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Convertible Bond Underpricing: Renegotiable Covenants, Seasoning and Convergence

Abstract

We investigate the long-standing puzzle on the underpricings of convertible bonds. We hypothesize that the observed underpricing is induced by the possibility that a convertible bond might renegotiate on some of its covenants, e.g., an imbedded put option, in financial difficulties. Consistent with our hypothesis, we find that the initial underpricing is larger for lower rated bonds. The underpricing worsens if the issuer experiences subsequent financial difficulties. However, conditional on no rating downgrades, our main empirical result shows that convertible bond prices do converge to their theoretical prices within two years. This seasoning period is shorter for higher rated convertible bonds.

1. Introduction

The underpricing of convertible bonds has been a long-standing puzzle in the finance literature. This phenomenon is also well known in the industry and has become the basis for a popular hedge fund strategy often referred to as "convertible arbitrage." There are numerous reports on this popular arbitrage strategy in the financial presses, for example,

> "…hedge funds, experts at arbitraging, seek to make money from differences in the price of the convertible bond and the price of the equity…the bond's valuation must be attractive." *Traders Magazine* (August 2000)

> "Funds specialising in convertible arbitrage – buying a company's convertible bonds and shorting its common shares – had the highest inflow (of funds in second quarter of 2003 among the different hedge fund strategies)" *Financial Times* (August 20, 2003).

In recent years, the size of the US convertible market has grown to be about 60% of the US high yield market (approximately US$0.5 trillion, Lehman Brothers). The success of the convertible bond market has generated significant academic research interest in the pricing of convertible bonds. While many theoretical pricing models for convertible bonds have been developed, the number of extensive empirical studies on the market pricing of convertible bonds remains small. This deficiency is probably due to the complexity of the computations necessary for the multiple contractual features of a typical convertible bond. Our study is an effort to provide a more comprehensive investigation on the pricing of US convertible bonds.

Ingersoll (1977a) and Brennan and Schwartz (1977) apply a contingent claim approach to price convertible bonds using firm value as the underlying variable. Brennan and Schwartz (1980) further extend the convertible bond model with a stochastic interest rate process, but conclude that the improvement from the incorporation of a stochastic interest rate is very small for the pricing and suggest that stochastic interest rates can be ignored for empirical purposes. Similar to Brennan and Schwartz, Buchan (1998b) builds a convertible bond pricing model with firm value and interest rates as the underlying variables. She integrates a "safety premium" in the firm's actual call policy, analyzes the existence of call protections and proposes a modified Monte Carlo procedure to numerically solve for the convertible bond price.

The advantage of using firm value as the underlying variable in a contingent claim approach is that it can endogenously take into account of the default risk. But, as firm value is not a traded asset, its market value cannot be easily measured. To price convertible bond with this approach also requires simultaneously valuing all other more senior liabilities of the issuer.

In view of this practical difficulty, McConnell and Schwartz (1986) propose a pragmatic approach to price convertible bonds with stock price as the underlying variable. They suggest using the *current credit rating and the contemporaneous market credit risk-adjusted interest rate* to take into account of the *conditional* default on the pricing of convertible bonds. Tsiveriotis and Fernandes (1998) extend the approach of McConnell and Schwartz by modeling the convertible bond as a portfolio consisting of a straight bond component and a stock component. They derive a partial differential equation for each of the two components and solve the two equations simultaneously for the convertible bond price.

On the other hand, Takahashi, Kobayashi and Nakagawa (2001) model the convertible bond prices with a reduced-form approach derived from the Duffie and Singleton (1999) approach of modeling defaultable bonds. By allowing the parameters of the model (conditional default risk premium, hazard rate, etc) to be conditional on the realizations of the current state variables (equity price, etc), this dynamic model can potentially overcome many of the criticisms of the more static models that may fail to take into account of the non-linearity of volatility as the state variables evolve. The main cost of implementing the Takahashi, Kobayashi and Nakagawa (2001) model with the Duffie and Singleton (1999) approach is that it is subject to more estimation errors as there are more parameters to estimate compared with the Tsiveriotis and Fernandes (1998). We will report results from both of these models to examine the robustness of our main hypotheses. In all these models, the conditional default effects are taken into account either explicitly in the modeling or implicitly in the prevailing market credit risk-adjusted interest rates.

Empirically, King (1986) studies the pricing of US convertible bonds using firm value as the underlying variable. He finds that there is an average underpricing of 3.75% for his 103 bond samples. Furthermore, he finds that in general deeply out-of-the-money bonds are underpriced; however, at-the-money or in-the-money convertible bonds are slightly overpriced. Carayannopoulos (1996) empirically investigates the pricing of US convertible bonds using a theoretical model with firm value and interest rates (Cox-Ingersoll-Ross short rate process) as the underlying variables. His findings are basically consistent with King (1986) and he finds that market prices are in general lower than the theoretical values by 12.90%.

Buchan (1998a) illustrates the underpricing of convertible bonds by implementing a hedge fund style convertible bond arbitrage strategy from January 1989 to June 1996 – taking long positions in an equally weighted portfolio of convertible bonds and taking short positions in the corresponding underlying stocks and in Treasury notes. She finds that the convertible hedging portfolio earns an average return of 75.53 basis points per month net of transaction costs, or an average excess return (over risk-free return) of 30.37 basis points per month net of transaction costs.

Ammann, Kind and Wilde (2003) investigate the French convertible bond market based on the Tsiveriotis and Fernadez (1998) (**TF**) model and daily market prices of 21 most active French convertible bonds from February 1999 to September 2000. They show that the observed market bond prices are, on average, 3% lower than the theoretical prices. Carayannopoulos and Kalimipalli (2003) investigate US convertible bonds with a model similar to the Takahashi, Kobayashi and Nakagawa (2001) model (**TKN**). Their bond sample consists of monthly closing price observations based on 25 US convertible bonds over a 21 month period (January 2001 to September 2002). Similar to previous research findings, they find that market prices of out-of-the-money convertible bonds are significantly lower than the theoretical values, some of which to the extent that their prices often imply *negative* imbedded option prices.

Empirical research on convertible bonds involves significant computational work to numerically solve for each theoretical bond price on each observation date. Each calculation requires many input parameters such as the bond contractual specifications, the underlying stock price, a schedule of conversion prices, interest rates, and estimates of dividend yield and volatility. These complexities may be a major reason why most of the existing literature of empirical research on convertible bonds relies on only a small number of bond price observations per convertible bond or a small number of convertible bonds. This narrow coverage of analysis makes it difficult to have a clear overall picture about the actual valuation process of convertible bonds in the market. King (1986) uses data from two trading days (bonds priced on March 31, 1977, and December 31, 1977). Carayannopoulos (1996) uses data from 12 trading days (monthly data over one year). Buchan (1997) uses data of 1 trading day (bonds prices on March 31, 1994). Carayannopoulos and Kalimipalli (2003) use a total of 434 observations. Ammann, Kind and Wilde (2003) use daily market prices of French convertible bonds to include more bond price observations; however, their bond sample covers only 21 French convertible bonds.

This paper is an attempt to look at the big picture through a comprehensive empirical investigation of all the actively traded US convertible bonds within a recent period. We investigate the daily market prices of a sample of 107 convertible bonds from their first available observations to the end of February 2003. We examine the time-series of the discrepancy between market prices and theoretical prices of convertible bonds. Furthermore, we also analyze the relationship between the discrepancy and the bond characteristics. We hypothesize that the discrepancy between the observed market price and the theoretical price is induced by the possibility that a convertible bond might renegotiate on some of its covenants.

In order to ensure that the observed price discrepancy is not driven by a particular theoretical model, we compute theoretical prices derived from three different models of convertible bonds: the classic McConnell and Schwartz (1986) model, the Tsiveriotis and Fernandes (1998) extension of the McConnell and Schwartz model, and the Takahashi, Kobayashi and Nakagawa (2001) - Carayannopoulos and Kalimipalli (2003) model based on Duffie and Singleton (1999). The theoretical prices are similar and therefore the empirical results are robust with respect to alternative model specifications.

We find that the lower the bond is rated, the larger is the underpricing at the initial private and public offerings. The underpricing worsens if the issuer experiences subsequent financial difficulties. But, most importantly, *conditional on no subsequent rating downgrades over the next 500 weekdays, the convertible bond's market price converges to the theoretical price* and becomes even slightly overpriced as discussed in Ingersoll (1977b). *Thus, the observed underpricing is mostly limited to the seasoning process and when the company faces imminent financial difficulties.* This seasoning period is shorter for bonds with higher ratings.

It should be noted that, in some aspects, this seasoning effect is observationally equivalent to the perception that convertible bond arbitrage profits could be traced to the market updating (seasoning) of the volatility reflected in the imbedded options. Indeed, for convertible bonds whose imbedded options are not close to the boundary conditions, we can observe the equivalent gradual seasoning (convergence) of the implied volatility to the recent historical volatility. But, this seasoning of the implied volatility would not apply to bond issuers who experience significant financial difficulties, especially those with convertible bond prices that imply negative imbedded option values [see Carayannopoulos and Kalimipalli (2003)]. The convertible bond prices of these distressed issuers are more consistent with the expectation that some of the bond covenants, e.g., an imbedded put, may not be honored or be subject to renegotiations.

The outline of this paper is as follows. In section 2, we first document some relevant stylized facts and then describe the valuation models and the data set. Section 3 discusses the hypotheses and presents the empirical results. We also investigate the robustness of our results by comparing against alternative models and alternative hypotheses. Section 4 concludes the paper.

2. The Stylized Facts, the Model and the Data

The theoretical value of a convertible bond is often calculated as the sum of values from a non-convertible bond component and the imbedded options. It is tempting to ascribe the underpricings of convertible bonds relative to non-convertible bonds to the differences in their expected credit losses (default probability × loss given default). The relevant stylized facts are documented in a large scale study by Moody's entitled "Default and Recovery Rates of Convertible Bond Issuers: 1970 to 2000." The study looks at the default history and recovery rates of *all* Moody's rated convertible bonds issued during that period. Moody's finds that, within the same rating class, there are no meaningful differences in default probability between convertible bonds and non-convertible bonds.

There is, however, a difference in the recovery rates between convertible and non-convertible bonds for all classes of seniority. But, the difference is statistically reliable only in the subordinated class with an average difference of 13 percent in the recovery rate (per $1 in market price of non-convertible bonds post-default) between convertible bonds and non-convertible bonds. This difference could explain the "underpricing" of the convertible bonds in the magnitude of 3 to 10 percent (as in some of the recent empirical studies) if the conditional default probabilities of the convertible bonds are substantial, say in the range of 25 percent or more.

But, the same study also points out that the historical population default probabilities are not so high. For investment grade convertible bonds, the cumulative 1-year default rate is 0.11 percent and 5-year default rate is 1.72 percent. For speculative grade, the corresponding rates are 3.25 percent and 15.72 percent. When we multiply these default probabilities with the differences in recovery rates to arrive at the differences in expected credit losses between convertible bonds and non-convertible bonds, they cannot explain the documented underpricing of the convertible bonds unless the near-term conditional probabilities of default are substantial.

These stylized facts point out that the "underpricing" of convertible bonds should be more apparent in times of heightened financial uncertainty of the issuers, for example, when their bonds are downgraded or when they are first issued. The later case is related to the well documented historical hazard rates of default (see Figure A.1 in Appendix: *from Moody's report*) that show that the probability of defaults reaches the peak in the second year after the issuance of the convertible bonds (and non-convertible bonds) and *declines thereafter* (the "seasoning"). The conventional wisdom for this pattern (see Moody's report) is that within the first few years, "the cash available from the debt is used up and the firm demonstrates itself and its business plan to be viable, or it defaults." The flip side of this argument is that we would expect the price of a convertible bond to move towards its idealized model price conditional on no new negative information.

The Moody's article also attributes that the lower recovery rates for convertible bonds to their "effectively" subordinated status (even though they may not be contractually subordinated). Very often, convertible bonds "have no covenants that restrict what happens at the operating company, their (convertible bondholders') consent is not needed for restructuring … while better positioned creditors at the operating company do other things to improve their position." Given that, the threat of restructuring, *without actually going into default*, is sufficient to pressure convertible bondholders into renegotiating their terms in heightened financial uncertainty. Thus, when the conditional probability of default increases, the price of convertible bond will fall not only because of the increase in expected credit loss, but also the expected concessions from renegotiated terms as illustrated in the following examples.

2.1 Why Market Prices Deviate from "Theoretical Prices?" —— Three Examples

Theoretical convertible bond prices do not usually take into account of the facts that the convertible bond covenants are often renegotiated in heightened financial uncertainty without going into defaults. As the following examples will show, the subtlety of these renegotiations makes it difficult to parameterize them explicitly in a theoretical model.

Our first example is CoreComm's renegotiation with its convertible bondholders in 2001 (see Appendix A.2). As CoreComm was experiencing financial difficulties, it first pressured its convertible bondholders into accepting a binding agreement as convertible bonds are the lowest in the pecking order other than equity. After the acceptance by the convertible bondholders, CoreComm would negotiate with the other non-convertible bondholders conditional on the binding agreement with the convertible bondholders (note: reversing the order of negotiation will induce a windfall on the convertible bondholders at the intermediate step which may change the negotiated outcome). This sequential nature of renegotiations points out the difficulties in modeling CoreComm's convertibles bonds as non-convertible bonds with options.

Our second example is related to the common practice of convertible bond issuers to imbed a schedule of put options in the convertible bonds to make them more attractive to the investors as investors can exercise their put options and force the issuers to buy back their bonds when the underlying stock price is falling. Issuers, on the other hand, often try to renegotiate with the investors not to exercise their puts if the company is cash-stranded. The article "Convertible Bombs" (*Economist,* Nov 14, 2002) illustrates this common scenario with the example of Tyco's 20-year convertible bond (issued in 2000) in which "…days before the (put) decision date (Nov 17, 2001)… Tyco held an upbeat investor meeting, stoking demand for its shares. The put option was largely ignored, much to the regret of many investors (later)…"

Those companies who are forced to honor their puts (e.g., Marriott, US Bancorp, Anadarko Petroleum, etc.) "have seen their stock hit hard" while their convertible bond prices move up to the exercise prices. Other convertible bond issuers (Cendant, Cox Communications, Neuberger Berman) "have bought off investors by sweetening terms, such as adding an interest payment, call protection or opportunities for future puts" with varying degrees of success. The sequential nature of the renegotiations also makes the underlying stochastic process rather complicated (see, e.g., Bensoussan and Lions [1984] and also the literature on endogenous debt renegotiation, e.g., Fan and Sundaresan [2000]) and the stock price and bond price often move in *opposite* directions in the process.

On the other hand, our third example shows that the market price of a convertible bond can also increase due to a reduced likelihood of renegotiations. Take the case of Sanmina-SCI convertible bonds with an imbedded put option schedule. On October 29, 2002[1], it was revealed in the earning conference call that the company has been reducing "amount of (their) convertible debt coming due in 2004 and 2005." The bond price reaction is illustrated in Figure 1. The theoretical prices are represented by the top curves. The market prices are represented by the solid curve. The "theoretical prices without the put option" are represented by the curves below. The bottom curve is the conversion value. It is interesting to note that the market price is always between the idealized theoretical curves (where the covenants are expected to be honored) and the curves assuming the company will not honor the put. It is clear from the graph that the market price of the convertible bond is supported by the existence of the put. After the signal that the issuer has enough money (the announcement of the recent buy-back of convertible bonds) to honor the put schedule in the convertible bonds, the convertible bond market price moves towards the idealized theoretical price, even though the stock price (and hence the conversion value) continues to fall.

Figure 1 about here

2.2 Model

To investigate our hypothesis on the "underpricing" of convertible bonds, we need a theoretical valuation benchmark. In this study, we look at the empirical results based three different benchmarks: the classic McConnell and Schwartz (1986) model, the Tsiveriotis and Fernandes (1998) (**TF**) extension of the McConnell and Schwartz model, and the Takahashi, Kobayashi and Nakagawa (2001) (**TKN**) - Carayannopoulos and Kalimipalli (2003) model based on Duffie and Singleton (1999). We find that our results are quite robust to the three model prices. This is not surprising because the magnitude of the underpricing is so large relative to

[1] Source: FD (Fair Disclosure) Wire, October 29, 2002 from LexisNexis.

the theoretical price differences between the various models. The following is a brief summary of those models.

Tsiveriotis and Fernandes (1998) (**TF**) [also used in Ammann, Kind and Wilde (2003)] is an extension of the theoretical framework of McConnell and Schwartz (1986), which uses the current credit risk adjusted interest rate to take into account of the conditional default risk in the valuation process. In order to better handle the state-dependent credit risk exposure of a convertible bond, Tsiveriotis and Fernandes consider the value of a convertible bond as the sum of two parts: cash-only component and non-cash equity component. Two differential equations are derived: one for the whole Convertible Bond value (CB) and another for the Cash-Only part of Convertible Bond (COCB). The holder of COCB is entitled to receive all cash flows only but no equity flows that a convertible bondholder will receive from bondholder's optimal conversion decision.

In this study, we also use the convertible bond valuation model in Takahashi, Kobayashi and Nakagawa (2001) (**TKN**) [also used in Carayannopoulos and Kalimipalli (2003)]. This model takes into account of the conditional default risk exposure of the convertible bond conditional on the current information set (for example, the current equity value). Takahashi, Kobayashi and Nakagawa (2001) develop a reduced form model based on the Duffie and Singleton (1999) approach. To model the convertible bond price, they take the pre-default underlying stock price, S_t, as the state variable and model the default hazard rate, $\lambda(S_t, t)$, as a non-negative decreasing function of the underlying stock price. Hence, it takes into account of the negative relationship between the underlying stock price and the default possibility. From this, they derive the partial differential equation governing the convertible bond price. Carayannopoulos and Kalimipalli (2003) implements the Takahashi, Kobayashi and Nakagawa model with the hazard rate having the functional form, $\lambda(S_t, t) = \exp(-\beta \times S_t)$, in order to reduce the parameter estimation requirements. We will use the same approach as Carayannopoulos and Kalimipalli (2003) in our empirical tests with 70% to be the loss given default[2]. The loss rate is based on the survey of default and recovery rates of U.S. convertible

[2] Interested readers about the implementation of the model can refer to the detailed discussion in Takahashi, Kobayashi and Nakagawa(2001) and Carayannopoulos and Kalimipalli (2003). As the straight bond price data from the convertible bond issuers in our analysis are not always available, we have to use the credit risk premium data for the same credit rating of the convertible bond to estimate the straight bond price (with the same coupon rate and the time-to-maturity) and then estimate the required parameter for the hazard rate function in the Takahashi, Kobayashi and Nakagawa model.

bonds from Hamilton (2001, p.13-14), where the estimated recovery rate for convertible subordinated bonds is $28.84 per $100 par amount.

2.3 Data

Convertible Bond Data Set

Our sample of convertible bonds and their market prices are obtained from *DataStream International*. The "*USCV*" (US convertible bonds) database contains basically all US domestic convertible bonds with face values greater than US$100 million. They can be convertible bonds issued by industrial or financial companies. A convertible bond is removed from "*USCV*" if the bond has matured, or has been redeemed or called early by the issuer or fully converted. [3]

We have downloaded data at different points in time from May 1999 to August 2003 to determine the survivorship characteristics of the data set. The most encouraging characteristic is that defaulted convertible bonds are still being carried in the dataset, though the "market prices" of these bonds are of questionable quality. On the other hand, while most convertible bonds satisfying the minimum size requirement are included in the dataset from their initial private or public offerings, *DataStream* does not make clear the criterion it uses to select which bond to record its market prices.[4] This may introduce some unknown selection bias and, in some way, this backfilling recording uncertainty limits our ability to investigate unconditional market efficiency in a systematic way and there is no other more comprehensive and systematic convertible bond data source that would allow us to supplement the data.

Thus, to create a sample that is least impacted by this selection bias, we limit ourselves to convertible bonds that are initially rated at B2 (Moody's ratings) or above in a recent period. An additional reason to limit our attention to bonds with a rating of B2 or higher is related to the

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[3] Information is provided by the Research Helpdesk from Thomson Financial.

[4] After downloading bond data from different points in time, we find that *Datastream* sometimes fills in price information ex-post. In other words, a convertible bond may exist in the data set without price information in an earlier download. In a subsequent download, the price data are filled in even for the period before the previous download. This induces a possible survivorship as bonds that default soon after issuance might not make it to the data base. We speculate that this might be the reason why the number of defaulted bonds in *Datastream* is less than what one would expect from the historical distribution. But, once the market prices of a convertible bond are included, *Datastream* continues to carry the bond prices even after the bond defaults.

practical difficulty of obtaining reliable market credit risk premium for bonds rated below B2. Thus, in this study, the empirical results apply only to this subset of the universe of convertible bonds and should not be generalized to bonds whose initial ratings are below B2.

Given all these considerations, we select our convertible bond sample in accordance with the following criteria: (1) we include only convertible bonds with initial Moody's credit ratings not lower than B2; (2) we only use those convertible bonds whose first recorded market price appears in 2001 or later to limit other possibilities of survivorship bias in the data source; (3) we only use those convertible bonds with sufficient data for calculations, e.g. stock price data and complete contractual specifications.

The choice of 2001 as the start date is due to a significant increase in the coverage of convertible bonds by *Datastream* starting with 2001 [see also Carayannopoulos and Kalimipalli (2003)]. Based on the above criteria, we include 107 US convertible bonds for this study. Daily market prices for each convertible bond from its first available observation to the end of February 2003, if available, are obtained from *DataStream*. Data related to bond contractual specifications, including face value, coupon rate, call schedule, put schedule, coupon date, maturity date, initial offer price, initial conversion price, etc, are obtained from the offering prospectuses as the contractual information provided by *DataStream* contains too many omissions. As convertible bond holders are protected from stock dilution events, such as stock split, right issue or issuance of stock dividend, the conversion price (and conversion ratio) is subject to adjustment. The history of conversion price adjustment is obtained through other supplementary sources, including company annual reports, newspapers, and other sources. Information about our convertible bond sample is presented in the appendix Table A.1.

Interest Rate, Credit Risk Premium, Stock Price, Dividend, and Volatility

Risk-free interest rate data are constructed from the US Treasury bond yields. Weekly data of the prevailing credit risk premiums for different rating class is obtained from *Bloomberg*. The underlying stock price and dividend yield data is obtained from *DataStream*. We estimate the dividend yield by calculating the moving average of the previous one-year dividend yield data. We estimate the volatility of underlying stock with the historical volatility estimate from the previous one-year's stock price data.

3. Hypotheses and Empirical Results

3.1 Hypotheses

Our hypothesis is that convertible bonds, being the lowest in the pecking order other than equity, are more likely to be subject to some renegotiations of the indenture terms if the company experiences some financial difficulties. Thus, a convertible bond will be underpriced relative to any of the idealized theoretical models unless the probability of restructuring is trivial. In this study, we will examine the following testable implications consistent with our hypothesis.

H.1 Initial underpricing is correlated with the rating of the issuer

Based on our earlier discussion in section 2, the underpricing of convertible bonds is related to the probability of renegotiation on some of their covenants. Thus, if the credit rating is high, the likelihood of renegotiations is low and the underpricing should be small. We predict that the higher the convertible bond rating, the smaller is the underpricing at the initial market price.

H.2 A convertible bond becomes more underpriced after a significant decline of its stock price

As the probability of renegotiating or defaulting on some of the convertible bond covenants increases when the company gets into financial difficulties, we predict that the underpricing becomes larger immediately after a significant decline of the stock price.

H.3 Most importantly, conditional on no downgrading of its securities, the convertible bond price will converge to the idealized theoretical price after seasoning

According to Moody's study above, *the seasoning happens typically within the first few years* for convertible bonds (with usual maturities of more than 15 years). The market updates the credit worthiness of the bond as time elapses. If there is no subsequent negative news significant enough to downgrade the convertible bond, we predict that the market prices of convertible bonds will converge to their theoretical prices and the convergence is earlier for higher rated bonds.

3.2 Empirical Results.

All the empirical results reported in this study are repeated for the three theoretical benchmarks derived from the McConnell and Schwartz (1986), Tsiveriotis and Fernandes (1998), and Takahashi, Kobayashi and Nakagawa (2001) models. The theoretical prices of the three models are similar and therefore the empirical results are robust with respect to those model specifications. As the results from McConnell and Schwartz (1986) are essentially the same as those of Tsiveriotis and Fernandes (1998), we will only report the results from the Tsiveriotis and Fernandes (1998) (**TF**) and Takahashi, Kobayashi and Nakagawa (2001) model (**TKN**) models. Comparing the two models, the main attraction of the **TF** model is its simplicity while the **TKN** model is more dynamic but may be subject to more estimation errors as there are more parameters to estimate.

3.2.1 Initial underpricing is correlated with the rating of the issuer

We construct a numerical variable corresponding to Moody's ratings, with "Aaa" being assigned a numerical value of 1 and "B2" a value of 15 (see Table 1). The initial "pricing error" is defined as the "the difference between the offer price and the theoretical price divided by the theoretical price". The mean of initial pricing error within each rating category is also reported in Table 1 for both the **TF** model and the **TKN** model. The mean underpricing for the **TF** model is 9.37%. The mean underpricing for the **TKN** model is 9.18%. The overall magnitude of underpricing is about the same, though the **TKN** estimates are more variable.

One can see from Table 1 that the lower rated bonds tend to be more underpriced at the initial issuance. When we regress the initial pricing error (of individual samples) on the numerical rating, the slope coefficient, which reflects the relation between the initial pricing error and the rating variable, is negative with a t-statistics of -1.64 for the **TKN** model and -4.97 for the **TF** model. Thus, the evidence shows that indeed the lower the bond rating, the larger is the magnitude of the undepricing.

A potential alternative explanation of the underpricing of convertible bonds is the presence of other more senior debts in the capital structure of the company. To test this possibility directly, we regress the initial pricing error (of individual bond samples) on the debt-equity ratio (defined as the sum of short and long term debt over the total common equity). While the slope coefficient is negative, the t-statistic is only -0.03 for the **TKN** model and -0.19 for the **TF** model. Thus, it does not appear that the presence of other debt is related to the underpricing of the convertible bonds.

Table 1 about here

We have also examined the relation between the initial pricing error and the moneyness, which is defined as the conversion value over the corresponding straight bond value. In general, a convertible bond with higher moneyness has a lower magnitude of initial underpricing at their initial issuance. This result is consistent with the finding of Carayannopoulos and Kalimipalli (2003). However, as we will see later in sections 3.2.2 and 3.2.3, the seasoning of the convertible bonds over the next two years eliminates their underpricing, even for those convertible bonds which are "out-of-money." Thus, being "out-of-money" by itself does not imply underpricing. On the other hand, the gradual elimination of the underpricing may be interpreted as the market updating of the volatility and other parameters of the convertible bonds. We will look into this point more closely in the next two sections.

Note that the underpricing we report here is quite different from the typical underpricing related to IPO. We are not measuring the usual "risk-adjusted return" of being able to buy the security at the offer price and realize abnormally high return during the first few trading days of an IPO. If convertible bonds could be replicated by non-convertible bonds plus options, what we are reporting here is the violation of this "arbitrage relation" and the convertible bond underpricing can last for months and years after the public trading. Of course, our hypothesis is that this arbitrage relation does not hold because we cannot replicate a convertible bond with non-convertible bonds plus options unless convertible bonds enjoy the same protection as non-convertible bonds. As this differential is related to the probability of renegotiations, the negative relation between bond rating and the initial underpricing is consistent with our hypothesis.

3.2.2 A convertible bond becomes more underpriced after a significant decline of its stock price

Consistent with our hypothesis of why convertible bonds are underpriced, we should detect a further widening of the market price and the theoretical price when the probability of renegotiations increases. In this section, we investigate the relationship between the underpricing magnitude and the stock price level. Table 2 reports the average underpricing magnitude of convertible bonds given different levels of stock price drop from the high level during the sample period (i.e., since the convertible bond issuance). In general, the underpricing magnitude is larger if the prevailing stock price has dropped by a greater magnitude from its high.

Table 2 about here

To examine this relation more precisely, we compare the "underpricing" of a convertible bond after a dramatic drop in its stock price with the "underpricing" before the event. We also compare this *change* in the "underpricing" with that of a control group over the same calendar time. We define a dramatic drop of stock price as falling at least 50% within the last ten trading days. Within our sample of convertible issuers, we scan for such an event during our sample period and find 15 such issuers.

We define the event date t = 0 as the first day that the issuer's stock price has dropped by more than 50% relative to the stock prices from day t = -10 to t = -1. We define the "mean pricing error for the next 10 days" as the average of "the difference between the market price and the theoretical price divided by the theoretical price" from t = +1 to t = +10, and the "mean pricing error for the last 10 days" as the average from t = -10 to t = -1. Table 3a (based on **TF** model) and Table 3b (based on **TKN** model) compare the mean pricing error before and after the event of a stock price collapse. The average after-event pricing error is 9.77% more than the before-event pricing error with a t-statistics of 4.42 (Table 3a) for the **TF** model and 10.25% (t-statistics of 4.16) for the **TKN** model. The magnitude is both economically and statistically significant, and it is consistent with our story that when the issuer experiences difficulties, the normal arbitrage condition between non-convertible bonds (plus options) and convertible bonds will be further violated. This empirical result is also consistent with the findings of King (1986) and Carayannopoulos and Kalimipalli (2003) where they find that out-of-money convertible bonds are more significantly underpriced.

Table 3a and Table 3b about here

To further verify that the before and after event difference is not due to certain common events (e.g., a stock market crash) that affect all convertible bonds, we construct a controlled sample of convertible bonds (to match against each of the 15 convertible bonds) whose issuers have not experienced any stock price collapse up to the same calendar time. The results are in Table 4a (**TF** model) and Table 4b (**TKN** model). The controlled group does not experience similar changes in their pricing errors in the same calendar time. The difference between the suffering issuers and the control group, reported in Panel B of Table 4a, is 10.41% (with a t-statistic of 4.55) for the **TF** model and 10.91% with a t-statistics of 4.92 for the **TKN** in Table 4b. Thus, the evidence is consistent with the hypothesis that the change in the average pricing error before and after the event is due to the heightened possibility of renegotiations or default after the significant stock price decline.

As Carayannopoulos and Kalimipalli (2003) observe, convertible bond prices can become so low that they imply *negative option values*. In these cases, the underpricing of convertible bonds cannot be due to just market misestimating volatility or other option related parameters. Such underpricing has to come from the increased likelihood that some of the bond covenants would be violated or renegotiated.

Along this line of reasoning, we would expect a similar pattern if we look at bond rating downgrades instead of stock price collapses. As we will see in the next section, the evidence is broadly consistent with this hypothesis. Events leading to rating changes, however, tend to occur over extended period of time (starting with credit watch) and the timing is not as sharply defined as a stock price collapse. Therefore, it is more natural to examine the evolution of the pricing error through time conditional on rating changes (or lack of). This is the subject of the next section.

Table 4a and Table 4b about here

3.2.3 Time-series behavior of pricing errors and convergence

In this section, we examine how pricing errors evolve over time and the conditions under which they will converge to zero. The time-series of pricing errors for all convertible bonds are reported in Figure 2a and Table 5a (**TF** model) and Figure 2b and Table 5b (**TKN** model). On average, the underpricing of all bonds, including high, medium and low grade bonds, seems to disappear after two years. While this is true for bonds of different *initial* ratings, we will see that it is not true for low grade bonds that experience a rating downgrade.

Table 5a and Table 5b about here

Figure 2a and Figure 2b about here

Before we look at the data more closely, we like to repeat our earlier caveat that our investigation here is limited by the aforementioned inclusion bias in the data base and the general lack of accurate market credit risk premium information for low grade bonds and the irregularity of defaulted bond prices. As such, the data limitation prevents us from conducting a general test of market efficiency for convertible bonds as the calculated pricing errors become unreliable for bonds whose issuers experience significant financial difficulties.

There are, however, other interesting implications that we can examine which avoid this data problem. In particular, the main implication of our discussions is that if a convertible bond rating is not downgraded, the conditional probability of renegotiations decreases over time (see aforementioned Moody's study) and we expect the pricing error to converge to zero or become slightly positive [Ingersoll (1977b)]. Thus, the most important hypothesis we examine in this study is that the convertible bond price do converge to the theoretical price as the probability of renegotiation decreases.

To test this implication, we select *ex-post* the subset of convertible bonds that have no rating downgrade in the 500 weekdays after their first price observations. There are 82 such convertible bonds in our sample. The pricing errors for this subset of bonds without rating downgrades are reported in Table 6a and Table 6b for the **TF** and **TKN** models, respectively. The time-series of their pricing errors are plotted in Figure 3a and Figure 3b. We divide the convertible bonds into three sub-groups. The "high grade" group contains bonds with *initial ratings* between Aaa and A3. The "medium grade" group contains bonds between Baa1 and Baa3. The "low grade" group contains bonds between Ba1 to B2. The initial underpricing is significantly negative for each of the three groups, including the group of high grade bonds. Over time, *conditional on no rating downgrades*, the average pricing errors for all three groups converge to zero or slightly above. From Figure 3a and Figure 3b, it is obvious that the convergence is earlier for the higher rated bonds.

Table 6a and Table 6b about here

Figures 3a and 3b about here

This time-series convergence pattern is consistent with our hypothesis. In some sense, it is the mirror image of the time-series pattern of defaults in Moody's study (Figure A.1 in Appendix). As the conditional probability of default decreases over time given no downgrades, one would expect the time-series of pricing errors to converge to zero. Conditional on the same amount of elapsed time, one would expect the conditional probability of default to be lower for higher rated bonds, and therefore the convergence sooner. Figures 3a and 3b confirm this intuition.

We also look at the results corresponding to a further subset of bonds that experience no rating changes (i.e., excluding those with upgrades). The results are similar and they are reported in Table 7a and Table 7b and plotted in Figure 4a and Figure 4b. Thus, conditional on no rating changes, the average pricing error of convertible bonds will also converge to zero.

Table 7a and Table 7b about here

Figure 4a and Figure 4b about here

To analyze our hypothesis further, we contrast the above results with the results on the complementary subset of convertible bonds that experience at least one rating downgrade in the first 500 weekdays of available price observations. The results are reported in Table 8a and Table 8b for the **TF** model and the **TKN** model, respectively. Here, the pricing errors are understated for bonds with downgrades because if the issuer's rating is drastically lowered beyond the range in which we can get reliable risk premium, we have to drop the bond. Hence, the average pricing error for this group of convertible bonds is likely to be understated. With the potentially understated pricing errors, we see from Table 8a and Table 8b that the lower rated bonds' pricing errors remain economically and statistically negative with a mean of -13.34% for the **TF** model and -14.81% for the **TKN** model five hundred weekdays after the first price observation. The results are also plotted in Figure 5a and Figure 5b (plotted *using the same scale* as in Figures 3a and 3b). The lack of price convergence in Figure 5a and Figure 5b for convertible bonds with downgrades is drastically different from the price convergence of bonds without any subsequent downgrade in credit rating in Figure 3a and Figure 3b.

Table 8a and Table 8b about here

Figure 5a and Figure 5b about here

3.3 Robustness Tests and Discussions

What we have shown is that *convertible bond prices do converge to their theoretical prices* over time if there is no negative news. The much discussed "underpricing" of convertible bonds is mostly a phenomenon of convertible bonds that are newly issued or have experienced significant negative events. One plausible explanation for such underpricing is that the convertible bond ratings are obsolete if rating agencies tend to be slow in downgrading. To test this hypothesis, we re-compute the results in section 3.2.2 (underpricing gets worse after significant price drop) and section 3.2.3 (convergence to theoretical prices) with the assumption that rating agencies err by three notches. In other words, if the current rating of the convertible bond is A2, we compute the theoretical price by assuming the convertible bond's "true" rating is Baa2 and use the credit-risk adjusted interest rate of Baa2 (down from A2 to A3 to Baa1 to Baa2).

The results in section 3.2.2 are not much affected because a three-notch downgrade would hardly make up a price deviation of about 10 percent. Results in section 3.2.3 are also not much affected: those that converge (Tables 7a and 7b, Figures 4a and 4b) will continue to converge with the higher credit-risk adjusted interest rate, and those that do not converge (non-investment grade bonds that experience at least one downgrade, Tables 8a and 8b and Figures 5a and 5b) will still not converge as a three-notch downgrade would only make a slight improvement on the underpricing but would not make up an underpricing of about 13 percent (Tables 8a and 8b, last column).

Since we select in our sample only convertible bonds whose first available price information occurs in 2001 or later, the convergence of pricing errors in Table 7a and Table 7b (bonds without any subsequent change in credit rating) cannot be driven by the maturing of the bonds as convertible bonds tend to have long maturities (typically 15 years or longer, though some might be as short as 5 years). A possible alternative explanation of the convergence might be due to the increase in the stock price of the issuers whose ratings have not been downgraded. When the conversion value becomes higher than the "straight bond component" of the convertible bond, the conversion option is in-the-money and the pricing error is likely to be small. To test whether being in-the-money is necessary for the convergence of the pricing error, we construct a subset of convertible bonds whose implicit options are out-of-money *at the end of the sample period*. Among convertible bonds that do not experience any rating downgrades, we select those whose conversion value at the end of the sample period are between 50 percent and 90 percent of the straight bond value. The lower bound of 50 percent ensures that the sample does not contain bonds whose issuers are experiencing financial difficulties but their ratings are not downgraded yet. We find that despite the out-of-moneyness of the option value of these convertible bonds, their pricing errors still converge to zero in the sample period. Thus, it is not necessary for the implicit conversion option to be in-the-money for the pricing errors to converge.

3.3.1 Volatility Updating

Another possible explanation[5] for the convergence of convertible bond price is the initial erroneous volatility estimation of the market. If market participants initially underestimate the volatility level and later update properly the volatility estimate, it may also induce the type of convergence of convertible bond prices as found in our result. In order to examine this potential explanation for the convergence of convertible bond prices, we first simulate convertible bond prices at different levels of volatility and find that in order for the average initial market prices and theoretical convertible bond prices to be the same, the volatility has to be at about the 70% level of the historical volatility (estimated over the past 12 months). Perhaps this explains the popular perception that convertible bonds tend to underprice volatility and this would give rise to arbitrage profits.

To examine this possibility further, we plot the average (across the convertible bonds in our sample) implied volatility against the average historical volatility over time in Figure 6a (**TF** model) and Figure 6b (**TKN** model). In constructing those plots of implied volatilities, we have to filter out convertible bonds whose prices are close to boundary conditions or have negative option values as these bonds produce unreasonable implied volatilities. In Figures 6a and 6b, we exclude bonds with implied volatilities of 150% or more[6]. Thus the bonds that enter into the average implied volatility curves tend to be those issuers that experience a rather smooth growth path than those that suffer a drastic collapse in equity price or downgrades. For these convertible bonds, their average implied volatility converges to the average historical volatility within a year after trading. In this aspect, the updating of the implied volatility is observationally equivalent to our hypothesis on the updating of the credit worthiness of the issuers, and each of the two

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[5] We thank an anonymous referee for suggesting this possible explanation.

[6] Since the historical volatility estimates for all convertible bond observations are far less than 150%, we use this value as a filter for implied volatility estimate. As the average implied volatility and the average historical volatility are calculated from observations with reasonable implied volatility estimates, the numbers of bond observations used for calculating those average values in the two Figures are different.

explanations can be a contributing factor to the convergence of the market price to the theoretical price.

Thus, we can separate our sample of convertible bonds into two groups. The first group of convertible bonds whose issuers do not experience any significant subsequent financial distress, their bond price behavior over time is consistent with both our hypothesis of updating of credit worthiness of the issuers and the hypothesis of market learning and updating of the volatility. On the other hand, for the other group of issuers who experience significant subsequent financial uncertainty, the time-series of these bonds cannot be easily ascribed to market updating of volatility as boundary conditions can be violated. The behavior of these convertible bonds are more consistent with our hypothesis that increased financial uncertainty leads to increased likelihood of covenants renegotiations and a widening of market price relative to the idealized theoretical price.

Figure 6a and Figure 6b about here

4. Conclusion

We empirically analyze the much reported underpricings of convertible bonds. The main finding of our study shows that seasoned convertible bonds without a rating downgrade actually converge to their theoretical prices within the first 500 weekdays. Thus, the much reported underpricing is mostly limited to the initial seasoning process and to the cases of heightened probability of renegotiations or default on some of the bonds' covenants after the issuers experience some significant negative events.

We find that the underpricing at the initial private and public offerings is related to the convertible bond ratings: the lower the bond ratings, the larger the initial underpricing. We hasten to point out that this initial underpricing is different the usual evidence of abnormally high return during the first few trading days of an IPO. The convertible bond underpricing is a violation of the "arbitrage" relations and it can last for months and years after the public trading.

Furthermore, we find that the underpricing increases after a significant decline in the stock price. On the other hand, if there is no downgrading of the credit rating of the convertible bonds, the market price of the convertible bond converges to that of its theoretical value. For these bonds, the convergence of the market price to the theoretical price is observationally equivalent to a market updating of the volatility to the appropriate level in the seasoning process. But, if there is a downgrading of the bond, there is no longer any evidence of convergence. Taking all these results collectively, the evidence is consistent with the hypothesis that the "underpricing" is induced by potential renegotiations on the covenant terms when the issuer faces possible imminent financial difficulties. In the absence of such events, the convertible bond price will converge to the theoretical price.

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Table 1

Initial Pricing Error and Pricing Error of the First Available Market Price Observation

Panel A. **TF** Model

The Initial Pricing Error is calculated as $\left(\frac{\text{Initial Offering Price - TF Theoretical Bond Price}}{\text{TF Theoretical Bond Price}}\right)$. The initial rating score is defined by the initial credit rating of convertible bond from Moody's.

Initial Moody's Rating	Initial Moody's Rating Score	Number of Bond Samples	Mean of Initial Pricing Error
Aaa	1	1	5.62%
Aa1	2	0	-
Aa2	3	0	-
Aa3	4	1	-9.88%
A1	5	3	-4.44%
A2	6	7	-5.84%
A3	7	4	-5.49%
Baa1	8	19	-8.78%
Baa2	9	11	-8.74%
Baa3	10	13	-7.17%
Ba1	11	7	-8.47%
Ba2	12	6	-6.25%
Ba3	13	15	-11.65%
B1	14	6	-13.80%
B2	15	14	-15.14%
Total		107	-9.37%

Panel B. **TKN** Model

The Initial Pricing Error is calculated as $\left(\frac{\text{Initial Offering Price - TKN Theoretical Bond Price}}{\text{TKN Theoretical Bond Price}}\right)$. The initial rating score is defined by the initial credit rating of convertible bond from Moody's.

Initial Moody's Rating	Initial Moody's Rating Score	Number of Bond Samples	Mean of Initial Pricing Error
Aaa	1	1	10.77%
Aa1	2	0	-
Aa2	3	0	-
Aa3	4	1	-13.34%
A1	5	3	-6.38%
A2	6	7	-7.18%
A3	7	4	-8.04%
Baa1	8	19	-11.18%
Baa2	9	11	-10.08%
Baa3	10	13	-6.71%
Ba1	11	7	-8.80%
Ba2	12	6	-5.30%
Ba3	13	15	-9.59%
B1	14	6	-10.28%
B2	15	14	-12.03%
Total		107	-9.18%

Table 2

Convertible Bond Pricing Error and Level of Stock Price Drop from the Highest Stock Price since the Issuance of Convertible Bond

This table presents the relationship between the pricing error magnitude of convertible bond and the level of stock price drop from the highest stock price since the issuance of convertible bond.

Panel A. **TF** Model

Stock Price Change from Historical High (*c*)	**Observation**	**Mean**	**25% Percentile**	**Median**	**75% Percentile**
0% ≤ *c* ≤ -10%	12753	-1.68%	-4.27%	-0.16%	1.73%
-10% < *c* ≤ -20%	7736	-0.95%	-2.86%	0.31%	2.77%
-20% < *c* ≤ -30%	7088	-1.17%	-3.68%	0.69%	3.23%
-30% < *c* ≤ -40%	6849	-0.98%	-3.76%	0.60%	3.98%
-40% < *c* ≤ -50%	6248	-0.95%	-2.76%	0.34%	2.97%
-50% < *c* ≤ -60%	5441	-2.09%	-4.04%	0.18%	2.33%
-60% < *c* ≤ -70%	3820	-5.66%	-11.63%	-3.40%	1.21%
-70% < *c* ≤ -80%	3260	-10.12%	-15.88%	-7.48%	-2.82%
-80% < *c* ≤ -90%	2951	-12.41%	-17.71%	-9.74%	-3.30%
-90% < *c* ≤ -100%	3541	-19.36%	-31.08%	-14.46%	-5.97%

Panel B. **TKN** Model

Stock Price Change from Historical High (*c*)	**Observation**	**Mean**	**25% Percentile**	**Median**	**75% Percentile**
0% ≤ *c* ≤ -10%	12753	-1.69%	-4.53%	0.02%	2.14%
-10% < *c* ≤ -20%	7736	-0.71%	-3.84%	0.30%	3.26%
-20% < *c* ≤ -30%	7088	-0.93%	-4.30%	0.28%	3.95%
-30% < *c* ≤ -40%	6849	-0.53%	-4.08%	0.17%	4.44%
-40% < *c* ≤ -50%	6248	-0.44%	-3.75%	-0.24%	4.58%
-50% < *c* ≤ -60%	5441	-2.17%	-3.93%	-0.45%	2.41%
-60% < *c* ≤ -70%	3820	-5.55%	-9.72%	-3.06%	0.85%
-70% < *c* ≤ -80%	3260	-10.94%	-16.04%	-8.83%	-4.00%
-80% < *c* ≤ -90%	2951	-13.63%	-22.45%	-8.82%	-3.49%
-90% < *c* ≤ -100%	3541	-20.55%	-32.04%	-14.79%	-6.12%

Table 3a

Change in Mean Pricing Error from TF Model after the First Detected Stock Price Collapse

Panel A. Convertible Bonds with Stock Price Collapses

This table presents the change of pricing error for convertible bonds in relation to the first detected stock price collapse. We define a stock price collapse as the underlying stock price dropping by more than 50% within the last 10 trading days. "Date" indicates the first detected stock price collapse. "Last 10 days' Mean Pricing Error" is the mean pricing error of convertible bond from **TF** Model during the last 10 days before the first detected stock price collapse. "Next 10 days' Mean Pricing Error" is the mean pricing error of convertible bond from **TF** Model during the next 10 days after the first detected stock price collapse. "Change in Mean Pricing Error" is the "Next10 days' Mean Pricing Error" less the "Last 10 days' Mean Pricing Error".

OBS	Bond Code	Date	Next 10 days Mean Pricing Error ($\varepsilon_{+10days}$)	Last 10 days Mean Pricing Error ($\varepsilon_{-10days}$)	Change in Mean Pricing Error ($\varepsilon_{+10days}$ - $\varepsilon_{-10days}$)
1	16008N	20010404	-27.48%	-27.83%	0.34%
2	16115U	20020725	-20.59%	-16.84%	-3.75%
3	16420F	20010918	-18.50%	-13.40%	-5.10%
4	16702P	20011019	-50.83%	-20.73%	-30.09%
5	17359N	20020205	-7.78%	0.22%	-8.00%
6	17386M	20010918	-23.64%	-10.81%	-12.83%
7	18596W	20020731	-35.41%	-26.96%	-8.45%
8	18891D	20020927	-64.67%	-56.34%	-8.33%
9	19086V	20021015	-67.64%	-52.51%	-15.12%
10	19119E	20020919	-5.76%	0.71%	-6.46%
11	19401W	20020725	-50.40%	-26.41%	-23.99%
12	223250	20010403	-16.66%	-17.03%	0.37%
13	234179	20020621	-35.01%	-16.32%	-18.69%
14	252305	20020614	-22.38%	-16.24%	-6.14%
15	252395	20020920	-2.80%	-2.46%	-0.34%

Panel B. Test of the Change in Mean Pricing Error Being Zero

The change in the mean pricing error from **TF** Model after the first stock price collapse [Difference between the pricing error over last 10 days and the pricing error over next 10 days; i.e. ($\varepsilon_{+10days}$ - $\varepsilon_{-10days}$).]

N	Mean	Std Error	t-statistics	P-value
15	-9.77%	0.0231	-4.42	0.0008

Table 3b

Change in Mean Pricing Error from TKN Model after the First Detected Stock Price Collapse

Panel A. Convertible Bonds with Stock Price Collapses

This table presents the change of pricing error for convertible bonds in relation to the first detected stock price collapse. We define a stock price collapse as the underlying stock price dropping by more than 50% within the last 10 trading days. "Date" indicates the first detected stock price collapse. "Last 10 days' Mean Pricing Error" is the mean pricing error of convertible bond from **TKN** Model during the last 10 days before the first detected stock price collapse. "Next 10 days' Mean Pricing Error" is the mean pricing error of convertible bond from **TKN** Model during the next 10 days after the first detected stock price collapse. "Change in Mean Pricing Error" is the "Next10 days' Mean Pricing Error" less the "Last 10 days' Mean Pricing Error".

OBS	Bond Code	Date	Next 10 days Mean Pricing Error ($\varepsilon_{+10days}$)	Last 10 days Mean Pricing Error ($\varepsilon_{-10days}$)	Change in Mean Pricing Error ($\varepsilon_{+10days}$ - $\varepsilon_{-10days}$)
1	16008N	20010404	-26.55%	-26.72%	0.17%
2	16115U	20020725	-29.60%	-25.69%	-3.90%
3	16420F	20010918	-25.90%	-17.39%	-8.51%
4	16702P	20011019	-59.36%	-29.91%	-29.45%
5	17359N	20020205	-10.63%	-1.20%	-9.43%
6	17386M	20010918	-29.72%	-14.31%	-15.42%
7	18596W	20020731	-34.25%	-25.04%	-9.21%
8	18891D	20020927	-64.37%	-55.82%	-8.55%
9	19086V	20021015	-69.89%	-56.17%	-13.72%
10	19119E	20020919	-7.43%	-1.19%	-6.24%
11	19401W	20020725	-54.75%	-32.01%	-22.75%
12	223250	20010403	-15.56%	-15.59%	0.03%
13	234179	20020621	-34.31%	-14.88%	-19.43%
14	252305	20020614	-20.81%	-13.64%	-7.17%
15	252395	20020920	-5.59%	-5.40%	-0.20%

Panel B. Test of the Change in Mean Pricing Error Being Zero

The change in the mean pricing error from **TKN** Model after the first stock price collapse [Difference between the pricing error over last 10 days and the pricing error over next 10 days; i.e. ($\varepsilon_{+10days}$ - $\varepsilon_{-10days}$).]

N	Mean	Std Error	t-statistics	P-value
15	-10.25%	0.0222	-4.16	0.0004

Table 4a

Pricing Error from TF Model at the First Detected Stock Price Collapse Relative to the Mean Pricing Error of Control Group

Panel A. The control group of convertible bond samples is composed of all bond samples without any detected stock price collapses.

			Convertible Bonds with Stock Price Collapse			Control Group			
Obs	Bond Code	Date	Pricing Error	Next 10 days Mean Pricing Error	Last 10 days Mean Pricing Error	Obs in Control Gp.	Mean Pricing Error	Next 10 days Mean Pricing Error	Last 10 days Mean Pricing Error
1	16008N	20010404	-24.90%	-27.48%	-27.83%	22	-8.41%	-7.70%	-9.10%
2	16115U	20020725	-18.79%	-20.59%	-16.84%	70	-3.85%	-3.60%	-3.62%
3	16420F	20010918	-8.40%	-18.50%	-13.40%	41	-3.87%	-4.64%	-5.12%
4	16702P	20011019	-40.85%	-50.83%	-20.73%	46	-3.98%	-3.39%	-4.37%
5	17359N	20020205	-1.98%	-7.78%	0.22%	51	-1.18%	-1.53%	-1.86%
6	17386M	20010918	-4.29%	-23.64%	-10.81%	41	-3.87%	-4.64%	-5.12%
7	18596W	20020731	-26.18%	-35.41%	-26.96%	69	-2.96%	-3.76%	-3.74%
8	18891D	20020927	-60.42%	-64.67%	-56.34%	69	-1.48%	-1.90%	-2.72%
9	19086V	20021015	-60.59%	-67.64%	-52.51%	68	-1.55%	-0.64%	-1.94%
10	19119E	20020919	-1.51%	-5.76%	0.71%	71	-2.37%	-2.23%	-3.17%
11	19401W	20020725	-31.18%	-50.40%	-26.41%	70	-3.85%	-3.60%	-3.62%
12	223250	20010403	-17.37%	-16.66%	-17.03%	23	-8.76%	-7.83%	-9.05%
13	234179	20020621	-23.46%	-35.01%	-16.32%	63	-2.95%	-2.73%	-3.22%
14	252305	20020614	-12.95%	-22.38%	-16.24%	63	-3.46%	-2.91%	-3.14%
15	252395	20020920	-2.31%	-2.80%	-2.46%	70	-2.85%	-2.10%	-2.99%
			Mean	-29.97%	-20.20%		Mean	-3.55%	-4.18%
			Change in Mean		-9.77%		Change in Mean		0.64%

Panel B. The Difference between the Change in Mean Pricing Error from **TF** Model (from the last 10 days to the next 10 days) of Convertible Bond with the First Detected Stock Price Collapse and the Change in Mean Pricing Error from **TF** Model (from the last 10 days to the next 10 days) of Control Group

N	Mean	Std Error	t-statistics	P-value
15	-10.41%	0.02288	-4.55	0.0005

Table 4b

Pricing Error from TKN Model at the First Detected Stock Price Collapse Relative to the Mean Pricing Error of Control Group

Panel A. The control group of convertible bond samples is composed of all bond samples without any detected stock price collapses.

			Convertible Bonds with Stock Price Collapse			Control Group			
Obs	Bond Code	Date	Pricing Error	Next 10 days Mean Pricing Error	Last 10 days Mean Pricing Error	Obs in Control Gp.	Mean Pricing Error	Next 10 days Mean Pricing Error	Last 10 days Mean Pricing Error
1	16008N	20010404	-24.14%	-26.55%	-26.72%	22	-9.19%	-8.34%	-9.42%
2	16115U	20020725	-27.54%	-29.60%	-25.69%	70	-3.68%	-3.47%	-3.45%
3	16420F	20010918	-16.05%	-25.90%	-17.39%	41	-4.99%	-5.69%	-6.15%
4	16702P	20011019	-49.67%	-59.36%	-29.91%	46	-4.21%	-3.56%	-4.76%
5	17359N	20020205	-4.18%	-10.63%	-1.20%	51	-1.28%	-1.61%	-1.93%
6	17386M	20010918	-11.43%	-29.72%	-14.31%	41	-4.99%	-5.69%	-6.15%
7	18596W	20020731	-25.14%	-34.25%	-25.04%	69	-2.82%	-3.59%	-3.60%
8	18891D	20020927	-60.12%	-64.37%	-55.82%	69	-1.15%	-1.42%	-2.48%
9	19086V	20021015	-63.14%	-69.89%	-56.17%	68	-1.21%	-0.03%	-1.46%
10	19119E	20020919	-3.24%	-7.43%	-1.19%	71	-2.16%	-1.88%	-3.04%
11	19401W	20020725	-36.88%	-54.75%	-32.01%	70	-3.68%	-3.47%	-3.45%
12	223250	20010403	-16.51%	-15.56%	-15.59%	23	-9.39%	-8.50%	-9.32%
13	234179	20020621	-22.99%	-34.31%	-14.88%	63	-3.09%	-2.69%	-3.33%
14	252305	20020614	-10.80%	-20.81%	-13.64%	63	-3.57%	-2.98%	-3.16%
15	252395	20020920	-5.34%	-5.59%	-5.40%	70	-2.57%	-1.72%	-2.86%
			Mean	-32.58%	-22.33%		Mean	-3.64%	-4.30%
			Change in Mean		-10.25%		Change in Mean		0.66%

Panel B. The Difference between the Change in Mean Pricing Error from **TKN** Model (from the last 10 days to the next 10 days) of Convertible Bond with the First Detected Stock Price Collapse and the Change in Mean Pricing Error from **TKN** Model (from the last 10 days to the next 10 days) of Control Group

N	Mean	Std Error	t-statistics	P-value
15	-10.91%	0.02219	-4.92	0.0002

Table 5a

Time-Series for Mean Pricing Errors from TF Model of All Convertible Bond Samples over 500 weekdays after the First Available Observation

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TF** Model for all convertible bond samples. "Date" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "Obs" indicates the number of bonds. "Mean" indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TF Theoretical Bond Price}}{\text{TF Theoretical Bond Price}}\right)$. "T_Stat" indicates the t-statistics for testing H_0 : Pricing Error = 0 . "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	107	-6.05%	-7.7384	0.0000	16	-2.35%	-2.3475	0.0330	43	-5.43%	-4.2690	0.0001	48	-7.84%	-6.4039	0.0000
20	107	-5.72%	-7.1075	0.0000	16	-1.88%	-1.8561	0.0832	43	-4.73%	-3.9136	0.0003	48	-7.88%	-5.9543	0.0000
40	106	-4.90%	-6.1761	0.0000	16	-1.07%	-1.1926	0.2516	43	-4.42%	-3.5700	0.0009	47	-6.64%	-5.1073	0.0000
60	106	-4.08%	-5.4490	0.0000	16	-0.50%	-0.5452	0.5936	43	-3.49%	-2.9272	0.0055	47	-5.85%	-4.8691	0.0000
80	90	-4.47%	-5.1867	0.0000	15	0.21%	0.1715	0.8663	35	-4.49%	-3.2986	0.0023	40	-6.20%	-4.4832	0.0001
100	89	-4.72%	-4.9966	0.0000	14	1.68%	1.9907	0.0680	35	-4.82%	-2.9420	0.0058	40	-6.87%	-5.0331	0.0000
120	88	-5.18%	-4.8134	0.0000	13	1.50%	2.2649	0.0428	35	-5.24%	-2.8175	0.0080	40	-7.30%	-4.6011	0.0000
140	84	-4.87%	-4.3589	0.0000	13	1.91%	2.5823	0.0240	32	-5.06%	-3.0278	0.0049	39	-6.97%	-3.7685	0.0006
160	84	-4.71%	-3.5284	0.0007	13	2.00%	2.8067	0.0159	32	-5.21%	-2.1551	0.0390	39	-6.54%	-3.2979	0.0021
180	75	-5.12%	-3.6749	0.0005	12	0.63%	0.7619	0.4622	27	-5.66%	-2.1212	0.0436	36	-6.63%	-3.2661	0.0024
200	71	-5.89%	-3.6420	0.0005	11	0.02%	0.0198	0.9846	25	-7.93%	-2.3040	0.0302	35	-6.29%	-2.9723	0.0054
220	65	-6.80%	-3.9689	0.0002	10	1.06%	2.0005	0.0765	23	-7.59%	-2.3428	0.0286	32	-8.69%	-3.4954	0.0015
240	63	-6.55%	-3.8510	0.0003	10	0.06%	0.0594	0.9540	22	-7.48%	-2.1828	0.0406	31	-8.02%	-3.3755	0.0021
260	60	-4.91%	-3.1070	0.0029	9	-0.31%	-0.3096	0.7648	21	-3.52%	-1.7146	0.1019	30	-7.27%	-2.6369	0.0133
280	59	-4.16%	-2.5956	0.0119	9	-0.43%	-0.4015	0.6986	21	-2.20%	-1.1280	0.2727	29	-6.74%	-2.3434	0.0264
300	58	-3.92%	-2.9537	0.0046	9	-0.76%	-0.7826	0.4564	21	-2.89%	-1.5986	0.1256	28	-5.71%	-2.4277	0.0221
320	55	-4.09%	-2.9673	0.0045	9	-0.04%	-0.0381	0.9705	21	-2.63%	-1.5236	0.1433	25	-6.79%	-2.6455	0.0142
340	54	-3.22%	-2.5267	0.0145	9	0.83%	0.7221	0.4908	20	-2.67%	-1.5268	0.1433	25	-5.11%	-2.2349	0.0350
360	51	-2.75%	-2.1888	0.0333	8	1.19%	1.1927	0.2719	18	-1.82%	-1.1020	0.2858	25	-4.67%	-2.1288	0.0437
380	46	-3.49%	-2.3028	0.0260	8	1.03%	1.0056	0.3481	18	-1.74%	-1.0068	0.3282	20	-6.88%	-2.3205	0.0316
400	45	-4.36%	-2.5107	0.0158	7	0.42%	0.2423	0.8167	18	-1.95%	-0.9296	0.3656	20	-8.19%	-2.5476	0.0197
420	45	-3.37%	-1.9533	0.0572	7	0.91%	0.6468	0.5417	18	-0.91%	-0.5048	0.6202	20	-7.09%	-2.1044	0.0489
440	43	-4.08%	-1.9378	0.0594	5	-0.63%	-0.3392	0.7515	18	0.24%	0.1535	0.8798	20	-8.84%	-2.1574	0.0440
460	32	-4.86%	-1.8187	0.0786	4	-0.18%	-0.0798	0.9414	12	1.04%	0.6145	0.5514	16	-10.45%	-2.1553	0.0478
480	27	-3.57%	-1.4047	0.1720	3	-0.96%	-0.4909	0.6721	10	1.34%	0.6354	0.5410	14	-7.64%	-1.7110	0.1108
500	25	-2.63%	-1.3007	0.2057	2	-1.87%	-0.5097	0.6999	9	1.36%	0.8681	0.4106	14	-5.30%	-1.5989	0.1339

Table 5b

Time-Series for Mean Pricing Errors from TKN Model of All Convertible Bond Samples over 500 weekdays after the First Available Observation

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TKN** Model for all convertible bond samples. "Date" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "Obs" indicates the number of bonds. "Mean" indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TKN Theoretical Bond Price}}{\text{TKN Theoretical Bond Price}}\right)$. "T_Stat" indicates the t-statistics for testing H_0 : Pricing Error = 0 . "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	107	-5.57%	-6.3995	0.0000	16	-3.36%	-2.5775	0.0210	43	-6.02%	-4.1524	0.0002	48	-5.91%	-4.2783	0.0001
20	107	-5.30%	-5.9583	0.0000	16	-2.61%	-2.0444	0.0589	43	-5.31%	-3.8441	0.0004	48	-6.19%	-4.1629	0.0001
40	106	-4.69%	-5.3965	0.0000	16	-1.83%	-1.4507	0.1675	43	-5.17%	-3.7514	0.0005	47	-5.22%	-3.6456	0.0007
60	106	-3.89%	-4.6234	0.0000	16	-1.76%	-1.6153	0.1271	43	-4.09%	-2.9223	0.0056	47	-4.43%	-3.2708	0.0020
80	90	-4.44%	-4.5430	0.0000	15	-0.82%	-0.5750	0.5744	35	-5.58%	-3.3903	0.0018	40	-4.80%	-3.0937	0.0037
100	89	-4.76%	-4.4117	0.0000	14	0.65%	0.7031	0.4944	35	-5.92%	-3.0104	0.0049	40	-5.64%	-3.5752	0.0010
120	88	-5.36%	-4.4102	0.0000	13	0.11%	0.1858	0.8557	35	-6.47%	-3.0170	0.0048	40	-6.16%	-3.3387	0.0019
140	84	-5.14%	-4.1716	0.0001	13	0.97%	1.2014	0.2528	32	-6.67%	-3.5144	0.0014	39	-5.92%	-2.8649	0.0068
160	84	-4.93%	-3.4431	0.0009	13	0.88%	1.2275	0.2432	32	-6.99%	-2.7151	0.0107	39	-5.19%	-2.3722	0.0229
180	75	-5.50%	-3.5414	0.0007	12	-0.37%	-0.3778	0.7127	27	-7.94%	-2.7305	0.0112	36	-5.38%	-2.3082	0.0270
200	71	-6.25%	-3.4834	0.0009	11	-0.67%	-0.6845	0.5092	25	-10.18%	-2.8233	0.0094	35	-5.19%	-2.0942	0.0438
220	65	-6.76%	-3.5592	0.0007	10	0.70%	0.8790	0.4023	23	-9.54%	-2.7443	0.0118	32	-7.10%	-2.4825	0.0187
240	63	-6.67%	-3.5769	0.0007	10	-0.33%	-0.2576	0.8025	22	-9.43%	-2.5876	0.0172	31	-6.75%	-2.5117	0.0176
260	60	-5.07%	-2.8855	0.0055	9	-0.82%	-0.6124	0.5573	21	-5.60%	-2.3418	0.0297	30	-5.97%	-1.9448	0.0616
280	59	-4.39%	-2.4744	0.0163	9	-0.81%	-0.5561	0.5934	21	-4.21%	-1.8638	0.0771	29	-5.64%	-1.7602	0.0893
300	58	-4.23%	-2.7956	0.0071	9	-1.69%	-1.6238	0.1431	21	-4.96%	-2.4193	0.0252	28	-4.50%	-1.6449	0.1116
320	55	-4.57%	-2.9643	0.0045	9	-0.91%	-0.7280	0.4874	21	-4.75%	-2.4471	0.0238	25	-5.75%	-1.9476	0.0633
340	54	-3.48%	-2.4100	0.0195	9	-0.28%	-0.2361	0.8193	20	-4.74%	-2.4285	0.0253	25	-3.63%	-1.3555	0.1879
360	51	-2.72%	-1.8622	0.0685	8	0.20%	0.2077	0.8414	18	-3.45%	-1.9353	0.0698	25	-3.14%	-1.1649	0.2555
380	46	-3.92%	-2.2839	0.0272	8	-0.14%	-0.1509	0.8843	18	-3.32%	-1.8232	0.0859	20	-5.98%	-1.6753	0.1103
400	45	-4.72%	-2.4323	0.0191	7	-0.60%	-0.3872	0.7120	18	-3.39%	-1.4744	0.1587	20	-7.37%	-1.9437	0.0669
420	45	-3.77%	-1.9642	0.0558	7	0.00%	-0.0008	0.9994	18	-2.36%	-1.2064	0.2442	20	-6.36%	-1.6288	0.1198
440	43	-4.47%	-1.9717	0.0553	5	-1.64%	-1.0241	0.3637	18	-1.21%	-0.7274	0.4769	20	-8.11%	-1.7808	0.0909
460	32	-5.43%	-1.8992	0.0669	4	-0.77%	-0.4271	0.6981	12	-0.44%	-0.2473	0.8092	16	-10.34%	-1.9309	0.0726
480	27	-3.52%	-1.3084	0.2022	3	-1.22%	-0.7725	0.5206	10	0.57%	0.2351	0.8194	14	-6.93%	-1.4451	0.1721
500	25	-2.50%	-1.1412	0.2650	2	-1.97%	-0.6214	0.6461	9	0.32%	0.1573	0.8789	14	-4.38%	-1.1961	0.2530

Table 6a

Time-Series for Mean Pricing Errors from TF Model of Convertible Bonds without Any Subsequent Downgrade over 500 weekdays after the First Available Observation

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TF** Model for convertible bonds which do not experience any subsequent downgrade. “Date” indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. “Obs” indicates the number of bonds. “Mean” indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TF Theoretical Bond Price}}{\text{TF Theoretical Bond Price}}\right)$. “T_Stat” indicates the t-statistics for testing H_0 : Pricing Error $= 0$. “P-value” is the p-value for the t-test.

	All Samples				**High Grade**				**Medium Grade**				**Low Grade**			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	82	-4.34%	-5.5640	0.0000	13	-2.46%	-2.2951	0.0406	32	-3.86%	-2.4781	0.0189	37	-5.41%	-5.3669	0.0000
20	82	-4.00%	-4.9418	0.0000	13	-1.63%	-1.4401	0.1754	32	-3.32%	-2.2013	0.0353	37	-5.41%	-4.7548	0.0000
40	81	-3.25%	-3.9240	0.0002	13	-0.78%	-0.7258	0.4819	32	-3.10%	-2.0236	0.0517	36	-4.27%	-3.5584	0.0011
60	81	-2.26%	-3.1014	0.0027	13	-0.41%	-0.3931	0.7012	32	-1.70%	-1.3056	0.2013	36	-3.42%	-3.1601	0.0033
80	66	-2.22%	-2.5706	0.0125	12	0.30%	0.2083	0.8388	25	-2.21%	-1.4942	0.1482	29	-3.27%	-2.3953	0.0235
100	65	-2.00%	-2.3767	0.0205	11	2.19%	2.6677	0.0236	25	-1.60%	-1.1821	0.2488	29	-3.93%	-2.9313	0.0067
120	64	-1.89%	-2.4365	0.0177	10	2.04%	3.3826	0.0081	25	-1.43%	-1.1666	0.2548	29	-3.64%	-2.9490	0.0064
140	60	-1.17%	-1.6842	0.0974	10	2.80%	4.4805	0.0015	22	-1.19%	-1.0695	0.2970	28	-2.58%	-2.3678	0.0253
160	60	-0.44%	-0.6780	0.5004	10	2.59%	3.9187	0.0035	22	-0.26%	-0.2454	0.8086	28	-1.67%	-1.6049	0.1202
180	51	-0.32%	-0.4327	0.6671	9	1.36%	1.5559	0.1583	17	0.51%	0.5540	0.5873	25	-1.50%	-1.1216	0.2731
200	47	-0.08%	-0.1332	0.8946	8	0.96%	1.1539	0.2864	15	-0.51%	-0.5112	0.6172	24	-0.15%	-0.1657	0.8699
220	42	-0.45%	-0.6329	0.5303	7	1.81%	3.5823	0.0116	14	-0.26%	-0.2718	0.7901	21	-1.33%	-1.0759	0.2948
240	40	-0.27%	-0.3724	0.7116	7	1.67%	3.4539	0.0136	13	-0.17%	-0.1527	0.8812	20	-1.02%	-0.8175	0.4238
260	38	0.48%	0.6943	0.4918	6	1.38%	1.8811	0.1187	13	0.33%	0.3104	0.7616	19	0.31%	0.2563	0.8006
280	38	1.20%	1.6561	0.1062	6	1.27%	1.2781	0.2573	13	1.74%	2.4563	0.0302	19	0.81%	0.5994	0.5564
300	37	0.65%	0.7558	0.4547	6	0.87%	1.1648	0.2966	13	0.53%	0.3884	0.7046	18	0.66%	0.4460	0.6613
320	34	0.72%	0.8792	0.3856	6	1.56%	1.5021	0.1934	13	0.64%	0.4314	0.6738	15	0.45%	0.3384	0.7401
340	33	1.00%	1.1076	0.2763	6	2.64%	2.8642	0.0352	12	0.20%	0.1040	0.9190	15	0.98%	0.7976	0.4384
360	32	0.94%	0.9405	0.3542	6	2.59%	4.8528	0.0047	11	0.28%	0.1374	0.8934	15	0.76%	0.4865	0.6341
380	30	-0.03%	-0.0236	0.9813	6	2.45%	4.6094	0.0058	11	-0.30%	-0.1160	0.9100	13	-0.95%	-0.4893	0.6335
400	29	0.37%	0.3007	0.7659	5	2.81%	3.9685	0.0166	11	0.98%	0.3851	0.7083	13	-1.09%	-0.6395	0.5346
420	29	1.15%	0.9866	0.3323	5	2.73%	4.9725	0.0076	11	0.93%	0.4021	0.6961	13	0.72%	0.4089	0.6898
440	27	0.46%	0.3211	0.7507	3	1.72%	1.6516	0.2404	11	1.24%	0.5425	0.5994	13	-0.49%	-0.2081	0.8387
460	17	0.22%	0.1500	0.8826	3	1.97%	2.0824	0.1727	5	0.14%	0.0483	0.9638	9	-0.32%	-0.1360	0.8952
480	15	0.24%	0.1580	0.8767	2	0.97%	1.9887	0.2966	5	-0.48%	-0.1315	0.9017	8	0.51%	0.2625	0.8005
500	13	0.52%	0.3756	0.7138	1	1.80%	-	-	4	-0.20%	-0.0714	0.9476	8	0.73%	0.3831	0.7130

Table 6b

Time-Series for Mean Pricing Errors from TKN Model of Convertible Bonds without Any Subsequent Downgrade over 500 weekdays after the First Available Observation

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TKN** Model for convertible bonds which do not experience any subsequent downgrade. "DATE" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "OBS" indicates the number of bonds. "Mean" indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TKN Theoretical Bond Price}}{\text{TKN Theoretical Bond Price}}\right)$. "T_Stat" indicates the t-statistics for testing H_0 : Pricing Error = 0 . "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	82	-3.48%	-4.1101	0.0001	13	-3.69%	-2.3899	0.0341	32	-3.65%	-2.2247	0.0335	37	-3.27%	-2.8697	0.0068
20	82	-3.22%	-3.6721	0.0004	13	-2.61%	-1.6778	0.1192	32	-3.15%	-1.9883	0.0557	37	-3.48%	-2.7013	0.0105
40	81	-2.69%	-3.0987	0.0027	13	-1.78%	-1.1439	0.2750	32	-3.13%	-1.9937	0.0550	36	-2.63%	-2.0635	0.0465
60	81	-1.74%	-2.2023	0.0305	13	-2.04%	-1.5666	0.1432	32	-1.56%	-1.1109	0.2752	36	-1.78%	-1.4897	0.1453
80	66	-1.81%	-1.9088	0.0607	12	-1.10%	-0.6411	0.5346	25	-2.39%	-1.4657	0.1557	29	-1.59%	-1.0578	0.2992
100	65	-1.56%	-1.7418	0.0863	11	0.80%	0.7315	0.4813	25	-1.72%	-1.1260	0.2713	29	-2.31%	-1.5921	0.1226
120	64	-1.55%	-1.9097	0.0607	10	0.24%	0.3384	0.7428	25	-1.70%	-1.2778	0.2135	29	-2.04%	-1.4942	0.1463
140	60	-1.06%	-1.4928	0.1408	10	1.56%	1.6584	0.1316	22	-2.04%	-1.8954	0.0719	28	-1.22%	-1.0259	0.3140
160	60	-0.23%	-0.3449	0.7314	10	1.10%	1.2822	0.2318	22	-1.30%	-1.2806	0.2143	28	0.13%	0.1138	0.9102
180	51	-0.10%	-0.1174	0.9070	9	0.10%	0.0797	0.9384	17	-0.98%	-1.0696	0.3007	25	0.43%	0.2847	0.7783
200	47	0.25%	0.3163	0.7532	8	0.11%	0.0925	0.9289	15	-2.09%	-2.2237	0.0431	24	1.76%	1.3487	0.1906
220	42	0.43%	0.4762	0.6365	7	1.39%	1.3489	0.2260	14	-1.58%	-1.7242	0.1084	21	1.44%	0.8915	0.3833
240	40	0.40%	0.4558	0.6511	7	1.14%	1.0372	0.3396	13	-1.48%	-1.4623	0.1693	20	1.36%	0.8722	0.3940
260	38	1.18%	1.3390	0.1887	6	0.96%	0.6844	0.5241	13	-1.08%	-1.1887	0.2576	19	2.80%	1.8376	0.0827
280	38	1.83%	1.9565	0.0580	6	0.89%	0.4991	0.6389	13	0.25%	0.2829	0.7821	19	3.21%	1.9381	0.0685
300	37	1.11%	1.0821	0.2864	6	-0.20%	-0.1768	0.8666	13	-1.08%	-0.9144	0.3785	18	3.13%	1.7306	0.1016
320	34	0.94%	1.0726	0.2912	6	0.60%	0.3950	0.7091	13	-0.82%	-0.6398	0.5343	15	2.61%	1.7685	0.0988
340	33	1.44%	1.5580	0.1291	6	1.24%	1.0699	0.3336	12	-0.99%	-0.6269	0.5435	15	3.46%	2.5173	0.0246
360	32	1.62%	1.5033	0.1429	6	1.29%	1.6215	0.1658	11	-0.73%	-0.4308	0.6758	15	3.48%	1.8993	0.0783
380	30	0.36%	0.2710	0.7883	6	1.02%	1.4085	0.2180	11	-1.23%	-0.5244	0.6114	13	1.41%	0.5954	0.5627
400	29	0.85%	0.6720	0.5071	5	1.56%	1.8499	0.1380	11	-0.06%	-0.0247	0.9808	13	1.34%	0.6597	0.5219
420	29	1.63%	1.3667	0.1826	5	1.67%	2.7963	0.0490	11	-0.18%	-0.0870	0.9324	13	3.15%	1.5931	0.1371
440	27	1.05%	0.7066	0.4861	3	0.57%	0.5613	0.6311	11	0.08%	0.0399	0.9690	13	1.97%	0.7664	0.4583
460	17	1.27%	0.8000	0.4354	3	0.96%	1.3439	0.3111	5	0.01%	0.0050	0.9962	9	2.06%	0.7580	0.4702
480	15	1.32%	0.7920	0.4416	2	0.33%	0.6750	0.6220	5	-0.67%	-0.1903	0.8583	8	2.82%	1.2277	0.2592
500	13	1.94%	1.1629	0.2675	1	1.20%	-	-	4	-0.87%	-0.3472	0.7514	8	3.44%	1.4658	0.1861

Table 7a

Time-Series for Mean Pricing Errors from TF Model of Convertible Bonds without Any Subsequent Change in Credit Rating over 500 weekdays after the First Available Observations

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TF** Model for convertible bonds which do not experience any subsequent change in credit rating. "Date" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "Obs" indicates the number of bonds. "Mean" indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TF Theoretical Bond Price}}{\text{TF Theoretical Bond Price}}\right)$. "T_Stat" indicates the t-statistics for testing H_0 : Pricing Error $= 0$. "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	68	-4.44%	-4.9150	0.0000	12	-2.37%	-2.0429	0.0658	29	-4.02%	-2.3378	0.0268	27	-5.81%	-4.7905	0.0001
20	68	-4.01%	-4.4545	0.0000	12	-1.76%	-1.4386	0.1781	29	-3.56%	-2.1488	0.0405	27	-5.50%	-4.3048	0.0002
40	67	-3.16%	-3.2917	0.0016	12	-0.96%	-0.8309	0.4237	29	-3.32%	-1.9751	0.0582	26	-4.00%	-2.6085	0.0151
60	67	-2.37%	-2.8185	0.0064	12	-0.44%	-0.3886	0.7050	29	-2.01%	-1.4238	0.1655	26	-3.67%	-2.6443	0.0139
80	52	-2.53%	-2.3790	0.0211	11	0.39%	0.2505	0.8073	22	-2.60%	-1.5730	0.1307	19	-4.13%	-2.0995	0.0501
100	51	-2.16%	-2.1052	0.0403	10	2.40%	2.7277	0.0233	22	-1.93%	-1.2649	0.2198	19	-4.83%	-2.5796	0.0189
120	50	-2.10%	-2.2561	0.0286	9	2.06%	3.0474	0.0159	22	-1.70%	-1.2254	0.2340	19	-4.52%	-2.7562	0.0130
140	46	-1.23%	-1.4778	0.1464	9	2.80%	3.9990	0.0040	19	-1.63%	-1.2947	0.2118	18	-2.81%	-1.9220	0.0715
160	46	-0.69%	-0.8568	0.3961	9	2.74%	3.8048	0.0052	19	-0.52%	-0.4238	0.6767	18	-2.57%	-1.8330	0.0844
180	37	-0.75%	-0.7967	0.4309	8	1.28%	1.2926	0.2372	14	0.05%	0.0449	0.9649	15	-2.58%	-1.3066	0.2124
200	33	-0.51%	-0.7005	0.4887	7	0.82%	0.8688	0.4183	12	-0.95%	-0.7747	0.4549	14	-0.80%	-0.6137	0.5500
220	29	-0.96%	-1.0581	0.2991	6	1.43%	3.5839	0.0158	11	-0.89%	-0.7820	0.4524	12	-2.23%	-1.1777	0.2638
240	28	-0.45%	-0.4865	0.6305	6	1.60%	2.8271	0.0368	10	-1.14%	-0.8690	0.4075	12	-0.89%	-0.4883	0.6349
260	26	0.10%	0.1027	0.9190	5	1.39%	1.5427	0.1978	10	-0.41%	-0.3217	0.7551	11	-0.02%	-0.0121	0.9906
280	26	0.72%	0.7681	0.4496	5	1.53%	1.3009	0.2632	10	1.23%	1.4546	0.1798	11	-0.11%	-0.0520	0.9596
300	25	0.02%	0.0160	0.9874	5	0.91%	0.9976	0.3750	10	-0.14%	-0.0810	0.9372	10	-0.27%	-0.1101	0.9147
320	23	0.16%	0.1586	0.8754	5	1.32%	1.0684	0.3456	10	0.51%	0.2775	0.7877	8	-1.00%	-0.5481	0.6007
340	23	0.98%	0.8270	0.4171	5	2.74%	2.4442	0.0709	10	0.42%	0.1805	0.8608	8	0.57%	0.3220	0.7569
360	22	0.52%	0.3859	0.7035	5	2.59%	3.9559	0.0167	9	0.20%	0.0817	0.9369	8	-0.41%	-0.1630	0.8751
380	21	-0.21%	-0.1219	0.9042	5	2.17%	3.9053	0.0175	9	-0.53%	-0.1674	0.8712	7	-1.51%	-0.4370	0.6774
400	20	0.40%	0.2364	0.8157	4	2.70%	2.9900	0.0581	9	0.98%	0.3121	0.7629	7	-1.65%	-0.5833	0.5809
420	20	0.80%	0.5239	0.6064	4	2.61%	3.7732	0.0326	9	1.12%	0.3937	0.7041	7	-0.66%	-0.2689	0.7970
440	18	0.14%	0.0742	0.9417	2	1.42%	0.8216	0.5622	9	1.52%	0.5417	0.6028	7	-1.99%	-0.5615	0.5948
460	10	-0.75%	-0.3229	0.7542	2	2.09%	1.2920	0.4193	4	0.02%	0.0056	0.9959	4	-2.93%	-0.6189	0.5798
480	9	-0.55%	-0.2324	0.8221	1	0.48%	-	-	4	-0.86%	-0.1819	0.8673	4	-0.50%	-0.1496	0.8906
500	9	-0.03%	-0.0181	0.9860	1	1.80%	-	-	4	-0.20%	-0.0714	0.9476	4	-0.32%	-0.0977	0.9284

Table 7b

Time-Series for Mean Pricing Errors from TKN Model of Convertible Bonds without Any Subsequent Change in Credit Rating over 500 weekdays after the First Available Observations

This table summarizes the convergence of convertible bond market price to the theoretical bond price from **TKN** Model for convertible bonds which do not experience any subsequent change in credit rating. "DATE" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "OBS" indicates the number of bonds. "Mean" indicates the mean value of pricing errors. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TKN Theoretical Bond Price}}{\text{TKN Theoretical Bond Price}}\right)$. "T_Stat" indicates the t-statistics for testing H_0 : Pricing Error $= 0$. "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	68	-3.72%	-3.7745	0.0003	12	-3.64%	-2.1717	0.0526	29	-3.82%	-2.1094	0.0440	27	-3.66%	-2.5874	0.0156
20	68	-3.37%	-3.4208	0.0011	12	-2.80%	-1.6698	0.1232	29	-3.46%	-1.9912	0.0563	27	-3.52%	-2.3419	0.0271
40	67	-2.83%	-2.7988	0.0067	12	-2.02%	-1.2101	0.2516	29	-3.45%	-1.9998	0.0553	26	-2.52%	-1.5467	0.1345
60	67	-2.02%	-2.2275	0.0293	12	-2.19%	-1.5545	0.1484	29	-1.93%	-1.2610	0.2177	26	-2.05%	-1.3568	0.1870
80	52	-2.39%	-2.0644	0.0441	11	-1.12%	-0.5922	0.5668	22	-2.90%	-1.5849	0.1279	19	-2.53%	-1.1750	0.2553
100	51	-2.07%	-1.9147	0.0613	10	0.90%	0.7433	0.4763	22	-2.23%	-1.3073	0.2053	19	-3.43%	-1.7181	0.1029
120	50	-2.10%	-2.1905	0.0333	9	0.09%	0.1123	0.9134	22	-2.16%	-1.4562	0.1601	19	-3.06%	-1.6860	0.1091
140	46	-1.41%	-1.7558	0.0859	9	1.46%	1.3913	0.2016	19	-2.81%	-2.4355	0.0255	18	-1.37%	-0.9122	0.3744
160	46	-0.89%	-1.1576	0.2532	9	1.12%	1.1703	0.2755	19	-1.93%	-1.7437	0.0983	18	-0.81%	-0.5375	0.5979
180	37	-0.97%	-1.0078	0.3203	8	-0.12%	-0.0922	0.9291	14	-1.91%	-2.0504	0.0611	15	-0.55%	-0.2564	0.8014
200	33	-0.60%	-0.6365	0.5290	7	-0.13%	-0.0921	0.9296	12	-3.04%	-3.0572	0.0109	14	1.24%	0.6762	0.5108
220	29	-0.38%	-0.3488	0.7299	6	0.96%	0.8676	0.4253	11	-2.73%	-3.2620	0.0086	12	1.10%	0.4559	0.6573
240	28	0.05%	0.0504	0.9601	6	1.00%	0.7757	0.4730	10	-2.87%	-3.1423	0.0119	12	2.01%	0.9462	0.3644
260	26	0.72%	0.6078	0.5488	5	0.89%	0.5167	0.6326	10	-2.13%	-2.3308	0.0447	11	3.24%	1.3542	0.2055
280	26	1.22%	1.0119	0.3213	5	1.10%	0.5034	0.6412	10	-0.57%	-0.5680	0.5839	11	2.90%	1.1572	0.2741
300	25	0.27%	0.1986	0.8443	5	-0.33%	-0.2477	0.8166	10	-2.14%	-1.5973	0.1447	10	2.99%	0.9940	0.3462
320	23	-0.03%	-0.0278	0.9781	5	0.22%	0.1241	0.9072	10	-1.33%	-0.8710	0.4064	8	1.44%	0.7018	0.5054
340	23	1.04%	0.9187	0.3682	5	1.17%	0.8208	0.4579	10	-1.19%	-0.6357	0.5408	8	3.75%	2.0361	0.0812
360	22	0.82%	0.5991	0.5555	5	1.12%	1.1763	0.3047	9	-1.25%	-0.6130	0.5569	8	2.97%	1.0241	0.3399
380	21	-0.22%	-0.1263	0.9008	5	0.62%	0.8387	0.4488	9	-1.94%	-0.6858	0.5122	7	1.38%	0.3478	0.7399
400	20	0.39%	0.2312	0.8197	4	1.32%	1.2639	0.2955	9	-0.55%	-0.1917	0.8527	7	1.06%	0.3262	0.7554
420	20	0.79%	0.5203	0.6089	4	1.46%	2.0228	0.1363	9	-0.47%	-0.1850	0.8579	7	2.02%	0.6797	0.5221
440	18	0.37%	0.1873	0.8537	2	-0.02%	-0.0110	0.9930	9	-0.13%	-0.0492	0.9620	7	1.11%	0.2718	0.7949
460	10	0.03%	0.0141	0.9891	2	0.82%	0.6745	0.6222	4	-0.62%	-0.1932	0.8591	4	0.29%	0.0518	0.9620
480	9	0.75%	0.2806	0.7861	1	-0.16%	-	-	4	-1.61%	-0.3656	0.7389	4	3.33%	0.7667	0.4991
500	9	1.16%	0.5553	0.5939	1	1.20%	-	-	4	-0.87%	-0.3472	0.7514	4	3.19%	0.7692	0.4978

Table 8a

Time-Series for Mean Pricing Errors of Convertible Bonds from TF Model with Subsequent Downgrade(s) over 500 weekdays after the First Available Observations

This table summarizes the time-series of convertible bond market price relative to the theoretical bond price from **TF** Model for convertible bonds with at least one subsequent downgrade. "Date" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "Obs" indicates the number of bonds. "Mean" indicates the mean value of pricing error. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TF Theoretical Bond Price}}{\text{TF Theoretical Bond Price}}\right)$.

"T_Stat" indicates the t-statistics for testing $H_0 : \text{Pricing Error} = 0$. "P-value" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	25	-11.66%	-6.6122	0.0000	3	-1.85%	-0.5878	0.6162	11	-9.99%	-7.3352	0.0000	11	-16.00%	-5.1182	0.0005
20	25	-11.36%	-6.2934	0.0000	3	-2.93%	-1.1267	0.3769	11	-8.84%	-7.9625	0.0000	11	-16.18%	-4.8166	0.0007
40	25	-10.26%	-6.2199	0.0000	3	-2.36%	-1.9158	0.1955	11	-8.29%	-5.7262	0.0002	11	-14.39%	-4.8325	0.0007
60	25	-10.01%	-5.9875	0.0000	3	-0.87%	-0.4023	0.7264	11	-8.68%	-4.1559	0.0020	11	-13.83%	-5.3384	0.0003
80	24	-10.65%	-6.4701	0.0000	3	-0.15%	-0.0578	0.9592	10	-10.21%	-4.6073	0.0013	11	-13.92%	-6.1440	0.0001
100	24	-12.10%	-5.9702	0.0000	3	-0.22%	-0.0832	0.9413	10	-12.88%	-3.5421	0.0063	11	-14.63%	-6.6282	0.0001
120	24	-13.96%	-5.2498	0.0000	3	-0.33%	-0.1746	0.8775	10	-14.76%	-3.1763	0.0113	11	-16.94%	-4.9760	0.0006
140	24	-14.11%	-5.1684	0.0000	3	-1.06%	-0.6507	0.5820	10	-13.59%	-3.8068	0.0042	11	-18.15%	-4.0040	0.0025
160	24	-15.38%	-4.2924	0.0003	3	0.04%	0.0199	0.9859	10	-16.10%	-2.5637	0.0305	11	-18.94%	-3.8533	0.0032
180	24	-15.31%	-4.7759	0.0001	3	-1.57%	-0.9609	0.4380	10	-16.17%	-2.7895	0.0211	11	-18.29%	-4.3265	0.0015
200	24	-17.28%	-4.6573	0.0001	3	-2.49%	-2.4385	0.1350	10	-19.07%	-2.6008	0.0287	11	-19.69%	-4.6134	0.0010
220	23	-18.40%	-5.1109	0.0000	3	-0.68%	-1.3269	0.3158	9	-18.99%	-2.8390	0.0219	11	-22.74%	-5.1085	0.0005
240	23	-17.47%	-5.0107	0.0001	3	-3.69%	-1.7762	0.2177	9	-18.04%	-2.5754	0.0329	11	-20.75%	-4.9963	0.0005
260	22	-14.23%	-4.2611	0.0004	3	-3.70%	-3.6812	0.0665	8	-9.76%	-2.2142	0.0624	11	-20.34%	-3.8002	0.0035
280	21	-13.87%	-4.0212	0.0007	3	-3.83%	-27.2040	0.0014	8	-8.60%	-2.0425	0.0804	10	-21.09%	-3.6802	0.0051
300	21	-11.99%	-4.7216	0.0001	3	-4.01%	-5.5372	0.0311	8	-8.47%	-2.4303	0.0454	10	-17.19%	-4.2655	0.0021
320	21	-11.88%	-4.5607	0.0002	3	-3.24%	-3.6099	0.0689	8	-7.93%	-2.5387	0.0387	10	-17.64%	-4.1578	0.0025
340	21	-9.84%	-4.2252	0.0004	3	-2.79%	-2.0475	0.1772	8	-6.98%	-2.5342	0.0390	10	-14.25%	-3.5697	0.0060
360	19	-8.95%	-3.8285	0.0012	2	-3.02%	-11.7988	0.0538	7	-5.13%	-2.0258	0.0892	10	-12.81%	-3.4001	0.0079
380	16	-9.98%	-3.1807	0.0062	2	-3.23%	-3.1733	0.1943	7	-4.01%	-2.2145	0.0687	7	-17.88%	-3.0485	0.0226
400	16	-12.93%	-3.7177	0.0021	2	-5.57%	-2.0168	0.2930	7	-6.56%	-2.1583	0.0743	7	-21.39%	-3.4614	0.0134
420	16	-11.56%	-3.1970	0.0060	2	-3.63%	-1.1635	0.4520	7	-3.80%	-1.4041	0.2099	7	-21.58%	-3.5413	0.0122
440	16	-11.76%	-2.5592	0.0218	2	-4.16%	-1.2784	0.4226	7	-1.34%	-0.7729	0.4689	7	-24.34%	-2.9130	0.0269
460	15	-10.62%	-2.0621	0.0583	1	-6.62%	-	-	7	1.67%	0.7690	0.4711	7	-23.48%	-2.7173	0.0348
480	12	-8.34%	-1.6055	0.1367	1	-4.82%	-	-	5	3.16%	1.4622	0.2175	6	-18.50%	-2.1733	0.0818
500	12	-6.05%	-1.6011	0.1377	1	-5.55%	-	-	5	2.62%	1.4776	0.2136	6	-13.34%	-2.1804	0.0811

Table 8b

Time-Series for Mean Pricing Errors of Convertible Bonds from TKN Model with Subsequent Downgrade(s) over 500 weekdays after the First Available Observations

This table summarizes the time-series of convertible bond market price relative to the theoretical bond price from **TKN** Model for convertible bonds with at least one subsequent downgrade. "DATE" indicates the number of weekdays after the first available bond market observations from *Datastream* dataset. "OBS" indicates the number of bonds. "Mean" indicates the mean value of pricing error. The pricing error is calculated as $\left(\frac{\text{Market Bond Price - TKN Theoretical Bond Price}}{\text{TKN Theoretical Bond Price}}\right)$. "T_TEST" indicates the t-statistics for testing H_0 : Pricing Error = 0. "PROBT" is the p-value for the t-test.

	All Samples				High Grade				Medium Grade				Low Grade			
Date	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value	Obs	Mean	T_Stat	P-value
0	25	-12.41%	-6.3498	0.0000	3	-1.92%	-0.8890	0.4678	11	-12.90%	-6.5917	0.0001	11	-14.78%	-4.0735	0.0022
20	25	-12.14%	-6.1246	0.0000	3	-2.65%	-1.6250	0.2457	11	-11.58%	-6.3171	0.0001	11	-15.28%	-4.0213	0.0024
40	25	-11.15%	-5.9081	0.0000	3	-2.02%	-3.3189	0.0800	11	-11.10%	-5.4165	0.0003	11	-13.69%	-3.9042	0.0029
60	25	-10.87%	-5.6031	0.0000	3	-0.56%	-0.3447	0.7632	11	-11.45%	-4.2994	0.0016	11	-13.09%	-4.1714	0.0019
80	24	-11.69%	-5.9968	0.0000	3	0.34%	0.1605	0.8872	10	-13.56%	-4.7391	0.0011	11	-13.27%	-4.8074	0.0007
100	24	-13.45%	-5.4750	0.0000	3	0.06%	0.0357	0.9748	10	-16.42%	-3.8245	0.0041	11	-14.43%	-4.7725	0.0008
120	24	-15.50%	-5.0339	0.0000	3	-0.32%	-0.2549	0.8226	10	-18.41%	-3.5478	0.0062	11	-17.00%	-3.9852	0.0026
140	24	-15.34%	-4.9489	0.0001	3	-1.02%	-1.0719	0.3959	10	-16.85%	-4.0882	0.0027	11	-17.87%	-3.3874	0.0069
160	24	-16.68%	-4.3662	0.0002	3	0.15%	0.1081	0.9238	10	-19.49%	-2.9928	0.0151	11	-18.72%	-3.4422	0.0063
180	24	-16.97%	-4.7711	0.0001	3	-1.75%	-1.1688	0.3630	10	-19.76%	-3.1781	0.0112	11	-18.59%	-3.7584	0.0037
200	24	-18.96%	-4.7577	0.0001	3	-2.75%	-3.2427	0.0834	10	-22.31%	-2.9467	0.0163	11	-20.34%	-4.1173	0.0021
220	23	-19.89%	-5.1649	0.0000	3	-0.91%	-2.0870	0.1722	9	-21.93%	-3.0610	0.0156	11	-23.40%	-4.8555	0.0007
240	23	-18.95%	-5.1372	0.0000	3	-3.75%	-1.4101	0.2939	9	-20.93%	-2.8181	0.0226	11	-21.49%	-4.9452	0.0006
260	22	-15.87%	-4.4877	0.0002	3	-4.38%	-2.9837	0.0964	8	-12.96%	-2.4416	0.0447	11	-21.12%	-3.7878	0.0036
280	21	-15.66%	-4.3658	0.0003	3	-4.21%	-5.1147	0.0362	8	-11.46%	-2.3472	0.0513	10	-22.45%	-3.8446	0.0039
300	21	-13.63%	-4.9040	0.0001	3	-4.69%	-10.3655	0.0092	8	-11.25%	-2.6207	0.0344	10	-18.22%	-4.1730	0.0024
320	21	-13.50%	-4.6785	0.0001	3	-3.94%	-5.4257	0.0323	8	-11.13%	-2.9481	0.0215	10	-18.27%	-3.7376	0.0046
340	21	-11.21%	-4.1782	0.0005	3	-3.32%	-2.0098	0.1822	8	-10.37%	-2.9392	0.0217	10	-14.26%	-3.0053	0.0148
360	19	-10.05%	-3.5873	0.0021	2	-3.07%	-2.4472	0.2470	7	-7.72%	-2.3686	0.0556	10	-13.07%	-2.7682	0.0218
380	16	-11.95%	-3.3915	0.0040	2	-3.61%	-19.3251	0.0329	7	-6.60%	-2.5448	0.0438	7	-19.69%	-2.8977	0.0274
400	16	-14.82%	-3.8023	0.0017	2	-6.00%	-3.9762	0.1569	7	-8.63%	-2.1346	0.0767	7	-23.53%	-3.4093	0.0143
420	16	-13.56%	-3.4283	0.0037	2	-4.19%	-2.1643	0.2755	7	-5.78%	-1.5815	0.1648	7	-24.01%	-3.6459	0.0108
440	16	-13.77%	-2.8695	0.0117	2	-4.94%	-2.3823	0.2530	7	-3.23%	-1.1781	0.2834	7	-26.83%	-3.1365	0.0202
460	15	-13.02%	-2.4769	0.0266	1	-5.98%	-	-	7	-0.77%	-0.2917	0.7803	7	-26.28%	-3.0200	0.0234
480	12	-9.57%	-1.8076	0.0981	1	-4.32%	-	-	5	1.81%	0.5004	0.6431	6	-19.92%	-2.3721	0.0638
500	12	-7.31%	-1.9246	0.0805	1	-5.14%	-	-	5	1.27%	0.3970	0.7116	6	-14.81%	-2.5800	0.0494

Figure 1

Sanmina-SCI Corporation

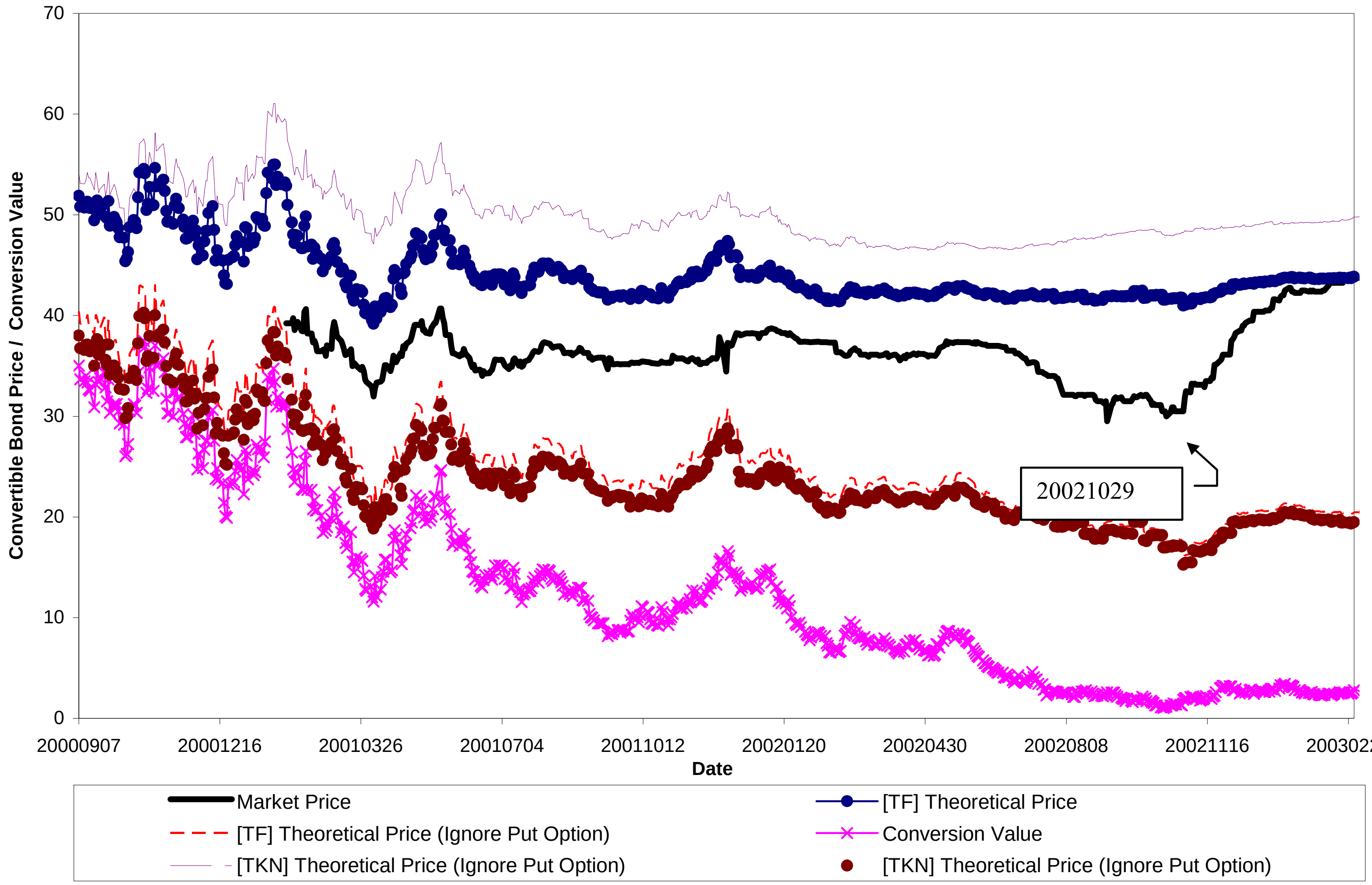


Figure 2a

Time Series for the Mean Pricing Errors from TF Model for All Convertible Bond Samples over 500 Weekdays after the First Available Observations

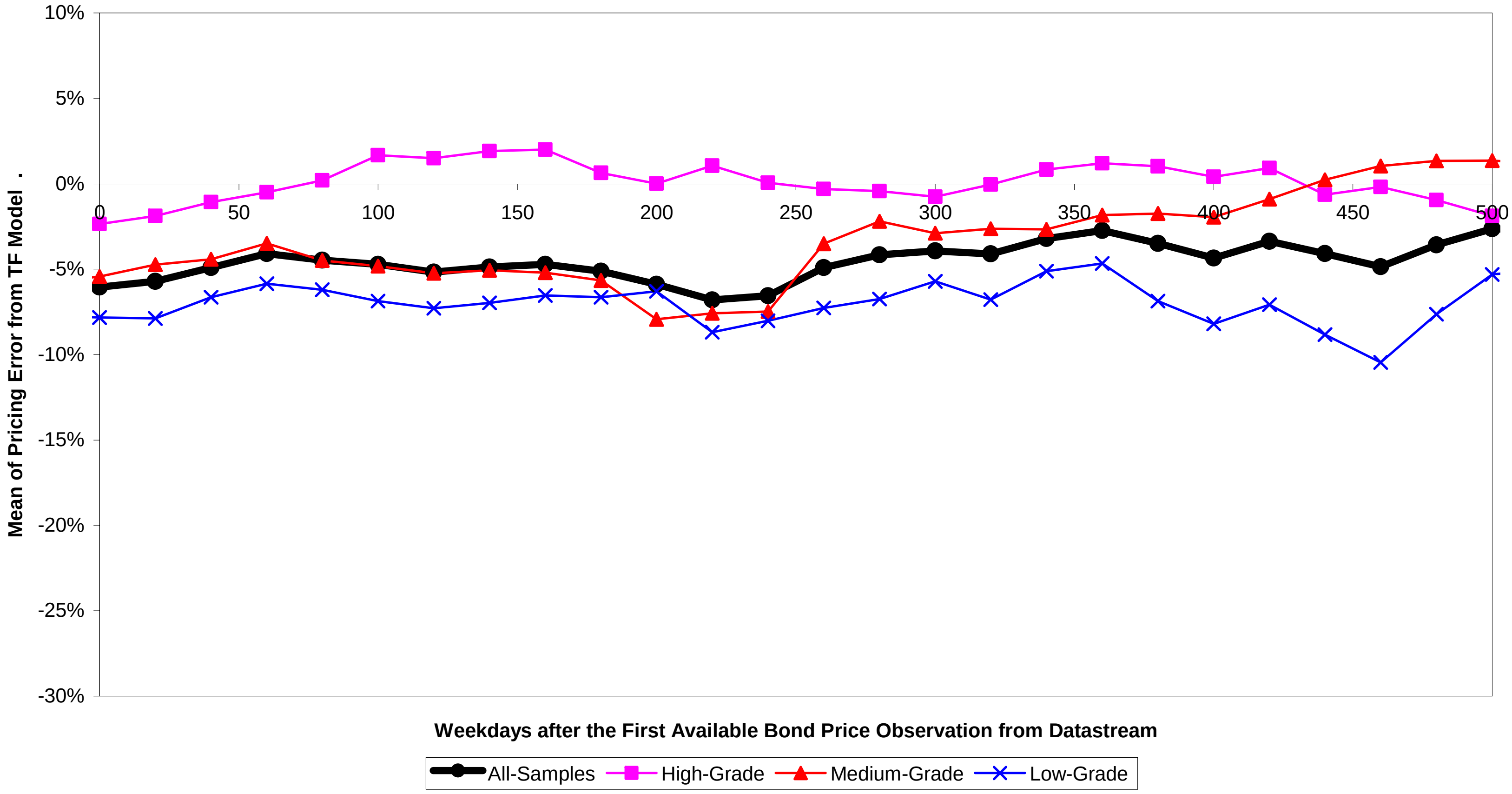


Figure 2b

Time Series for the Mean Pricing Errors from TKN Model for All Convertible Bond Samples over 500 Weekdays after the First Available Observations

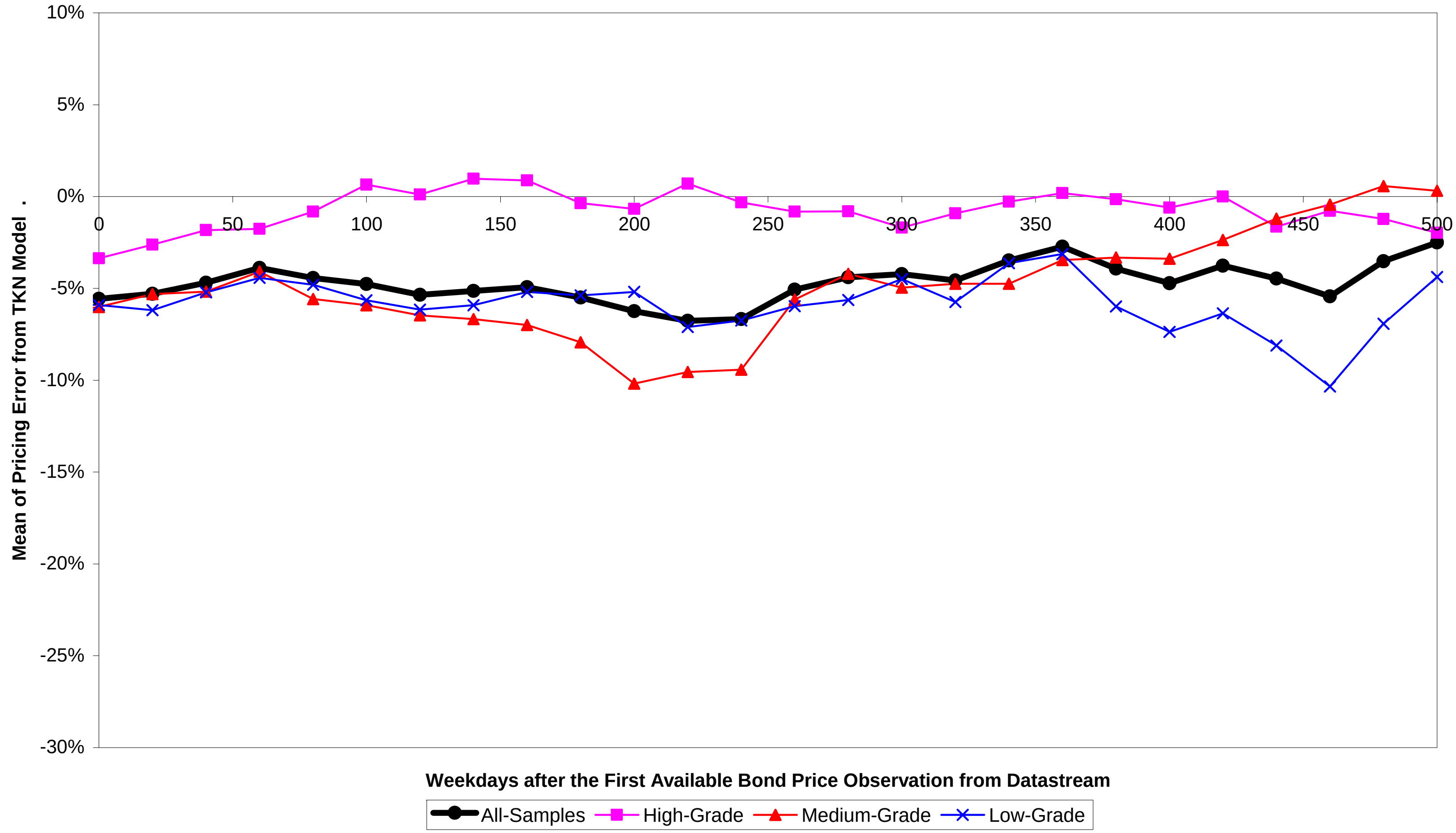


Figure 3a

Time Series for the Mean Pricing Errors from TF Model for Convertible Bonds without Any Subsequent Downgrade over 500 Weekdays after the First Available Observations

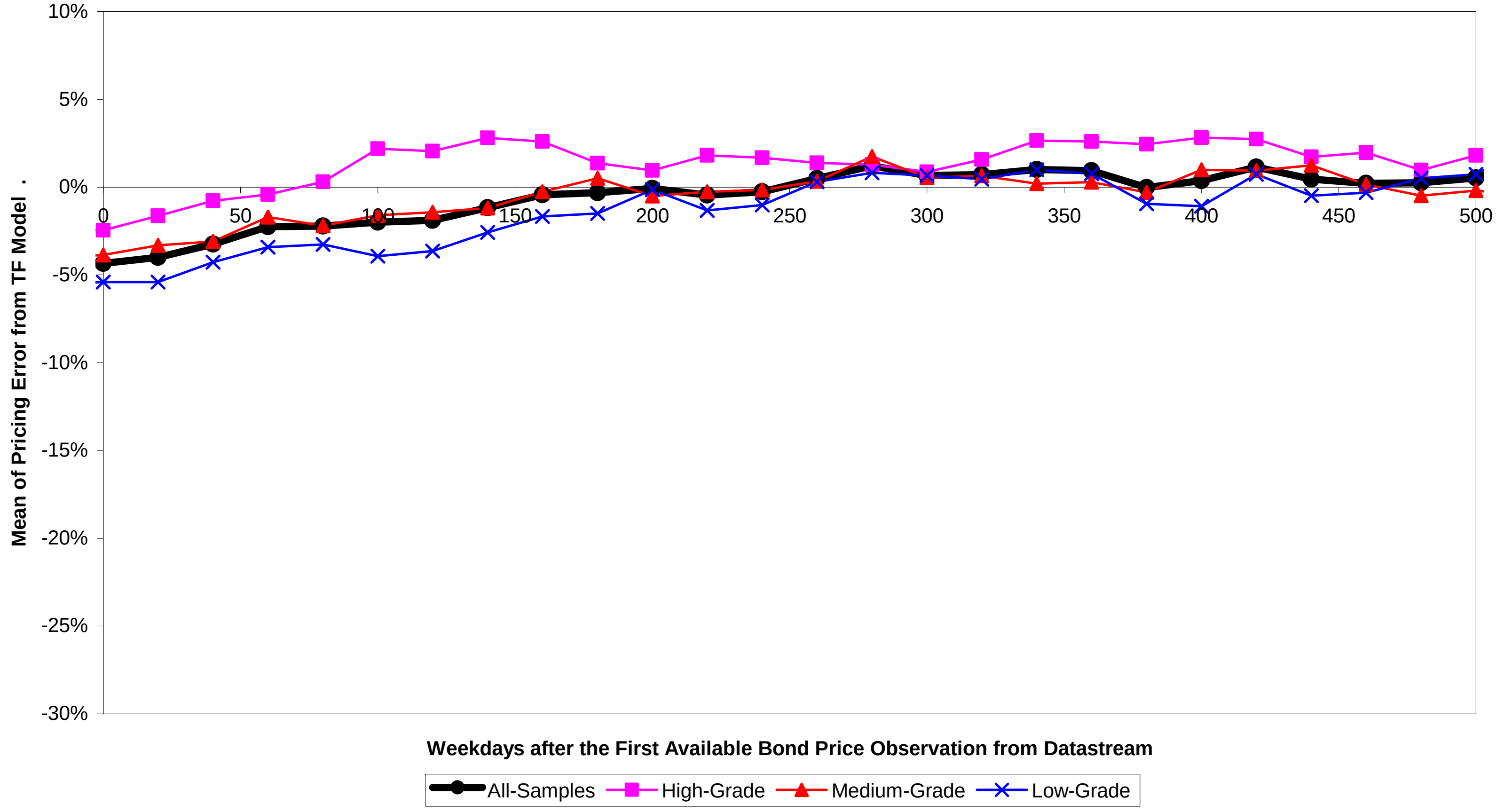


Figure 3b

Time Series for the Mean Pricing Errors from TKN Model for Convertible Bonds without Any Subsequent Downgrade over 500 Weekdays after the First Available Observations

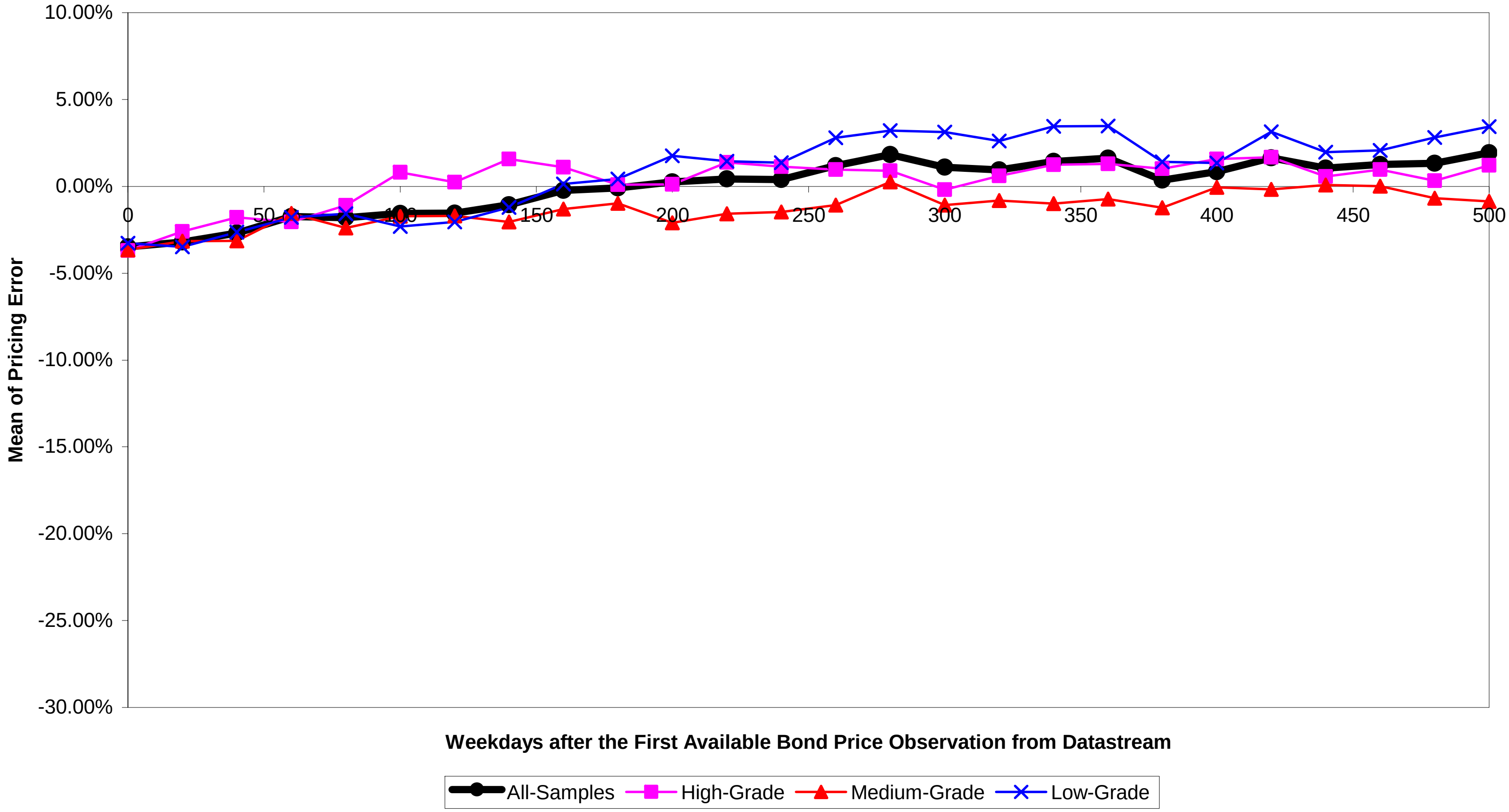


Figure 4a

Time Series for Mean Pricing Errors from TF Model for Convertible Bonds without any Subsequent Change in Credit Rating over 500 Weekdays after the First Available Observations

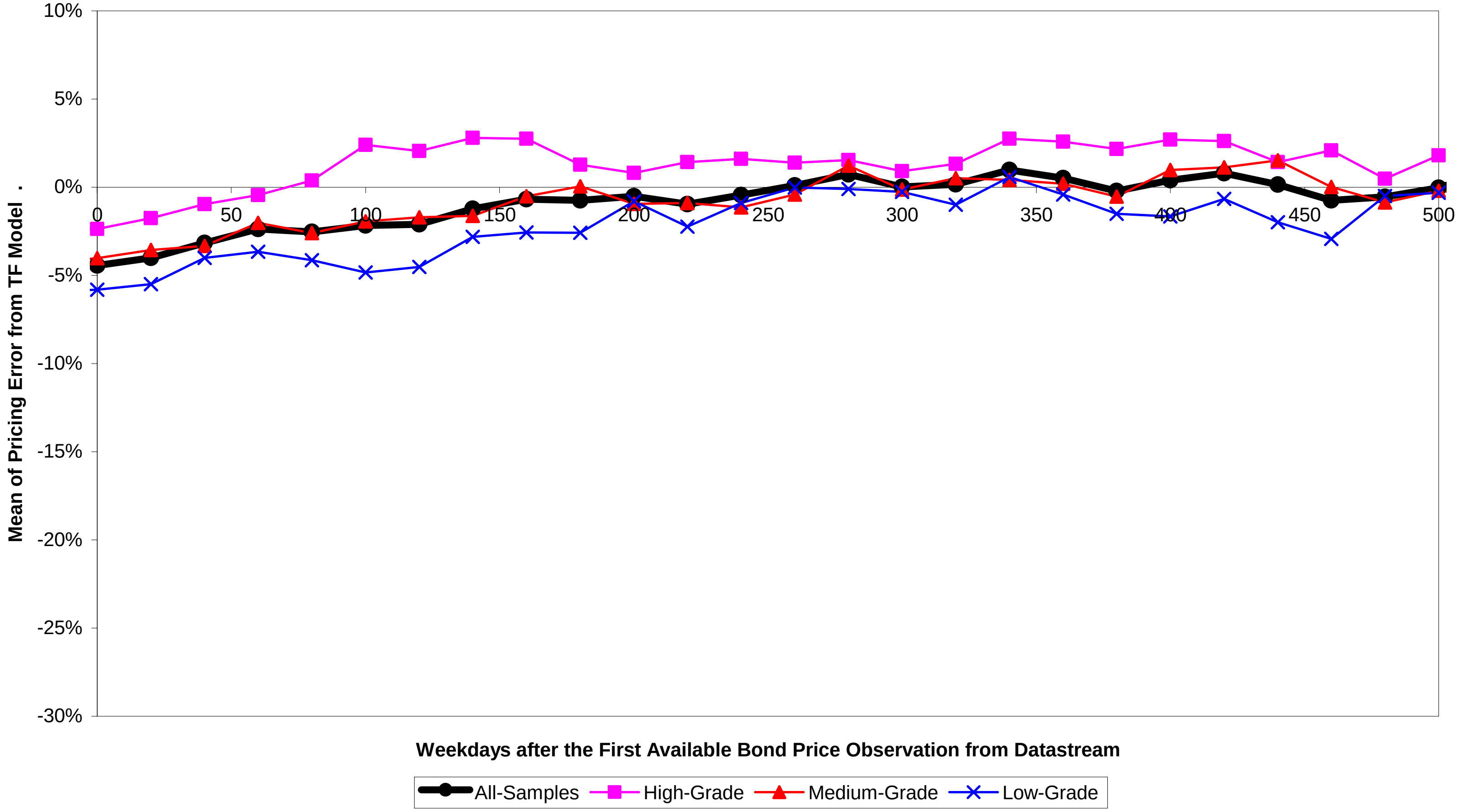


Figure 4b

Time Series for Mean Pricing Errors from TKN Model for Convertible Bonds without any Subsequent Change in Credit Rating over 500 Weekdays after the First Available Observations

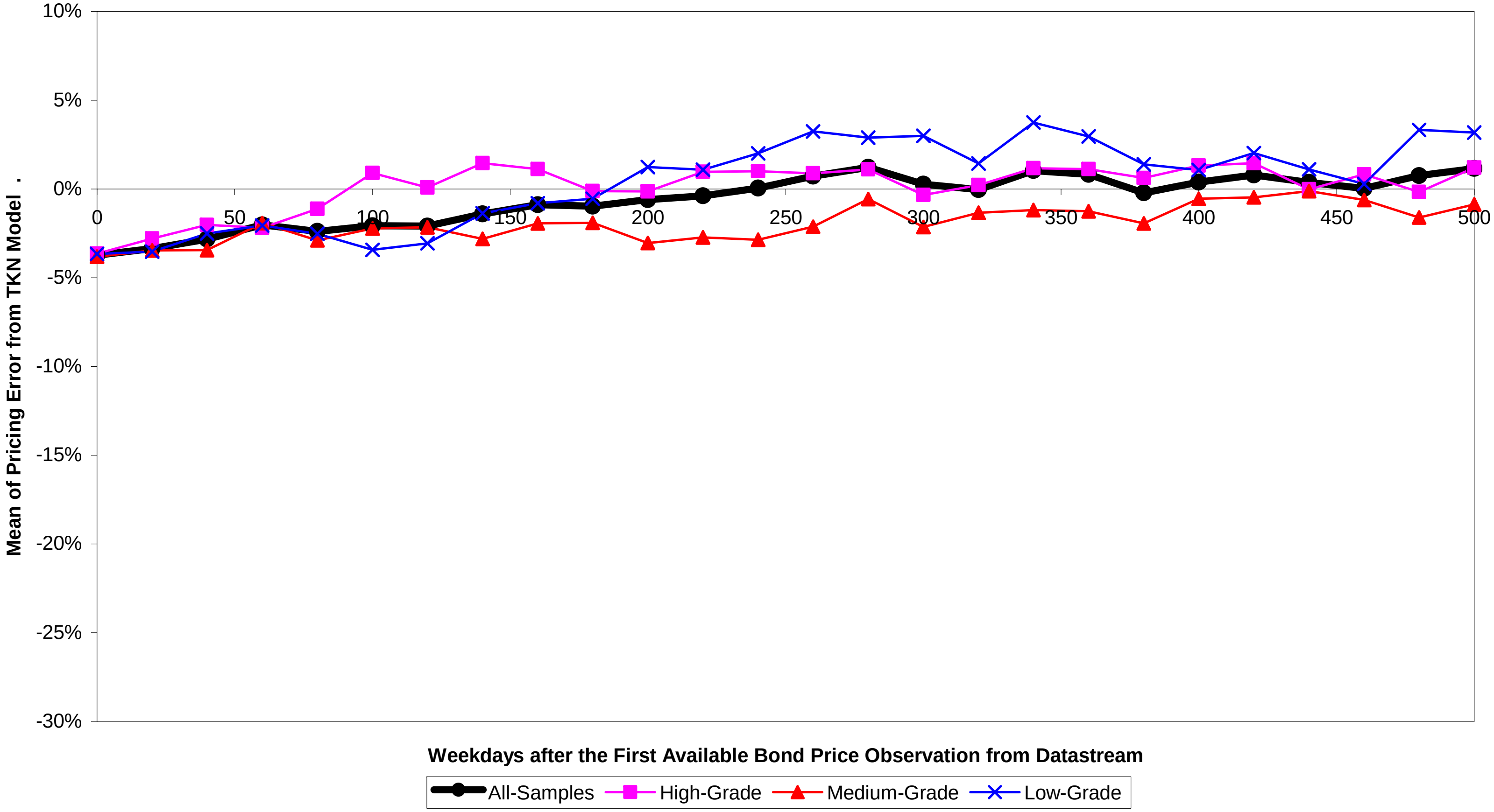


Figure 5a

Time Series for Mean Pricing Errors from TF Model for Convertible Bonds with Subsequent Downgrade(s) over 500 Weekdays after the First Available Observations

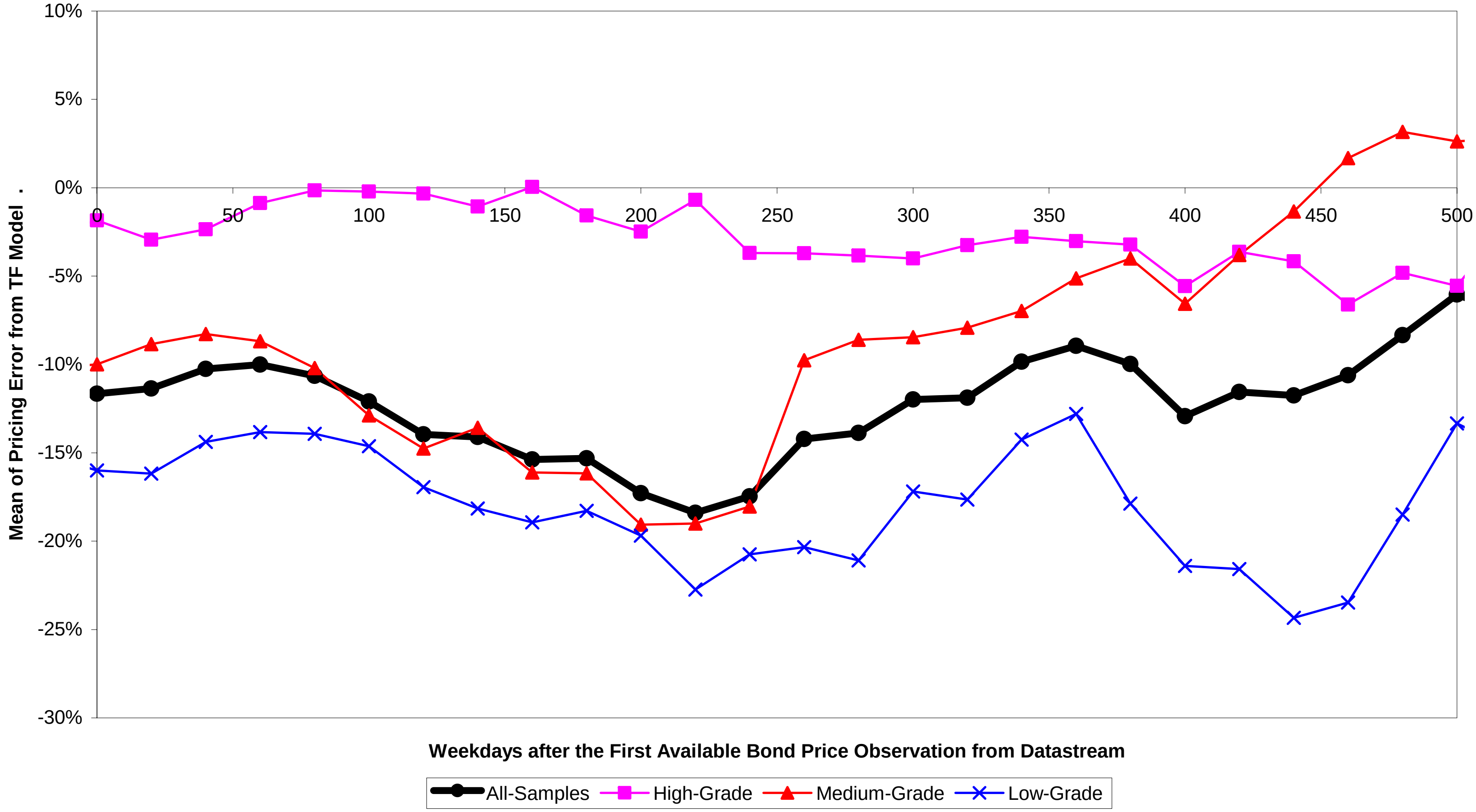


Figure 5b

Time Series for Mean Pricing Errors from TKN Model for Convertible Bonds with Subsequent Downgrade(s) over 500 Weekdays after the First Available Observations

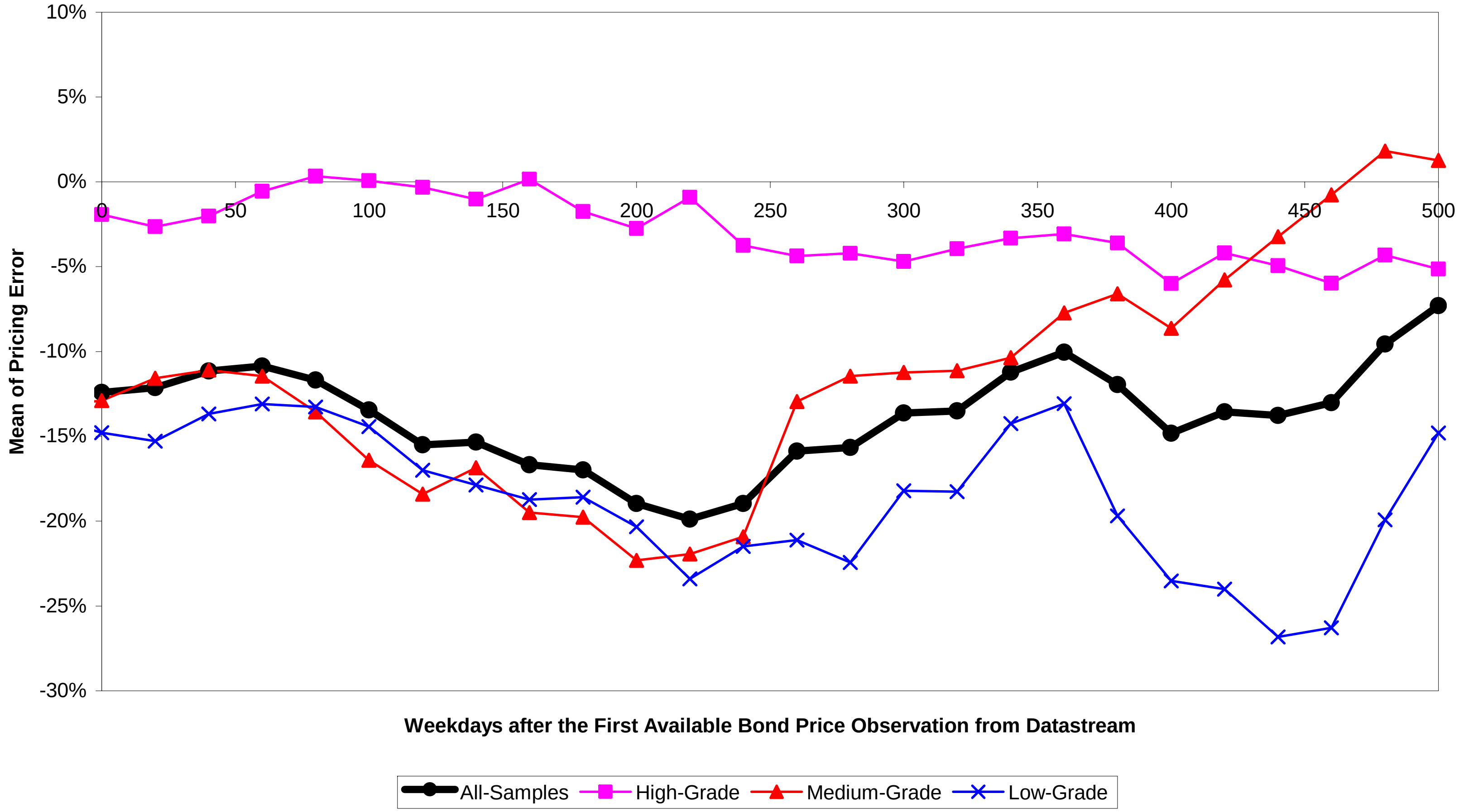


Figure 6a

Time Series for Average Implied Volatility from TF Model, Average Historical Volatility, and Average Difference between Implied Volatility and Historical Volatility over 250 Weekdays after the First Available Observations

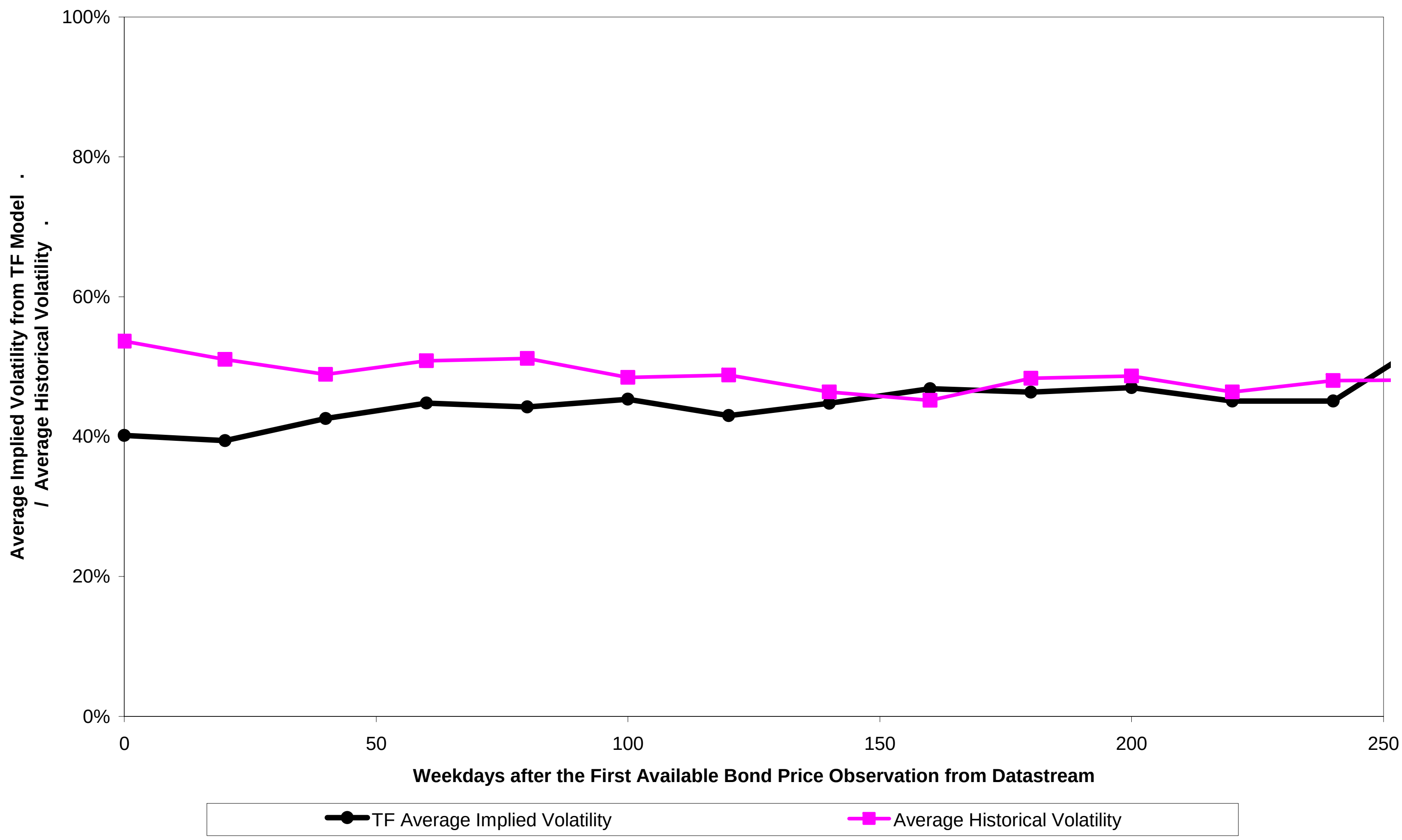
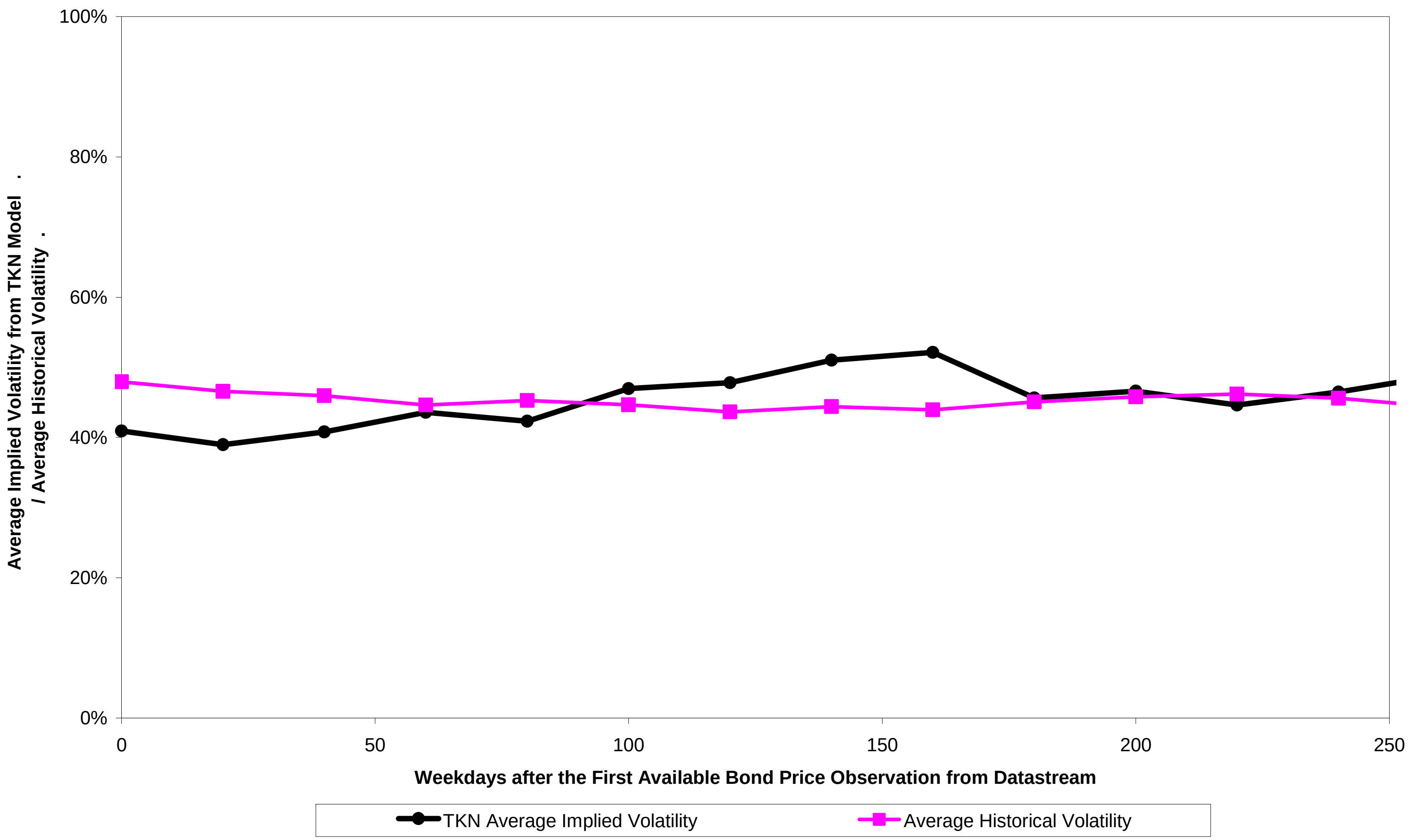


Figure 6b

Time Series for Average Implied Volatility from TKN Model, Average Historical Volatility, and Average Difference between Implied Volatility and Historical Volatility over 250 Weekdays after the First Available Observations



Appendix I: Technical Notes for TF Model

Let $u(S,t)$ denote the price of CB (in clean price format, which is the gross price less the accrual interest). It can be shown that $u(S,t)$ must satisfy the following partial differential equation (see **TF**):

$$\frac{1}{2}\frac{\partial^2 u}{\partial S^2}\times\sigma_s^2\times S^2+\frac{\partial u}{\partial S}\times\left[(r-d)\times S\right]+\frac{\partial u}{\partial t}-r\times(u-v)-(r+l)\times v+F\times e=0 \tag{1}$$

Similarly, let $v(S,t)$ denote the price of the COCB. It can be shown that $v(S,t)$ must satisfy the following partial differential equation:

$$\frac{1}{2}\frac{\partial^2 v}{\partial S^2}\times\sigma_s^2\times S^2+\frac{\partial v}{\partial S}\times\left[(r-d)\times S\right]+\frac{\partial v}{\partial t}-(r+l)\times v+F\times e=0 \tag{2}$$

where d and σ_S are respectively the dividend yield and the standard deviation of the instantaneous return on the underlying share; r and l are respectively the instantaneous risk-free interest rate, and the instantaneous credit risk premium for straight bonds from the same issuer (or issuers with the same credit rating); F, e, and T are respectively the face value, coupon rate, and maturity date of the convertible bond.

At the maturity date, the convertible bond value (CB) and the cash-only part convertible bond value (COCB) depends on the underlying stock price as follows[7]:

$$u(S_T,T)=\begin{cases}(q\times S_T) & \text{for } F<q\times S_T\\ F & \text{otherwise}\end{cases} \tag{3}$$

and

$$v(S_T,T)=\begin{cases}0 & \text{for } F<q\times S_T\\ F & \text{otherwise}\end{cases}$$

In addition to the maturity condition, the partial differential equations have the following boundary conditions resulting from the convertibility feature of convertible bond:

i. When the underlying stock price is very high, the convertible bond is dominated by the equity component. Hence, the upper boundary of convertible bond value is the conversion value.

[7] In reality, a coupon interest is paid in discrete time. As in most circumstances bondholders will not receive any accrued interest payment upon conversion, the accrued interest will change the maturity condition to $u(S,T)\le Max\{F,((q\times S_T)-\text{Accrual Interest})\}$.

$$u(S,t) \to q \times S \text{ and } v(S,t) \to 0 \qquad \text{as} \qquad S \to \infty \tag{4}$$

where q is the conversion rate, the number of shares can be converted into by each unit of the convertible bond.

ii. When the underlying stock price is very low, the convertible bond is dominated by the straight bond component[8]. Hence, the lower boundary of convertible bond value is the straight bond component value.

$$u(S,t) \to F \times \left\{ \frac{e}{(r+l)} \times \left[1 - \exp(-(r+l)\times(T-t))\right] + \exp(-(r+l)\times(T-t)) \right\} \tag{5}$$

$$v(S,t) \to F \times \left\{ \frac{e}{(r+l)} \times \left[1 - \exp(-(r+l)\times(T-t))\right] + \exp(-(r+l)\times(T-t)) \right\}$$

$$\text{as} \qquad S \to 0$$

Furthermore, convertible bond contracts usually provide call provisions to the bond issuer and put provisions to the bondholders. The partial differential equations have the following additional boundary conditions resulting from those early exercisable options of the convertible bond:

a. Call Boundary Condition (if a call schedule exists)

Given a call schedule, the convertible issuer will call back the bond if $u(S,t) > C(t)$ and the convertible bond value can be analyzed through one of the two cases -

Case (i): If $C(t) \geq (q \times S)$, $u(S,t) = C(t)$ and $v(S,t) = C(t)$.

Case (ii): If $C(t) < (q \times S)$, $u(S,t) = (q \times S)$ and $v(S,t) = 0$.

Hence, an upper boundary for convertible bond price is[9,10]:

$$u(S,t) \leq Max\{C(t), (q \times S)\} , \quad \forall\, t \in [0,T] \tag{6}$$

where $C(t)$ is the pre-determined call price at time t.

b. Put Boundary Condition (if a put schedule exists)

---

[8] The straight bond component value can be easily derived by the sum of present values from the stream of continuous coupon payments and final repayment of face value.

[9] Exercising call option by the bond issuer may induce bondholders to convert the bond into the underlying stock. Hence, the upper bound is the greater of call price and conversion value.

[10] Similarly, as in most circumstances bondholders will not receive any accrued interest payment upon conversion, the accrual interest will change the call boundary condition to $u(S,t) \leq Max\{C(t), ((q \times S) - \text{Accrual Interest})\}$.

Given the put option, the convertible bondholders will exercise the put option if $u(S,t) < P(t)$. And then, $u(S,t) = P(t)$ and $v(S,t) = P(t)$.

Hence, a lower boundary for convertible bond price is:

$$u(S,t) \geq P(t) \ , \qquad \forall \ t \in \{\text{Putable Dates}\} \tag{7}$$

where $P(t)$ is the pre-determined put price at time t .

c. Premature Conversion Condition[11]

Given the premature conversion option, the convertible bondholders will convert the bond into stocks if $u(S,t) < (q \times S)$. And then, $u(S,t) = (q \times S)$ and $v(S,t) = 0$.

Hence, a lower boundary for convertible bond price is:

$$u(S,t) \geq (q \times S), \qquad \forall \ t \in \{\text{Conversion Period}\} \tag{8}$$

We numerically solve the two resultant partial differential equations subject to the above boundary conditions by the implicit finite difference method[12].

[11] Similarly, the accrued interest will change the premature conversion condition to $u(S,t) \geq ((q \times S) - \text{Accrual Interest})$.

[12] See Tsiveriotis and Fernandes (1998) for details.

Appendix II: Tables and Figures

Table A.1

Convertible Bond Data Sample

This table lists all U.S. convertible bond samples in our study.

Bond Code	Bond Name	Moody's Rating at Issue	1st OBS Date	Market Price for 1st OBS	TF Theoretical Price	TF Pricing Error
20334F	ACXIOM CORPORATION CV 3 3/4% 15/02/09 S	Ba3	20021121	112.75	111.44	1.17%
17119L	AFFILIATED COM.SVS. CV 3 1/2% 15/03/06	Baa3	20010420	101.46	105.25	-3.60%
668395	AFFILIATED COM.SVS. CV 4% 15/03/05 S	Ba2	20010102	147.00	145.83	0.80%
20822T	AIRBORNE INCO. CV 5 3/4% 01/04/07 S	Ba3	20021121	98.00	104.29	-6.04%
19460R	AM.GREETINGS CORP. CV 7% 15/07/06 S	Ba3	20020320	134.45	140.99	-4.64%
19482L	AMERICAN INTL.GP. CV ZERO 09/11/31	Aaa	20020529	59.68	56.93	4.83%
17638M	AMERISOURCE HEALTH CV 5% 01/12/07 S	Ba3	20020508	160.42	156.92	2.23%
20579H	AMGEN INCO. CV ZERO 01/03/32	A2	20021025	72.39	73.27	-1.21%
234179	AMKOR TECH.INCO. 2000 5% 15/03/07 S	B2	20010102	66.13	83.30	-20.61%
252286	ANADARKO PTL.CORP. CV ZERO 07/03/20	Baa1	20010201	72.75	72.32	0.60%
19240N	APOGENT TECHS. CV 2 1/4% 15/10/21	Baa3	20021127	101.75	94.42	7.77%
16502E	ARROW ELECTRONICS CV ZERO 21/02/21	Baa1	20010327	42.18	52.31	-19.36%
19401W	AVAYA INC CV ZERO 31/10/21	Baa1	20011102	49.38	55.38	-10.84%
17154U	BARNES & NOBLE INCO. CV 5 1/4% 15/03/09 S	Ba3	20010614	130.14	136.67	-4.78%
21164D	BJ SERVICES CO. CV 1/2% 24/04/22 S	Baa2	20020510	81.97	86.55	-5.29%
18006W	BRIGGS & STRATTON CV 5% 15/05/06 S	Ba1	20011212	105.21	106.30	-1.02%
21604W	BRINKER INTL.INCO. CV ZERO 10/10/21	Baa2	20020619	70.21	69.25	1.39%
19459U	CARNIVAL CORP. CV ZERO 24/10/21	A2	20020430	61.03	68.32	-10.67%
20930V	CBRL GROUP INCO. 2002 ZERO 03/04/32	Baa3	20020625	43.23	42.81	0.99%
21709V	CENDANT CORP. CV 3 7/8% 27/11/11 S	Baa1	20020821	98.03	99.78	-1.75%
17669U	CENDANT CORP. CV ZERO 04/05/21	Baa1	20021127	98.13	93.62	4.81%
16693W	CENDANT CORP. CV ZERO 13/02/21	Baa1	20010614	71.27	76.28	-6.57%
19007F	CHIRON CORP CV ZERO 12/06/31	Baa1	20011107	59.28	60.50	-2.01%
20734M	COMPUTER ASSOCS. CV 5% 15/03/07	Baa2	20020823	85.54	111.22	-23.09%
17378P	COOPER CAMERON CORP CV 1 3/4% 17/05/21 S	Baa1	20010614	99.81	105.13	-5.06%
17378Q	COOPER CAMERON CORP. CV ZERO 17/05/21	Baa1	20010619	76.19	78.71	-3.20%
19713V	CORNING INCO. CV 3 1/2% 01/11/08 S	Baa1	20020822	54.44	80.35	-32.25%
17669K	COUNTRY.CR.INDS.INCO. CV ZERO 28/02/31 LYONS	A3	20010625	70.43	72.71	-3.13%
252305	COX COMMS.INCO. CV 3% 14/03/30 S	Baa3	20010118	65.00	76.87	-15.44%
19373J	CSX CORP. CV ZERO 30/10/21	Baa2	20020625	83.05	82.91	0.17%
16950L	DANAHER CORP. CV ZERO 22/01/21	A2	20010703	59.82	60.86	-1.72%
17669L	DIAMOND OFFSHORE CV 1 1/2% 15/04/31 S	A3	20020624	92.97	92.57	0.43%
17325M	DR HORTON INCO. CV ZERO 11/05/21	Ba1	20010614	50.33	53.72	-6.31%
19119E	ELECTRONIC DATA SYS CV ZERO 10/10/21	A1	20011026	84.53	81.25	4.04%
16572F	FIRST DATA CORP. CV 2% 01/03/08 S	A2	20010405	101.87	105.58	-3.51%
19501W	FRANKLIN RES.INCO. CV ZERO 11/05/31	A2	20020307	58.22	58.14	0.14%
20287C	GATX CORP. 2002 7 1/2% 01/02/07 S	Baa2	20021121	106.13	112.14	-5.37%
18409C	GEN.SEMICONDUCTOR CV 5 3/4% 15/12/06 S	B2	20010928	95.32	100.72	-5.36%
18401V	GENESCO CV 5 1/2% 15/04/05 S	B2	20010928	99.50	97.29	2.27%
668523	GETTY IMAGES INCO. 2000 5% 15/03/07	B2	20010102	75.52	94.36	-19.97%
19838H	GTECH HOLDINGS CORP. CV 1 3/4% 15/12/21 S	Baa1	20020627	114.41	113.43	0.86%
18430X	HANOVER COMPRESSOR CV 4 3/4% 15/03/08 S	Ba3	20010928	88.40	88.62	-0.24%
19677X	HASBRO INCO. CV 2 3/4% 01/12/21 S	Ba3	20011228	98.99	101.20	-2.18%
22028M	HEALTH MAN.AS.INCO. CV ZERO 28/01/22	Baa3	20021126	84.88	79.51	6.75%
238239	HEALTHSOUTH CORP. CV 3 1/4% 01/04/03 S	Ba2	20010102	88.25	89.94	-1.88%
19805F	INTERPUBLIC GROUP CV ZERO 14/12/21 S	Baa1	20020510	86.94	94.15	-7.66%
21332M	IOS CAPITAL INCO. CV 5% 01/05/07 S	Baa3	20020711	83.70	108.67	-22.98%
19174X	J C PENNY CO.INCO. CV 5% 20/10/08 S	Ba3	20020821	85.65	96.97	-11.67%
17473H	JONES APPAREL GROUP CV ZERO 01/02/21	Baa2	20010601	55.26	57.49	-3.87%
252273	JUNIPER NETWORKS CV 4 3/4% 15/03/07 S	B2	20010201	91.36	116.79	-21.77%
252233	KERR MCGEE CORP. CV 5 1/4% 15/02/10 S	Baa2	20010102	124.65	129.82	-3.99%
224210	KOHLS CORP. CV ZERO 12/06/20	Baa1	20010102	59.97	62.13	-3.48%

Bond Code	Bond Name	Moody's Rating at Issue	1st OBS Date	Market Price for 1st OBS	TF Theoretical Price	TF Pricing Error
251879	LAMAR ADVERTISING CV 5 1/4% 15/09/06 S	B2	20010201	118.92	125.75	-5.43%
20481L	LEAR CORP. CV ZERO 20/02/22	Ba1	20021126	41.75	39.52	5.65%
19502C	LEGG MASON INCO. CV ZERO 06/06/31	Baa1	20011129	47.34	48.48	-2.36%
17003F	LENNAR CORPORATION CV ZERO 04/04/21	Ba3	20010521	34.50	37.51	-8.03%
18120U	LIBERTY MEDIA CORP. CV 3 1/2% 15/01/31 S	Baa3	20021127	67.63	72.25	-6.40%
245651	LOEWS CORP. CV 3 1/8% 15/09/07 S	A2	20010131	90.63	97.17	-6.73%
252010	LSI LOGIC CORP CV 4 1/4% 15/03/04 S	B1	20010201	160.81	178.11	-9.72%
252251	LSI LOGIC CORP. CV 4% 15/02/05 S	B1	20010201	81.42	94.28	-13.64%
18891E	MANPOWER INCO.WIS CV ZERO 17/08/21	Baa2	20021121	63.88	62.99	1.40%
17443Q	MERRILL LYNCH & CO. CV ZERO 23/05/31	Aa3	20010525	52.78	57.19	-7.71%
19086V	MIRANT CORPORATION CV 2 ½% 15/06/21 S	Baa2	20020315	78.03	88.88	-12.21%
16609C	NABORS INDS.INCO. CV ZERO 20/06/20	A3	20010306	76.08	78.69	-3.32%
20747T	NAVISTAR FINL.CORP. CV 4 3/4% 01/04/09	Ba2	20020530	93.13	97.00	-3.99%
19551N	NEXTEL COMMS.INCO. CV 6% 01/06/11 S	B1	20020228	62.04	86.18	-28.01%
18891D	NORTEL NETWORKS CORP. CV 4 1/4% 01/09/08 S	Ba3	20010925	84.30	104.80	-19.56%
18596W	OAK INDUSTRIES INCO. CV 4 7/8% 01/03/08 S	B2	20010928	96.59	97.81	-1.25%
20734L	OHIO CLTY.CORP. CV 5% 19/03/22	Baa2	20021121	90.50	100.68	-10.11%
238235	OMNICARE INCO. CV 5% 01/12/07 S	Ba3	20010102	79.93	86.77	-7.89%
16749R	OMNICOM GROUP INCO. CV ZERO 07/02/31	A3	20010614	98.86	101.78	-2.87%
21288P	PEP BOYS-MANNY MOE CV 4 1/4% 01/06/07 S	B1	20020625	98.90	104.06	-4.96%
252447	PERKINELMER INCO. CV ZERO 07/08/20	Baa1	20010201	66.51	69.71	-4.60%
19781Q	PHOTRONICS INCO. CV 4 3/4% 15/12/06 S	B2	20021126	82.25	95.87	-14.21%
17977L	PMI GROUP INCO. CV 2 1/2% 15/07/21 S	A1	20010830	102.61	107.57	-4.61%
18651C	POGO PRODUCING CO. CV 5 1/2% 15/06/06 S	B2	20010928	92.61	90.03	2.87%
16693J	PRIDE INTL.INCO. CV ZERO 16/01/21	Ba3	20010614	66.78	70.04	-4.66%
16702P	PROVIDIAN_FINL.CORP. CV ZERO 15/02/21	Ba1	20010504	43.65	50.15	-12.97%
19615C	QUEST DIAGNOSTICS CV 1 3/4% 30/11/21 S	Ba1	20020524	114.68	113.95	0.64%
20157T	RADIAN CV 2 1/4% 01/01/22	A2	20021121	101.63	101.54	0.08%
16420F	ROYAL CRBN.CRUISES CV ZERO 02/02/21 LYONS	Baa3	20010214	41.26	46.36	-11.01%
17386M	ROYAL CRBN.CRUISES CV ZERO 18/05/21 LYONS	Baa3	20010525	39.96	45.51	-12.20%
16115U	SANMINA CORP CV ZERO 12/09/20	Ba3	20010201	39.22	52.87	-25.82%
17669P	SHAW GROUP INCO. CV ZERO 01/05/21	Ba2	20020509	57.36	63.41	-9.53%
252395	SOLECTRON CORP. CV ZERO 08/05/20	Baa3	20010125	61.50	70.67	-12.97%
17660J	SPX CORP. CV ZERO 06/02/21	Ba3	20010619	65.45	73.69	-11.18%
21673L	SPX CORP. CV ZERO 09/05/21	Ba3	20020626	62.85	66.13	-4.96%
19140H	STARWOOD HTLS.RSTS. CV ZERO 25/05/21	Ba2	20020712	50.10	52.51	-4.59%
18181H	STILWELL FINL.INCO. CV ZERO 30/04/31	Baa1	20021121	74.38	70.34	5.74%
20267E	SUNRISE ASTD.LVG. CV 5 1/4% 01/02/09 S	B1	20021126	95.50	105.49	-9.47%
19428X	SUPERVALU INCO. CV ZERO 02/11/31	Baa3	20020625	31.91	30.67	4.05%
19750J	TECH DATA CORP. CV 2% 15/12/21 S	Ba2	20021121	92.88	92.14	0.80%
17699R	TJX COS.INCO. CV ZERO 13/02/21	Baa1	20020529	78.14	78.06	0.10%
252005	TOTAL RENAL CARE CV 7% 15/05/09 S	B1	20010201	87.50	98.07	-10.78%
246532	TOWER AUTOMOTIVE CV 5% 01/08/04 S	B2	20010102	68.75	85.53	-19.62%
17320E	TRANSOCEAN SEDCO. CV 1 1/2% 15/05/21 S	Baa2	20010614	98.01	102.83	-4.69%
16008N	TRANSWITCH CORP. CV 4 1/2% 12/09/05 S	B2	20010129	100.00	134.52	-25.66%
17359N	TYCO INTL.GROUP CV ZERO 12/02/21	Baa1	20010522	73.11	76.93	-4.96%
244967	UNIVERSAL HLTH.SVS. CV 0.426% 23/06/20 S	Ba1	20010102	65.19	65.62	-0.65%
18911D	VALASSIS COMMS.INCO. CV ZERO 06/06/21	Baa3	20020417	55.28	54.81	0.85%
19440C	VENATOR GROUP INC CV 5 1/2% 01/06/08 S	B2	20020408	124.30	124.48	-0.14%
17670D	VERIZON COMMS.INCO. CV ZERO 15/05/21	A1	20010910	54.19	55.07	-1.60%
19373K	VISHAY INTECGY.INC. CV ZERO 04/06/21	Ba1	20021126	54.38	55.62	-2.24%
223250	VITESSE SEMICON.CORP CV 4% 15/03/05 S	B2	20010216	88.71	111.43	-20.39%
18803W	WASTE CNCTS.INCO. CV 5 1/2% 15/04/06 S	B2	20020125	102.48	110.08	-6.91%
242116	WEATHERFORD INTL. CV ZERO 30/06/20	Baa1	20010102	59.38	66.43	-10.60%
251802	WELLPOINT HLTH.NET. CV ZERO 02/07/19	Baa3	20010201	78.23	79.11	-1.11%

A detailed summary of statistics for the above convertible bond samples is available on request.

Table A.2

CoreComm Limited's Agreements with the Convertible Bondholders

HEADLINE: CoreComm Limited Announces Agreements Providing for the Retirement of $146 million of its 6% Convertible Subordinated Notes; Commencing Program to Recapitalize Other Debt

DATELINE: NEW YORK, Oct. 31, 2001

BODY:
CoreComm Limited (Nasdaq: COMM), announced today that it has signed binding agreements for transactions that would allow the Company to retire approximately$146 million, or 88%, of its $164.75 million outstanding 6% Convertible Subordinated Notes (the "Notes").

Under the terms of the binding agreements, if CoreComm determines to close the transactions, CoreComm will pay each holder that has signed the agreement a cash payment equal to the October 1, 2001 interest payment due to such holder, plus an agreed percentage of equity in CoreComm, in exchange for retiring their Notes. The agreements terminate on December 15, 2001 if CoreComm has not determined to close the transactions by that time. If the agreements terminate, each holder that has signed the agreement will receive 50% of the October 1, 2001 interest payment due to such holder. The agreements include a temporary waiver of interest currently due under the Notes, as well as an agreement not to take any action with respect to the Notes. Substantially all of the holders that the Company was able to contact have signed the agreements.

CoreComm announced that these agreements are part of a larger program to recapitalize a significant portion of its other debt. CoreComm's decision whether to close the transactions on the Notes will be based, in part, on agreements reached with respect to CoreComm's other debt.

Thomas Gravina, Chief Operating Officer, stated: "Over the last several months, we have engaged in a significant effort to improve the overall operations and profitability of the Company. The success of these initiatives has been shown in the rapid improvement in the Company's financial results so far this year. We expect this progress to continue during the remainder of the year and going forward.

"Now that the Company has begun to demonstrate more clearly the success of its business plan, it is the appropriate time to initiate a program to reduce the Company's overall level of debt. The agreements signed with holders of the Convertible Notes represent the first step in this process, and negotiations with other debt holders have already commenced.

[Source: Business Wire, Inc., October 31, 2001 from LexisNexis]

Figure A.1

Historical Hazard Rates of Default for US Convertible Bonds (During 1970-2000) from Moody's Investor Service

[Source: Exhibit 11 from page 11 of Hamilton, David T., 2001, Default and Recovery Rates of Convertible Bond Issuers: 1970-2000, *Moody's Special Comment*, Moody's Investors Service, July 2001.]