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Stock market reaction when the firm issues puts against its own stock *

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ABSTRACT

Until recently, over 100 firms have issued puts on their own stock. Puts are noted to signal the firm's private information to the market. However, no study directly shows to what extent puts affect stock price. This paper shows a separating equilibrium in which the high quality firm issues puttable stock (a combination of a put and common stock) and the low quality firm issues common stock. In this equilibrium, the high quality firm can differentiate itself from the low quality firm by issuing puts. Therefore, stock price is predicted to appreciate upon the put issuance and to depreciate upon the common stock issuance.

Key words: puttable, put, asymmetric information, signaling, stock market reaction

Management usually has more information on the firm than does the market. The market, with less information, may react severely to the firm's decisions such as executing a new project, or taking over other firms. Then, management may try to inform the market of details of the decisions to resolve informational asymmetry. At first, they may provide seminars for outside investors. However, due to communication barriers, including a need to preclude competitors from access to the information, seminars often end in vain (Tucker, 1990; Tufano, 1996). The firm may engage in open-market stock repurchases. According to empirical studies, stock price appreciates upon the announcement of stock repurchases (McNally, 1999; Stephens and Weisbach, 1998; Liu and Ziebart, 1997; Ikenberry, Lakonishok, and Vermaelen, 1995; Comment and Jarrell, 1991; Netter and Mitchell, 1989; Vermaelen, 1981). However, much cash is needed to repurchase stock and investment opportunities may be abandoned because of the reduction in funds available.

If management has strong confidence that the firm's future is bright (in other word, puts are never exercised), they may issue puts on their own stock. Including Microsoft, Dell and McDonald's Restaurants, over 100 firms have issued puts since 1988, but the news of the issuances is not known well (Gibson and Singh, 2000). Put issuance may give the market the same signal that

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stock repurchases do (Tufano, 1996). Put issuance by the firm is also included in a puttable stock arrangement. A puttable stock is composed of a share of common stock and a unit of put issued by the firm. Chen and Kensinger (1988) reviews some cases of puttable stock issuance and notes that puttable stock may serve as a means of signaling to new shareholders the implications of the information held by the insiders.

Tucker (1990) shows a signaling equilibrium model where the high quality firm issues puttable stock at a higher exercise price than the low quality firm does, with the assumption that outside investors employ the puttable stock's exercise price as a signal of firm type. Tucker (1990) notes that the issuance of puttable stock alleviates the agency cost of undervaluation in a market characterized by informational asymmetry, thus reducing share price dilution at issuance. There are, however, two further points which need to be clarified in Tucker (1990). First, what signal does the put issuance give to the market? In the Tucker (1990) model, both types of firms are presumed to issue puts and outside investors are presumed to employ the put exercise price as the signal of firm type. It can be said that Tucker (1990) shows a pooling equilibrium in which both types issue puts, and that Tucker (1990) analyzes the signal of exercise price level, not the signal of whether to issue puts or not. Second, most cases of put issuance including puttable stock issuance seem to increase stock price (Tufano, 1996; Chen and Kensinger, 1988). A model is needed which can show the expected stock price increase upon the issuance of puttable stock.

Gibson and Singh (2000) shows a separating equilibrium in which the low quality firm funds the investment entirely with equity and the high quality firm funds with a combination of put and equity (i.e. puttable stock). They note that puts can be used to mitigate adverse selection costs. Their model is a two-date model where a firm without debt raises funds for a positive NPV investment opportunity by issuing common stock or puttable stock. The sole source of non-transparency for investors in their model is the stochastic property of cash flows generated by asset-in-place and the investment opportunity. The model's implications are that (i) put warrants are effective whether or not they are attached to equity shares, (ii) the number of puts issued must exceed the number of new equity shares issued, and (iii) a ceiling exists on the amount of project financing that a firm can successfully raise.

Although preceding papers note that puts might be able to mitigate adverse selection costs, no paper directly shows to what extent put issuance affects stock price. The purpose of this paper is to show clearly the stock market reaction to put issuance. In our model, the firm has asset-in-place, bringing certain income in the future and a project opportunity with positive NPV. The firm issues stock to fund the project opportunity. In our model, the sole source of information asymmetry is the cash flows generated by the investment opportunity, not by asset-in-place. Without asymmetric information about asset-in-place, if the firm has a positive NPV opportunity, common stock is issued without regard to firm type. Common stock issuance cannot be a signal and the high quality firm may be undervalued in the market (Myers and Majluf, 1984).

In the same model setting, if the firm can choose between puttable stock issuance and common stock issuance, the high quality firm issues puttable stock and the low quality firm issues common

stock. Therefore, puttable stock issuance can be a signal, and stock price appreciates upon the puttable stock issuance and depreciates upon the common stock issuance.

What follows is in three sections. Section 1 describes the model. Section 2 provides analysis of the model. Section 3 discusses the stock market reaction to two kinds of stock issuances. Section 4 provides the conclusion.

1 The model

The firm (i.e., management) has information about the firm's investment prospects that outside investors (i.e., the market) do not have. Management acts in old shareholders' interest and old shareholders are assumed to be passive (i.e., not to sell old shares, not to buy new shares and puts). This assumption is the same as that in Myers and Majluf (1984). Myers and Majluf (1984) notes that although there are other possible assumptions about management objectives and old shareholder behavior, the above assumption is superior in terms of explanation effect in the empirical analysis, because it explains why stock prices fall, on average, when firms announce an equity issue. The firm is funded by only equity and existing shares are normalized to be one. All participants are risk-neutral. Capital markets are perfect and efficient with respect to publicly available information.

The firm has asset-in-place bringing certain income " $y (>0)$ ". The firm has a new project opportunity with positive NPV and the project opportunity needs cash " $I (>0)$ ". The firm does not consider any kinds of debt financing and the firm raises fund by issuing common stock or puttable stock.

The firm raises cash " I " by issuing common stock. By issuing puttable stock, the firm can raise more cash, equivalent to the sum of put premiums, than by issuing common stock. This setting might raise the question that raising more cash than needed for the project is irrelevant in terms of maximization of shareholder value. Considering a setting that the firm raises only " I " by issuing puttable stock might be useful for avoiding the question. However, two reasons make us retain the previous setting. First, it can be said that management intentionally raises more cash than needed for the project in order to maximize shareholder value. Because they are convinced of the firm's bright future, they make the best of the fact that if puts are not exercised, put holders have no claims against the firm. In other words, if puts are not exercised, put premiums eventually contribute to the increase in shareholder value. Second, the setting that the firm raises only " I " by issuing puttable stock does not produce enough tractability. The difficulties in tractability come from an increase in the number of factors to be considered. The firm invests put premiums in the risk-free asset. For simplicity, the risk-free rate is zero, and there is no dividend and no cost in offering stock and options.

The profitability of the project depends entirely on the type of the firm: $t \in \{H, L\} \in T$. "H" is the type of high quality firm that has a project with the expected gross return " $(1+r_t)I$ " with the probability of "1". "L" is the type of low quality firm that has a project with the expected gross

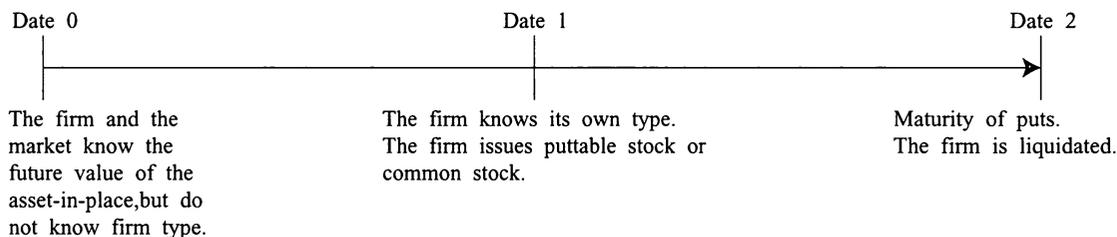


Figure 1 Sequence of events and decisions

return $(1+r_1)I'$ with the probability of "1", where $r_1 > r_2 > 0$.

In our model, there are three dates (Date 0, Date 1 and Date 2). At Date 0, the market has the same information that management does about the asset-in-place. However, the market and the firm do not know firm type.

At Date 1, management receives additional information about firm type (i.e., the value of project opportunity), and updates firm value accordingly. The market does not receive this information until Date 2. In other words, informational asymmetry exists with regard to firm type. However, the market knows only that the probability of the firm being type H is θ ($0 < \theta < 1$), and that the probability of the firm being type L is $(1-\theta)$. Management issues common stock or puttable stock. The issuance is a message to the market by management. The message is: $m \in \{p, c\} \in M$, where p means the issuance of puttable stock and c means the issuance of common stock. The firm issues n (>0) stock. When the firm issues common stock, it raises cash " I ". With puttable stock issuance, it raises cash " $(I+nO)$ " that is n units of option premiums (O) more than with common stock issuance.

According to Chen and Kensinger (1988), there is no standard puttable stock contract. A variety of terms and conditions can be laid out in any given puttable stock prospectus, but the essential elements are simple. A puttable stock unit contains a put for each share of common stock, and the issuer must be able to satisfy all obligations by issuing more shares of common stock if the puts are exercised. In the case of Gearhart Co., puttable stock was made redeemable in cash, debt, preferred stock, or common stock at the option of the issuer. For simplicity of analysis, a puttable stock unit in this paper is defined as containing a share of common stock and a put. A put entitles the unit holder to claim more cash if its stock price falls below a stated level at maturity. In other words, if a put is exercised, the holder is paid the difference between exercise price and stock price.

At Date 2, the put is exercised or abandoned and the firm is liquidated. The exercise price is X . Firm value of type t selecting signal m is $V(m;t)$ and stock price is $S(m;t)$.

$$V(c;H) = y + (1+r_1)I \tag{1}$$

$$V(c;L) = y + (1+r_2)I \tag{2}$$

$$V(p;H) = y + (1+r_1)I + nO \tag{3}$$

$$V(p;L) = y + (1+r_2)I + nO - n(X - S(p;L)) \tag{4}$$

(1) is firm value of type H issuing common stock and (2) is firm value of type L issuing common stock. For tractability in the case of puttable stock issuance, first, let us define

$X = \frac{I}{n} + O$ ¹. Exercise price equals the selling price of a newly issued common stock plus an option premium, which shows that the firm believes a bright future. Second, let us define $\frac{y+(1+r_2)I+nO}{1+n} \leq X \leq \frac{y+(1+r_1)I+nO}{1+n}$. This inequality is the condition that determines if the put is exercised or not. The right side in the second inequality is stock price of type H at maturity. This condition makes the put be abandoned. The first inequality is derived from the following: from (4)

$$y+(1+r_2)I+nO-n(X-S(p;L))=(1+n)S(p;L) \tag{5}$$

$$S(p;L)=y+(1+r_2)I+nO-nX \tag{6}$$

When stock price at date 2 is less than or equal to exercise price, put is exercised.

$$y+(1+r_2)I+nO-nX \leq X \tag{7}$$

$$\frac{y+(1+r_2)I+nO}{(1+n)} \leq X \tag{8}$$

With the condition of (8), put holders exercise the option and receive cash amounting to the difference between exercise price and stock price.

It is worthwhile to note that even type L will not go bankrupt by issuing puttable stock. By substituting $X = \frac{I}{n} + O$ for (6), we can confirm that stock price of type L issuing puttable stock is greater than zero, which gives type L strong motivation for issuing puttable stock.

2 Analysis of the model

In this model setting, if the firm can choose between issuing common stock and doing nothing, both types choose to issue common stock. Myers and Majluf (1984) notes that without asymmetric information about asset-in-place, common stock is always issued when the firm has a positive NPV opportunity. Therefore, common stock issuance cannot be a signal of firm type in this model setting and firm value of type H may be relatively undervalued.

This section analyzes a separating equilibrium in terms of signaling effect². In the same model setting as above, if the firm can choose between puttable stock issuance and common stock issuance, type H chooses to issue puttable stock and type L chooses to issue common stock. In other words, type H can differentiate itself from type L by issuing puttable stock.

First, consider that the market believes that type H issues puttable stock and type L issues common stock. In the case of puttable stock issuance, the ratio of firm value going to new shareholders is $\alpha_r = \frac{I}{V(p;H)}$. In the case of common stock issuance, the ratio of firm value going

1 If X satisfies the condition of $(\frac{I}{n} + O) \leq X \leq \frac{y+(1+r_1)I+nO}{1+n}$, the result of this model is effective.

2 From Tucker (1990), we can imagine one of pooling equilibriums in which both types of firms issue puttable stock.

to new shareholders is $\alpha_i = \frac{I}{V(c;L)}$. When the firm is type H , old shareholder payoffs are respectively

$$u(p;H) = (1 - \alpha_p)V(p;H) = y + r_1I + nO \quad (9)$$

$$u(c;H) = (1 - \alpha_c)V(c;H) = \frac{y + r_2I}{y + (1 + r_2)I} \{y + (1 + r_2)I\} \quad (10)$$

Subtract (9) from (10),

$$u(p;H) - u(c;H) = \frac{nO\{y + (1 + r_2)I\} + (r_1 + r_2)I^2}{y + (1 + r_2)I} > 0 \quad (11)$$

(11) shows that puttable stock issuance gives larger payoff to old shareholders than common stock issuance does. When the firm is type L , old shareholder payoffs are respectively

$$u(p;L) = (1 - \alpha_p^*)V(p;L) = y + r_2I \quad (12)$$

$$u(c;L) = (1 - \alpha_c^*)V(c;L) = y + r_2I \quad (13)$$

$$u(c;L) = u(p;L) \quad (14)$$

(14) shows that puttable stock issuance gives the same payoff to old shareholders as common stock issuance does. According to (11) and (14), there are no incentives for management to behave against the market's belief.

Second, consider that the market believes that type H issues common stock and type L issues puttable stock. In the case of puttable stock issuance, the ratio of firm value going to new shareholders is $\alpha_p^* = \frac{I}{V(p;L)}$, and $\alpha_c^* = \frac{I}{V(c;H)}$ in the case of common stock issuance. When the firm is type L , old shareholder payoffs are respectively

$$u(p;L) = (1 - \alpha_p^*)V(p;L) = y + r_2I \quad (15)$$

$$u(c;L) = (1 - \alpha_c^*)V(c;L) = \frac{y + r_1I}{y + (1 + r_1)I} \{y + (1 + r_2)I\} \quad (16)$$

$$u(c;L) - u(p;L) = \frac{(r_1 + r_2)I^2}{y + (1 + r_1)I} > 0 \quad (17)$$

(17) shows that common stock issuance gives larger payoff to old shareholders than puttable stock issuance does. When the firm is type H , old shareholder payoffs are respectively

$$u(p;H) = (1 - \alpha_p)V(p;H) = \frac{y + r_1I}{y + (1 + r_1)I} \{y + (1 + r_1)I + nO\} \quad (18)$$

$$u(c;H) = (1 - \alpha_c)V(c;H) = y + r_1I \quad (19)$$

$$u(p;H) - u(c;H) = \frac{nO(y + r_1I) + (r_1 + r_2)I^2}{y + (1 + r_1)I} > 0 \quad (20)$$

(20) shows that puttable stock issuance gives larger payoff to old shareholders than common stock issuance does. According to (17) and (20), both types have no incentives to behave according to the market's belief.

Therefore, we can conclude as follows:

Proposition 1

There is a separating equilibrium that type H issues puttable stock and type L issues common stock.

3 Stock issuance and stock market reaction

This section analyzes stock price dynamic in relation to the puttable stock and common stock issuance. The puttable stock issuance means a signal of type H . Stock price at date 1 is

$$S_1^p = \frac{V(p;H)}{1+n} = (1-\alpha_p^*)V(p;H) = y+r_1I+nO \tag{21}$$

The common stock issuance means a signal of type L . Stock price at date 1 is

$$S_1^c = \frac{V(c;L)}{1+n} = (1-\alpha_c^*)V(c;H) = y+r_2I \tag{22}$$

Because the market knows only that the probability of the firm being type H is θ , and that the probability of the firm being type L is $(1-\theta)$, stock price at date 0 is

$$S_0 = \theta S_1^p + (1-\theta)S_1^c = y+r_2I + \theta\{nO + (r_1-r_2)I\} \tag{23}$$

To show the stock market reaction to the puttable stock issuance, let us define the rate of return as

$$R_p \equiv \frac{S_1^p - S_0}{S_0} = \frac{(1-\theta)\{nO + (r_1-r_2)I\}}{S_0} > 0 \tag{24}$$

(24) shows that stock price appreciates in response to the puttable stock issuance. To show the stock market reaction to the common stock issuance, let us define the rate of return as

$$R_c \equiv \frac{S_1^c - S_0}{S_0} = -\frac{\theta\{nO + (r_1-r_2)I\}}{S_0} < 0 \tag{25}$$

(25) shows that stock price depreciates in response to the common stock issuance.

Many studies note that stock price decreases in response to common stock issuance. In addition, most cases of puttable stock and put issuances seem to increase stock price. These facts are consistent with this paper's prediction.

As mentioned earlier, the market does not know firm type and knows only that the probability of the firm being type H is θ . To see the relationship between the probability θ and the rate of return

on puttable stock issuance, R_p is differentiated with θ .

$$\frac{\partial R_p}{\partial \theta} = \frac{-\{nO + (r_1 - r_2)I\}(y + r_1I + nO)}{(S_0)^2} < 0 \quad (26)$$

According to the increase of θ , the numerator in (24) becomes less while the denominator becomes greater. Therefore, as shown in (26), the greater the probability of the firm being type H , the lower the rate of return on puttable stock issuance. Similarly, the rate of return on common stock issuance R_c is differentiated with θ .

$$\frac{\partial R_c}{\partial \theta} = \frac{-\{nO + (r_1 - r_2)I\}\{y + r_2I\}}{(S_0)^2} < 0 \quad (27)$$

According to the increase of θ , the numerator in (25) becomes less while the denominator becomes greater. Therefore, as shown in (27), the greater the probability of the firm being type H , the lower the rate of return on common stock issuance.

From the analysis of market reaction, we can conclude as follows:

Proposition 2

Puttable stock issuance increases stock price, while common stock issuance decreases stock price. The greater the probability of the firm being type H , the lower the rate of return on puttable and common stock issuance.

4 Summary

More than 100 firms have issued puts on firms' own common stock. Although several papers note that puts might be able to mitigate adverse selection costs, no paper shows concretely to what extent puts affect stock price. In this paper, we specifically show the stock market reaction to put issuance in a separating equilibrium.

In our model, the firm has asset-in-place bringing certain income in the future and a project opportunity with positive NPV. The firm issues stock to fund the project opportunity. Myers and Majluf (1984) shows that without asymmetric information about asset-in-place, common stock is always issued when the firm has a positive NPV opportunity. Therefore, common stock issuance cannot be a signal of firm type and the high quality firm may be relatively undervalued. In the same model setting, if the firm can choose between puttable stock issuance (a combination of a put and a common stock) and common stock issuance, the high quality firm issues puttable stock and the low quality firm issues common stock. This result is consistent with Gibson and Singh (2000). From this result, we directly show the stock market reaction to put issuance. The high quality firm can differentiate itself from the low quality firm by issuing puts, which means that issuing puts can be a signal. Therefore, stock price is predicted to appreciate upon puttable stock issuance and to depreciate upon common stock issuance.

Stock price decrease upon common stock issuance is well known and verified by many papers. In most cases of puttable stock and put issuance, stock price increases. These are consistent with our model's prediction. From this fact, we can note that puttable stock issuance (including put issuance) can be a useful tool to signal firm type to the market.

Despite the signaling effect, most firms do not write puts against their own stock. As the reason for so few put issuances, Gibson and Singh (2000) notes that corporate managers may not be fully informed about puts as a viable financing alternative given their relative newness, or that they may perceive that puts restrict future financing flexibility in a way similar to that with debt or that puts carry prohibitively high transaction costs.

In late September 2002, EDS Co. announced that it had to issue \$225 million in commercial paper to buy back 3.7 million of its own shares, thanks to puts it had sold on them through June. The price was \$60.61 a share, when EDS stock was selling on the open market for \$17. The announcement, coming on the heels of a surprise profit warning, sent the stock down 66 percent in the week following (Nyberg, 2002). This case might provide a basic explanation for the reason why a majority of firms do not issue puts. Although management is presumed to know firm type (i.e., profitability) in our model, in reality, management might not know it well even over the relatively short period to the maturity of puts.

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