap, and Scharfstein (1990b) suggestion that since cost of financial distress is higher for non-keiretsu firms, firms connected with keiretsu systems can take on more debt. In a regression among my Japanese sample firms (see columns (g) and (h) of Table 2.5.), other independent variables are insensitive to inclusion of the keiretsu dummy variable, and the coefficient on the keiretsu dummy itself is very close to zero, which alleviates the concern about omitted variable bias.

Interestingly, regressions within the Japanese sample reveal that unlike in full sample, coupon rates are positively related to call protection in Japan. Also, original maturity does not affect the choice of call protection type in Japan.

Overall, Table 2.5. reports very strong evidence of a relationship that both stockholder friendliness and creditor friendliness have with call protection terms on convertible bonds. Findings are robust to several alternative proxies of the test variables, and do not appear to be driven by any other country-specific variation.

2.6. Summary

This study presents a new way to observe adjustments in corporate financing practices induced by local legal infrastructure. Building upon LLSV (1998) finding that countries whose legal system is based on common law system are more shareholder-friendly and civil law countries are more creditor-friendly, I find that firms from common law countries provide weaker call protection on their convertibles than issuers from civil law countries. My finding is consistent with the hypothesis that in countries where commercial law makes share ownership less appealing, investors view weaker call protection and the consequent higher likelihood of a call as a threat and therefore shy away from convertible bond issues with such terms.

An interesting topic for further research in this area is to study the explanatory power of call protection terms on stock price reactions to convertible financing announcements in a cross-country sample. Given my results, prior international evidence of positive reactions in civil law countries and negative reactions in common law countries could be explained by the balance between debt-like and equity-like features of individual bonds. Consistent with this idea, Lewis, Rogalski, and Seward (1999) find more favorable average stock price reaction to debt-like convertibles within the U.S.

Appendix 2.1.Measurement and definition of variables used in empirical analysis

Independent variable EPSILON is measured as:

$$EPSILON = \left(\frac{1}{2} - \frac{GROW1}{(sigma)^2}\right) + \sqrt{\left(\frac{GROW1}{(sigma)^2} - \frac{1}{2}\right)^2 + \frac{2(WACC)}{(sigma)^2}},$$

where GROW1 is the growth in issuer's stock market capitalization during the year following the issue. Information on market capitalization for non-U.S. companies is obtained from *Datastream International*, measured at the end of the issue year and at the end of the year following the issue year. For U.S. firms, market capitalization is obtained from *CRSP* and measured on issue day and on the first anniversary of the issue. Sigma for non-U.S. firms is the annualized standard deviation of weekly stock returns during the 52-week period preceding the issue. Data source again is *Datastream International*. For U.S. firms, sigma is the annualized standard deviation of daily stock returns during the year preceding the issue, obtained from *CRSP*. I proxy cost of capital for each issuer (WACC) by using the coupon rate of the issue. Using each country's bank lending rate in issue year as a proxy for issuers' cost of capital does not significantly change my findings.

Market to book ratio (MTB) for non-U.S. issuers is obtained from *Datastream international* and is measured at the year-end following the issue. For domestic issuers, I multiply the stock price on the issue date by the number of shares outstanding. All of the issue-specific control variables come from the *SDC New Issues* database. PROCEEDS is the natural logarithm of issue proceeds measured in U.S. dollars. MAT is the natural logarithm of original time to maturity in years.

LOGGDP is the natural logarithm of Gross Domestic Product in local currency from *International Financial Statistics* by International Monetary Fund, translated into U.S. dollars at the year-end exchange rate, also from International Financial Statistics. Each country's legal origin is obtained from LLSV (1998), with the exception of Panama, Poland, and China which countries are not covered in their study. For Poland, the legal origin is obtained from Pistor (1999). LOWSHP is an indicator variable that takes on value of one for countries with a value less than four on the anti-director rights index from LLSV (1998), Table 2, and LOWCRP takes a value of one when the creditor protection index in LLSV (1998), Table 4 is lower than three. RULE is average of the five law enforcement variables reported in Table 5 of LLSV (1998). ACCT is the accounting standards rating in the same table. MKTCAP is the total market value of significant portion of country's stock markets (*Datastream* item *TOTMK*) at the end of the year of an issue divided by the country's Gross Domestic Product. DOMCR divides the value of domestic credit to private sector from *International Financial Statistics* by the country's Gross Domestic Product.

Information on keiretsu ties of Japanese companies comes from *Industrial Groupings in Japan* (1999). Variable KEIRETSU takes on value of one for companies that are members in DKB, Fuyo, IBJ, Mitsubishi, Mitsui, Sanwa, Sumitomo, and Tokai groups, and zero otherwise. Inflation data is obtained from World Bank web site (www.worldbank.org). Variable GDPDEFL is the GDP implicit deflator for either 1980s or 1990s, depending on the year of issuance.

Bibliography

Abhyankar, Abhay, and Alison Dunning, 1999, "Wealth effects of convertible bond and convertible preference share issues: An empirical analysis of the UK market", *Journal of Banking and Finance* 23, 1043-1065.

Allen, Franklin, and Douglas Gale, 2000, *Comparing Financial Systems*, MIT Press, Cambridge, MA.

Allen, Franklin, and Douglas Gale, 1995, "A welfare comparison of intermediaries and financial markets in Germany and the U.S.", *European Economic Review* 39, 179-209.

Berndt, E.K., B.H. Hall, R.E. Hall, and J.A. Hausman, 1974, "Estimation and inference in nonlinear structural models", *Annals of Economic and Social Measurement*, 653-665.

Calamos, John P., 1998, *Convertible Securities*, revised edition, McGraw-Hill, New York, NY.

Chang, Shao-Chi, Sheng-Syan Chen, and Yichen Liu, 2001, "Further evidence on why firms use convertibles: Corporate focus and the sequential-financing hypothesis", Yuan Ze University working paper.

Dann, Larry Y., and Wayne H. Mikkelson, 1984, "Convertible debt issuance, capital structure change and financing-related information: Some new evidence", *Journal of Financial Economics* 13, 157-186.

de Roon, Frans, and Chris Veld, 1998, "Announcement effects of convertible bond loans and warrant-bond loans: An empirical analysis for the Dutch market", *Journal of Banking and Finance* 22, 1481-1506.

Demirguc-Kunt, Asli, and Vojislav Maksimovic, 1999, "Institutions, financial markets, and firm debt maturity", *Journal of Financial Economics* 54, 295-336.

Demirguc-Kunt, Asli, and Vojislav Maksimovic, 1998, "Law, finance, and firm growth", *Journal of Finance* 53, 2107-2137.

Diamond, Douglas W., 1993, "Seniority and maturity of debt contracts", *Journal of Financial Economics* 33, 341-368.

Diamond, Douglas W., 1991, "Debt maturity and liquidity risk", *Quarterly Journal of Economics* 106, 709-737.

Easterbrook, Frank H., 1997, "International corporate differences: Markets or law?", *Journal of Applied Corporate Finance* 9, Winter, 23-29.

Frankel, Jeffrey A., and David Romer, 1999, "Does trade cause growth?", *American Economic Review* 89, No. 3, 379-399.

Gompers, Paul A., 1995, "Optimal investment, monitoring, and the staging of venture capital", *Journal of Finance* 50, 1461-1489.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1990a, "Bank monitoring and investment: Evidence from the changing structure of Japanese corporate banking relationship" in R. Glenn Hubbard, ed., *Asymmetric Information, Corporate Finance, and Investment*, University of Chicago Press, Chicago, IL.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1990b, "The role of banks in reducing the costs of financial distress", *Journal of Financial Economics* 27, 67-88.

Kahan, Marcel, and David Yermack, 1998, "Investment opportunities and the design of debt securities", *Journal of Law, Economics, and Organization* 14, 136-151.

Kang, Jun-Koo, Yong-Cheol Kim, and Rene M. Stulz, 1999, "The underreaction hypothesis and the new issue puzzle: Evidence from Japan", *Review of Financial Studies* 12, 519-534.

Kang, Jun-Koo, and Rene M. Stulz, 1996, "How different is Japanese corporate finance? An investigation of the information content of new security issues", *Review of Financial Studies* 9, 109-139.

Kester, W. Carl, 1986, "Capital and ownership structure: A comparison of United States and Japanese manufacturing corporations", *Financial Management*, Spring, 5-16.

Korkeamaki, Timo, 2001, "Convertible securities in sequential financing: Matching the timing of real options with financial options", University of South Carolina working paper.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, 2000, "Agency problems and dividend policies around the world", *Journal of Finance* 55, 1-33.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, 1998, "Law and finance", *Journal of Political Economy* 106, 1113-1155.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny, 1997, "Legal determinants of external finance", *Journal of Finance* 52, 1131-1150.

Levine, Ross, 1997, "Financial development and economic growth: Views and agenda", *Journal of Economic Literature* 35, 688-726.

Lewis, Craig M., Richard J. Rogalski, and James K. Seward, 1999, "Is convertible debt a substitute for straight debt or for common equity", *Financial Management* 28, Autumn, 5-27.

Lewis, Craig M., Richard J. Rogalski, and James K. Seward, 1998a, "Agency problems, information asymmetries, and convertible debt security design", *Journal of Financial Intermediation* 7, 32-59.

Lewis, Craig M., Richard J. Rogalski, and James K. Seward, 1998b, "Understanding the design of convertible debt", *Journal of Applied Corporate Finance* 11, Spring, 45-53.

Mayers, David, 1998, "Why firms issue convertible bonds: the matching of financial and real investment options", *Journal of Financial Economics* 47, 83-102.

McDonald, Robert, and Daniel Siegel, 1986, "The value of waiting to invest", *Quarterly Journal of Economics* 101, 707-728.

Mikkelson, Wayne H., and Partch, Megan M., 1986, "Valuation effects of security offerings and the issuance process", *Journal of Financial Economics* 15, 30-60.

Miyajima, Hideaki, 1998, "The impact of deregulation on corporate governance and finance" in Lonny E. Carlile and Mark C. Tilton, eds., *Is Japan Really Changing Its Ways?*, Brookings Institution Press, Washington, D.C.

Modigliani, F., and E. Perotti, 2000, "Security markets versus bank finance: Legal enforcement and investors' protection", *International Review of Finance* 1, 81-96.

Myers, Stewart C., 1977, "Determinants of corporate borrowing", *Journal of Financial Economics* 5, 147-175.

Noddings, Thomas C., Susan C. Christoph, and John G. Noddings, 1998, *The International Handbook of Convertible Securities*, Glenlake Publishing Company, Chicago, IL.

Pistor, Katharina, 1999, "Law as determinant for equity market development - the experience of transition economies", Max Planck Institute for Comparative and International Private Law working paper.

Rajan, Raghuram G., 1992, "Insiders and outsiders: The choice between informed and arm's length debt", *Journal of Finance* 47, 1367-1400.

Rajan, Raghuram G., and Luigi Zingales, 1995, "What do we know about capital structure? Some evidence from the international data", *Journal of Finance* 50, 1421-1460.

Reese, William A., and Michael S. Weisbach, "Protection of minority shareholder interests, cross-listings in the United States, and subsequent equity offerings", Tulane University working paper.

Shleifer, Andrei, and Robert W. Vishny, 1997, "A survey of corporate governance", *Journal of Finance* 52, 737-783.

Spiess, D. Katherine, and John Affleck-Graves, 1999, "The long-run performance of stock returns following debt offerings", *Journal of Financial Economics* 32, 263-292.

Stein, Jeremy C., 1992, "Convertible bonds as backdoor equity financing", *Journal of Financial Economics* 32, 3-21.