Economic Modelling 31 (2013) 198–205

Contents lists available at SciVerse ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

# Convertible bonds with resettable conversion prices ☆

Junfeng Qiu, Yongli Zhang *

*Central University of Finance and Economics, China*

ARTICLE INFO

*Article history:*
Accepted 30 November 2012

*JEL classification:*
D82
D83
G15
G32

*Keywords:*
Convertible bonds
Resettable conversion prices
Corporate financing
Adverse selection
Asymmetric information

ABSTRACT

We examine the convertible bonds whose conversion prices can be reset under certain conditions, by extending the asymmetric information framework of Stein (1992). These convertibles are more common in Japan and China and are in sharp contrast with the convertible bonds with fixed conversion prices. We find that resettable convertibles can help firms reduce liquidity cost. But the adverse selection problem caused by bad firms may be exacerbated if the cost of financial distress is not sufficiently high. Firms can mitigate the problem through costly signaling with fixed-price convertibles. Finally, we show that pooling and separating equilibria may coexist for some parameter values.



## 1. Introduction

Convertible bonds as a sensible financing choice of firms have been extensively studied in the literature. Existing studies[1] usually focus on the convertible bonds with *fixed* conversion prices. In reality, however, there are convertible bonds whose conversion prices can be reset periodically, or conditionally. Nelken (2000) documents the issuance of such convertibles by Japanese banks during the 1995–1998 period. These convertibles have since become common in the Japanese market. The conversion price of a typical Japanese resettable convertible can be changed annually on a specific date to equal that day's closing stock price. Most of the resets are allowed only when the new conversion price is lowered. This would increase the number of converted shares. The feature is designed as a sweetener, which was especially important to attract investors when Japanese banks were struggling to strengthen their balance sheets amid the turmoil in the real estate market during that period.

When convertible bonds were introduced into China in the late 1990s, the reset features of the Japanese counterparts were adopted, but with a slight twist. Instead of letting the issuers have periodic and reoccurring opportunities to change the conversion prices, the issuers of Chinese convertible bonds can lower the conversion prices only when certain conditions are met. A typical condition for resetting the conversion price is that the share price of an issuer needs to be lower than the conversion price by thirty percent for a total of twenty out of thirty consecutive trading days.[2]

Reset clauses like this give issuers provisional rights to lower conversion prices, when stock prices are deeply depressed. This makes the convertibles more attractive to investors, who could convert the debt into more equity shares. Additionally, since standard call provisions relate calls to the extent to which share prices exceed the conversion prices, the lowered conversion prices make it easier for the issuers to satisfy the call provisions, call the convertibles, and force conversion. Such reset clauses are ubiquitous in the Chinese convertible bonds. Hereafter we will refer to the aforementioned Asian-style convertible debt with adjustable conversion prices as the resettable convertible debt (or resettable convertibles in short), and the convertibles with constant conversion prices as the fixed-price convertible debt (or fixed-price convertibles in short).

While fixed-price convertibles have received much attention of researchers, less is understood about resettable convertibles. Based on the asymmetric information framework of Myers and Majluf (1984), Stein (1992) shows that fixed-price convertibles can solve the adverse selection problem caused by bad firms. Chakraborty and

☆ Both authors acknowledge the financial support from the Cultivation Fund of the Key Scientific and Technical Innovation Project, Ministry of Education of China (No: 708015).

* Corresponding author at: China Economics and Management Academy, Central University of Finance and Economics. 39 South College Road, Beijing 100081, China. Tel.: +86 10 6228 8482.

*E-mail addresses:* qiujunfeng@cufe.edu.cn (J. Qiu), zhangyongli@cufe.edu.cn (Y. Zhang).

[1] For example, Stein (1992) and Chakraborty and Yilmaz (2011).

[2] See Neftci and Menager-Xu (2007) for a detailed introduction of Chinese convertible bonds. See also Ma (2004).

0264-9993/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.econmod.2012.11.058

Yilmaz (2011) argue along the same line that fixed-price convertible bonds can be an optimally designed security that completely eliminates the problem of adverse selection. Can the reset convertibles fulfill the same role? Since it is easier for issuers of resettable convertibles to force conversion when stock prices fall sharply, would bad firms be more inclined to issue this kind of convertible debt and thus exacerbate the adverse selection problem? We will answer these questions in this paper by revising Stein's (1992) model to accommodate resettable convertible bonds.

In Stein's (1992) model, there are three types of firms: good, medium, and bad. The good firm will choose the straight debt in the separating equilibrium because it faces zero probability of financial distress. The medium firm will use the convertible debt, and the bad firm will adopt the equity. Since our focus is on how reset clauses would change the appeal of the convertible debt, we ignore the good firm with zero possibility of financial distress and the choice of straight debt without loss of generality. That is, we only consider the medium and the bad firm's choices over convertible debt and equity. If being added back to our model, the good firm would still choose the straight debt without changing other results qualitatively. With only two types of firms to analyze, our model is made neater. In what follows, we call the better-quality firm the good firm and the worse-quality firm the bad firm, which correspond to the medium firm and the bad firm in Stein (1992), respectively.

In their theoretical analyses, both Stein (1992) and Chakraborty and Yilmaz (2011) point out that a floating-price convertible debt with a conversion price proportional to the reciprocal of the share price is "adverse selection proof." It is important to note that our resettable convertibles are different from floating-price convertibles. While the conversion prices of floating-price convertibles move inversely and constantly with stock prices, those of resettable convertibles can only be changed if certain conditions are met. For Japanese resettable convertibles, the conversion prices may not be reset if they are lower than the share prices on a scheduled reset date. For Chinese resettable convertibles, the initiative of resetting the conversion price must be approved by more than two-thirds of the shareholders, as required by law.[3]

Following Stein (1992), we assume that firms will incur cost of financial distress if they fail to meet their debt obligation. If the bad firm who issues the resettable convertible were not able to lower the conversion price during difficult times, it would face unaffordable cost of financial distress. Therefore this cost deters the bad firm from using resettable convertibles. As long as the expected cost of financial distress is sufficiently high, there exists a separating equilibrium where the bad firm chooses equity financing and the better-quality firm adopts resettable convertibles. The insight here is similar to Stein (1992). But since the ability to reset the conversion prices when share prices tumble is valuable to issuers, it would now take a higher cost of financial distress to discourage the bad firm from issuing convertibles than the case with fixed-price convertibles.

What happens when the cost of financial distress is not high enough to scare away the bad firm? Since the bad firm's tendency of issuing resettable convertibles would make the same security issued by the good firm undervalued, the good firm would have strong incentives to signal their quality through fixed-price convertibles. By issuing fixed-price convertibles, the firm foregoes the opportunities to lower the conversion prices, force conversion, and add equity through the back door in some circumstances. This means that the firm may have to repay its debt. Even if the asset value is large enough to cover the debt payments, the firm may have to liquidate part of its assets in place in order to service the debt. This process is costly and may limit the firm's ability to reinvest. We name this the liquidity cost, which serves as an important obstacle to both types of firms to use fixed-price convertibles. But since the good firm is eager to separate itself from the bad type, only the good firm can afford the costly signaling under some situations. We find that under some parameter values there exists a separating equilibrium where the good firm chooses the fixed-price convertible, and the bad firm issues the equity.

But the good firm cannot always afford the costly signaling. If the liquidity cost is too high for the good firm and the cost of financial distress is too low for the bad firm, the former may have to endure the pain of being mimicked by the latter and seeing their assets undervalued by the market. This entails a pooling equilibrium where both types of firms issue the same resettable convertible debt.

It is possible that the separating and pooling equilibrium mentioned in the last two paragraphs can coexist for the same set of parameter values.

This implies that the initial market condition is very important in determining subsequent financing strategies. If it is a convention that good firms will always issue fixed-price convertibles to separate themselves from the bad firms, as is the case in the separating equilibrium, then bad firms will have a hard time using the convertible instrument at all. The adverse selection problem is solved through costly signaling by good firms. On the other hand, in a market where selling resettable convertibles is regarded as standard practices for both good and bad firms, as is the case in the pooling equilibrium, good firms will find themselves content, albeit painfully, with the reality that their assets are systematically undervalued due to the adverse selection problem caused by the bad firms.

This multiple equilibria echo the phenomenon that resettable convertible bonds are common in Asian markets, whereas the convertibles elsewhere do not have such reset clauses. They also represent a theoretical prediction that the markets with resettable convertibles may be plagued by adverse selection. Whether such a prediction is accurate warrants an empirical investigation that we do not carry out here.

The remaining of the paper is organized as follows. Section 2 describes the environment and defines pooling and separating equilibria. Section 3 presents a benchmark case where the fixed-price convertible is the only form of convertible debt and establishes the conditions for a separating equilibrium where the good firm adopts the fixed-price convertible and the bad firm chooses the equity. Section 4 establishes the main results in the case where the resettable convertible is added to the set of financing choices. The last section concludes the paper.

## 2. The model

We extend the Stein (1992) model. Our model differs from the Stein (1992) model in that we have three states of nature instead of two. As we show in Section 4, this will make the resettable convertible debt a valuable financing tool. In addition, we reduce the number of firm type from three to two, and do not consider straight debt.[4]

Following Stein (1992), we consider a representative firm in a model with three dates (0, 1 and 2). The firm is originally all-equity financed and has a new investment opportunity that has a positive expected net present value (NPV) at date 0. The investment project requires an immediate outlay of capital $I$, which must be raised from external sources. The manager of the firm privately observes the quality of the firm and selects a financing method at date 0. The amount of the firm's original equity shares is normalized to 1.

There are three states of nature at date 2: high, medium, and low. They are denoted by $H$, $M$, and $L$, respectively. The gross payoffs from

[3] See the Administrative Measures for the Issuance of Securities by Listed Companies, issued in the year 2006 by the China Security Regulatory Commission, the government body overseeing the security markets.

[4] As mentioned in Section 1, the purpose is to focus on the reset feature of convertible debt. Our results would still hold if we considered a fuller model as in Stein (1992). But the analysis would become much messier.