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Why Do Financial Intermediaries Buy Put Options from Companies?

Stanley Gyoshev and Todd R. Kaplan and Samuel Szewczyk and George Tsetsekos

University of Exeter, University of Exeter and University of Haifa, Drexel University, Drexel University

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Abstract

Companies have collected billions in premiums from privately sold put options written on their own stock, yet almost all of these puts expired worthless and their owners lost money as a result. Although these losses seem puzzling, we model how by offering to buy put options from better informed parties, investment banks receive private information about the issuing company. Empirically, we find a 12% increase in the stock prices and a 40% increase in the trading volumes around the put sales. An examination of 13D filings reveals that upper management insiders increased their long position on the stock around the put sale - consistent with them having private information. However, the magnitude of the volumes and the lack of change in the shares outstanding indicate that other informed-of-the-put-sale parties might also have acted. By examining 13F filings, we find no evidence that these parties were institutional investors.

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Why Do Investment Banks Buy Put Options from Companies?[*]

Stanley B. Gyoshev[†]   Todd R. Kaplan[‡]   Samuel Szewczyk[§]

George P. Tsetsekos[¶]

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[†]Xfi Centre for Finance & Investment, University of Exeter Business School, Streatham Court, Rennes Drive, Exeter EX4 4ST, UK, +44-1392-72-3227, S.Gyoshev@exeter.ac.uk

[‡]Department of Economics, University of Haifa, Haifa, Israel and Department of Economics, University of Exeter Business School, Exeter, UK; email: Dr@ToddKaplan.com

[§]Department of Finance, Drexel University, Philadelphia, PA 19104, US, szewczsh@drexel.edu

[¶]Department of Finance, Drexel University, Philadelphia, PA 19104, US, tsetsekos@drexel.edu

1   Introduction

In February 1991, the Securities and Exchange Commission (SEC) issued a ruling that allowed publicly traded companies to sell put options written on their own stock. This practice began modestly with IBM, which realized profits in 1992 in excess of $2 million from its put option sales.[1] The practice quickly spread to companies such as Microsoft, which over a seven-year period beginning in 1993, received over $2 billion in total premiums from sales of puts including $766 million in 1999 alone.[2] While bringing in such significant revenues, company-written put options expired out of the money in almost all cases. The practice of companies writing put options on their own stock abated in the wake of the 2000-2002 bear market; however, usage of these deals has reemerged. For instance, in 2011, Qualcomm Inc. received $75 million in put option proceeds (and its put option program is ongoing as of January 2015).

Although the original spirit of the SEC ruling was to allow companies to issue put options publicly on an organized exchange like the Chicago Board Options Exchange (CBOE), most companies placed their options privately with investment banks or other qualified institutional buyers.[3] Like with any put option, the issuer takes a long position on the stock while the purchaser takes a short position. Gibson et al. (2006) compare the accounting performances of companies with put option sales to a matched sample and find that companies with these sales have significantly higher return on assets (ROA), operational return on assets (OpROA), and net income return on assets (NIROA) for the first three years after

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[1]University of Virginia, Darden Case Study UVA- F-1009 (1992).

[2]For a detailed Microsoft case study refer to Gyoshev (2001).

[3]The initial ruling to allow the sale of put options was in fact made in favor of a request submitted by the CBOE.

the put sales (with the lone exception the first year of NIROA). Jenter et al. (2011) finds an abnormal mean stock return of 4.68% over 100 days after a put option sale along with a 3.36% abnormal mean return around the first earnings announcement after the sale (from 5 days before to 40 days after). Gibson et al. (2006) and Jenter et al. (2011) find that not only are the companies that issue puts gain from the sales, but also their managers are making use of privately held information to help the companies time the market.

The writing of a put option is a zero-sum game in which the two parties bet on the direction and magnitude of future changes in stock prices. Gibson et al. (2006) and Jenter et al. (2011) show that one side (the managers) are consistently winning this game, which is not surprising because they are better informed. Intriguingly, of the few options that did not expire worthless, a large percentage were settled before the expiration date where again the company had an informational advantage. So why, does the counterparty agree to these bets?

Furthermore, investment banks commonly approach issuing companies about purchasing put options.[4] So either the investment banks choose to make losing purchases for themselves or choose to arrange such purchases for their clients. The clients are fully informed that the counterparty is the company itself due to the fact that this is a non-standard option with a default risk by the company.

Gibson and Singh (2000) and Gibson et al. (2006) provide a possible explanation to this puzzle with a signalling model of put option sales. In their models, companies with strong outlooks choose to signal their long-term expected value in order to increase the

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[4]For example, Tom Pratt (1994) cites Paul Mazzilli at Morgan Stanley & Co. as stating that "a large portion of the companies that do [repurchase] programs with me have been introduced to [selling put derivatives], and use the strategy."

price of their stock in the short term (companies maximize a weighted sum of short-term and long-term share prices). The counterparty is willing to buy the options since they are sold at a fair price (and neither side profits directly from the transaction).

We build a model that captures the information content of put issues in the Gibson and Singh (2000) and Gibson et al. (2006) models. To this model, we add a stage to where the option can be bought back by the company. This second stage provides a means for the put owner to obtain new information acquired by the company after the first stage. While the purchasers may lose money from the transactions (and the companies gain), the purchasers gain information. While outside the model, the purchasers can overall profit if this privately obtained information is used in trading on the company's stock.

Our model yields insight as to why investment banks purchase put options from companies and we empirically explore the data for consistency with the model. To start, we substantiate Jenter et al.'s (2011) result of abnormal stock performance around the put transaction; however, in contrast, we only look at the first put transaction used by a company since the information content can vary in strength over repeated put option sales (as Gyoshev, 2001, suggests). Here, we find a 12% abnormal return in the stock prices over 60 days compared to the 4.68% found by Jenter et al. (2011) over 100 days.

This abnormal return supports the hypothesis that the companies had private information about their future stock performance and used this information to time the sale of put options to when the stock was undervalued. However, we then test for abnormal volume around put option sales and find an increase of 40%. This increase indicates that a party gained and used information beyond a private put sale and is consistent with our model. Furthermore, we find no significant change in the number of outstanding shares

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and treasury shares, indicating that the company itself was not actively involved in the increase in volume.

We also test for structural breaks in the time series of the abnormal return of the stock prices around the put transactions and reject the null hypothesis that no structural break exists at day 0 and endogenously find a structural break at day 7. We also test for structural breaks in the volume time series and endogenously find structural breaks at day -19 and day 12. The observation that the trading volume increased before the transaction date is consistent with the knowledge that a put transaction is likely to have an effect.

Ben-Rephael et al. (2014) find that there is a stock price increase following a stock repurchase, but unlike what we find with put option sales, these increases only occur once companies disclose their purchases in their earnings announcements. Since stock repurchases can be accomplished without the seller knowing that the buyer is the company itself nor the size of the repurchases, no party outside the company itself, its upper management, and perhaps its broker would know about the size of the recent repurchases. The difference again suggests that the early price and volume movements could be due to outside parties who possess information.

To further explore which parties are making the trades, we examine 13D and 13F filings. An examination of 13D filings reveals that upper management insiders (but not shareholder insiders, i.e., those with more than a 10% stake in voting shares) increased their long position on the stock around the put sale - consistent with them having private information. However, the magnitude of the volumes and the lack of change in the shares outstanding indicate that other informed parties might also have acted. By examining 13F filings, we find no evidence that these were institutional investors. This is still consistent

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with our model. If the investment banks are intermediaries and not the final holders of the put options, then their clients that purchased the put options could also be purchasing shares because the transaction remains private for an average of six months.

2 Theoretical Model

One reason that investment banks are willing to buy put options from better informed parties is that while they may lose in that transaction, they gain private information from those companies that issue the put options. In a similar manner, the investment banks act merely as an intermediaries for clients where each client may lose in the transaction but gain information. If true, this reasoning requires that companies make decisions that depend upon their information about future company value. In other words, the companies must be in a separating equilibrium in regards to put contracts. This equilibrium allows investment banks or their clients to screen for companies with positive outlooks.

In this section, we demonstrate how this separating equilibrium exists in a screening model where the contracts are offered by a buyer to a company. To ease exposition, we do not explicitly model how buyers profit from information gained nor how they decide upon what terms to offer the company, only how they may gain information from particular contracts.

As we mentioned, our model demonstrates how the company can privately reveal information to the buyer of the put option via screening. There are other related papers about how information can be revealed through financial transactions. Oded (2005) demonstrates how information can be publicly revealed in a signalling model of repurchase program an-

nouncements. Similarly, Kim and Kallberg (1998) show how information can be revealed by converting (or not converting) bonds. Oded (2011) takes into account that when a company makes a tender offer to its shareholders to buy back its shares as a means to distribute excess cash, there is an asymmetry of information between the company buying back the shares and the shareholders. Due to this asymmetry, the company must pay a premium since the shareholders do not profit from the information they acquire.

Gibson and Singh (2000) and Gibson et al. (2006), henceforth GS and GPS, provide a two-type model on how put options sold by a company can convey information to the purchasers of the option. Namely, a company with a good outlook should wish to increase its short-term price by signalling its value via a (public) put sale. The purchaser is willing to buy the options since they are sold at a fair price (and neither side profits directly from the transaction). The main differences between GS/GPS and our model is that, first, we model the situation as screening as opposed to signalling. Second, we allow for sales to be actuarially unfair since the buyer could lose money on the sale, but gain through market purchases of the underlying stock. Third, we model the company's put buyback option that allows more information to be conveyed.

This put buyback option, which we believe may be present either explicitly or implicitly in contracts in the future, allows the company to buy back the put options at market prices (and may have implicitly been exercised in the past such as by Microsoft). However, this option might make one question whether the put buyback option could disrupt the original separating equilibrium. We also explore this possibility and show that not only can the original separating equilibrium remain intact, but there can be an additional stage of separating where only those companies with a low final value will make use of this

option. This use shows that the tool of the put option with a buyback gives a purchaser the ability to screen the market in both directions and enables them to discover both the signal received by the company about its future valuation but also potentially learn the value before the market.

2.1 Example with Put Sales Only

In this subsection, we provide a basic example of how the separating equilibrium occurs with just put option sales before proceeding to an example of the put buybacks. Such an equilibrium is necessary for screening to occur on behalf of an investment bank or their clients.

For simplicity we assume that the future value can be one of two types: high or low. A company receives a signal about the likelihood that its value is high. This signal also can be either high or low. A company with a high signal is willing to sell put options at a specified premium and strike price, while a company with a low signal is not willing to sell put options under these conditions. These conditions allow the buyer of the put option to deduce the company's signal.

A company has one project that has an uncertain value v. This is the entire worth of the company. The company receives a signal about the distribution of the value of the project. The signal can be h (high) or ℓ (low) with equal probability. If the signal is h, then there is a $\frac{4}{5}$ chance that the company is worth $\$200,000$ (a high value) and a $\frac{1}{5}$ chance it is worth $\$100,000$ (a low value). If the signal is ℓ then there is a $\frac{1}{5}$ chance the company is worth $\$200,000$ and a $\frac{4}{5}$ chance it is worth $\$100,000$. There are $1,000$ shares of stock. The company's objective is to maximize its expected (future) share price (keeping the

outstanding shares constant). Note that this setup differs from GS and GPS, who assume a company's objective is to maximize a weighted average of its expected future share price and current share price.

As is, the stock price is $150. Now assume that the company sells 500 put options for a combined premium of $10,000 with a strike price of $150. As a function of value, the stock price must satisfy:

$$s = \frac{v + 10,000 - 500 \cdot \max\{150 - s, 0\}}{1000}. \tag{1}$$

Note that we assume that the company pays in cash rather than shares for an exercised option. This assumption simplifies the analysis and makes no difference in the results.[5,6] If $v \geq 140,000$, then the equilibrium price is $s = \frac{v}{1000} + 10$. On the other hand, if $v \leq 140,000$, then $s = \frac{v}{1000} + 10 - 75 + \frac{s}{2}$. This last equation can be simplified to $s = \frac{v}{500} - 130$. Thus, with a high value the stock is worth $s = 210$ and with a low value the stock is worth $s = 70$.

A company with a signal of h has an expected stock price before the sale of $E[s] = \frac{4}{5}200 + \frac{1}{5}100 = 180$ and after the sale of $E[s] = \frac{4}{5}210 + \frac{1}{5}70 = 182$. Therefore, selling the put options is worthwhile to the company. A company with a signal of ℓ has an expected stock price before the sale of $E[s] = \frac{1}{5}200 + \frac{4}{5}100 = 120$ and after the sale of

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[5]In practice, the put options gave the company the choice of settling the options in cash or company stock but the options were never settled in stock. For example, Microsoft 10-Q, filing date 11/14/96, states "The warrants expire at various dates between the second quarter of fiscal 1997 and the second quarter of fiscal 1998, are exercisable only at maturity, and are settleable in cash at Microsoft's option."

[6]We see this equivalence by the following example. If a company has two shares outstanding, a sole investment worth $200, and an outstanding put option with a strike price of $120. The company can settle for stock and pay $120. In this case, the remaining share is worth $80. Otherwise, the company can pay the cash difference of $40 and then have two shares worth $80 each (which would be the market price beforehand).

$E[s] = \frac{1}{5}210 + \frac{4}{5}70 = 98$. Therefore, selling the put options are not worthwhile to the company. See Figure 1 for a graphical representation of this analysis.

$<<<$ Insert Figure 1 $>>>$

Hence, a separating equilibrium exists in which only companies that receive a high signal sell put options. Notice that in this particular example, the company selling the put options, on average, has a gain from the sale. In a full screening model, the buyer chooses the put option and premium to create the minimum benefit to the company that is necessary to ensure separating. For instance, here, the strike price can be set to 160. This would lower the share price in the low state to 60, whereby, the expected share price after the sale is $E[s] = \frac{4}{5}210 + \frac{1}{5}60 = 180$. (This strike price makes the put options actuarially fair since there is a 1/5 chance of them being in the money making $160 - 60 = 100$ per put.) However, this strike price could be limited by both the bargaining power of the buyer and the information structure. (See the end of Section 2.3 for a longer explanation.)

After the put option is sold (or not sold), the party buying the put option could then use this information to make an additional bet on the stock price such as buying the stock and betting that the share price will go up (or if the put option is not sold, it could sell the stock short betting the price will go down).

2.2   Example with Put Buybacks

Now let us add to the above example, put buybacks. This happens when the company has additional information after the put sale. Let us say that the company has a μ chance $(1 \geq \mu > 0)$ of knowing the value of the project before the market (but after the put

transaction).[7] The company can buy the puts back for a price of b per put. Since the puts are only in the money when the value of the project is $v = 100,000$, the company only buys them back in that case. A timeline is presented in Figure 2 and a game tree of the options (excluding those of the bank) is presented in Figure 3.

$<<<$ Insert Figure 2 $>>>$

$<<<$ Insert Figure 3 $>>>$

If the company buys back the puts, then the stock price is then $s = 110 - b/2$.[8] (Note that they only do so if $b \leq 80$ since the strike price is 150 and the stock price with the buyback will be 70.)

A company with a signal of h has an expected stock price before the sale of $E[s] = \frac{4}{5}200 + \frac{1}{5}100 = 180$ and after the sale of $E[s] = \frac{4}{5}210 + \frac{1}{5}\left[\mu\left(110 - \frac{b}{2}\right) + (1-\mu)70\right]$. Therefore, to maximize the expected share price, selling the put options is worthwhile if $\mu\left(40 - \frac{b}{2}\right) \geq -10$.

A company with a signal of ℓ has an expected stock price before the sale of $E[s] = \frac{1}{5}200 + \frac{4}{5}100 = 120$ and after the sale of $E[s] = \frac{1}{5}210 + \frac{4}{5}\left[\mu\left(110 - \frac{b}{2}\right) + (1-\mu)70\right]$. Therefore, the options are not worth selling if $27.5 \geq \mu\left(40 - \frac{b}{2}\right)$.

Thus, we can have separation at two different times in three different ways. First, we can have separation as in the previous example where only the companies with the h signal sell puts but do not buy them back after learning their value such as when $b > 80$. Second,

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[7]We assume that μ is independent of both the signal and the actual value, although similar results would hold with dependency.

[8]The stock price is equal to the value $(100,000)$ plus the premiums from selling puts $(10,000)$ minus the cost of buying back the put contracts $(500 \cdot b)$, all divided by the number of shares outstanding (1000).

only the companies with the h signal sell puts and then they buy them back only if the outcome is bad. For example, if $b = 30$ and $\mu = 0.9$. Third, for a small enough b and a large enough μ, we can have no separation occurring when the put is sold, but there is separation when the put is bought back such as when $b = 22$ and $\mu = 0.95$.

2.3 Two-Type Model with Buybacks.

We now proceed to generalize the basic example into a two-type screening model with put buybacks and two possible outcomes. Again, there is a company that has an uncertain value v with N_s shares of stock outstanding. The company gets a signal, h (high) or ℓ (low), about the distribution of its value. If the signal is h, then there is a θ chance (where $1 > \theta > 1/2$) the company is worth v_h (a high value), and a $(1 - \theta)$ chance it is worth v_ℓ (a low value) where $v_h > v_\ell$. If the signal is ℓ, then there is a $(1 - \theta)$ chance the company is worth v_h, and a θ chance it is worth v_ℓ. Again, the company has a μ chance $(1 \geq \mu > 0)$ of knowing the value of the project before the market (but after any put sale) and can buy the puts back for a price of $b > 0$ per put. Again, the timeline of this setup is the same as that in Figure 2 and the game tree is the same as that in Figure 3.

A company is offered a take-it-or-leave-it contract of $(N_p, p, x, b) \in \{1, \ldots, N_s\} \times \mathbb{R}^+ \times \mathbb{R}^+ \times \mathbb{R}^+$ where N_p is the number of put options, p is the premium for each share, x is the strike price, and b is the buyback price.

Lemma 1 *If $p \geq x$ then the company will always accept the put contract.*

Proof. Since the stock price will be strictly positive, the maximal payment for each put contract is strictly less than x. Since a company receives p for each put contract, it will

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always make a profit. Thus, it is worthwhile to accept the offer. ■

Lemma 2 *If $b < p$, then the company will always accept the put contract.*

Proof. It will be profitable for the company to sell the contract to the bank and then buy back the contract for a lower price. A company may not buy back the put option, but even if the company knew ahead of time the state would be v_ℓ, it would be worthwhile to sell the put option. ■

Lemmas 1 and 2 show which parameter regions will not be of interest. The following lemma finds for which values the options are in the money, which must occur for low values if signalling exists via the purchase of the options.

Lemma 3 *If the company sells the options and does not buy them back, then the options are in the money at the expiration date if and only if the project value v is strictly less than $v^* = xN_s - pN_p$.*

Proof. If the company indeed sells the put options but does not exercise the buyback, then as a function of the value, the stock price (if positive) must satisfy:

$$s = \frac{v + pN_p - N_p \max\{x - s, 0\}}{N_s}. \tag{2}$$

By substitution x for s into equation (2), we can find the value v^* that causes $s = x$. This computes to $v^* = xN_s - pN_p$, strictly below which the option is in the money. ■

Corollary 1 *If the cutoff is strictly higher than the high value $(xN_s - pN_p > v_h)$, then the options are always in the money.*

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Proof. The cutoff is always lower than the value. By Lemma 3, the options are always in the money. ∎

Corollary 2 *If the cutoff is strictly lower than the low value ($v_\ell > xN_s - pN_p$), then there is pooling.*

Proof. In this case, the cutoff is always lower than the value, which can be high or low. By Lemma 3, the options are always out of the money. In this case, the company is always willing to sell them and is never willing to buy them back. ∎

If there is pooling, then there is no information gained from the initial sale. Furthermore, the company does not buy back the put options since they are always out of the money and there is no information gained from any buyback offer. Overall, a buyer would lose money from buying a put that reveals no information and always expires worthless. Thus, we would not expect to see such offers.

There are cases where there will be buybacks. The following lemma finds for which values a company will try to buyback the put options. This buyback must occur only for low values if signalling occurs via buybacks.

Lemma 4 *A buyback occurs only if $xN_s - pN_p - b(N_s - N_p) \geq v$.*

Proof. Without buybacks, if $v \geq v^*$, then $s_{nb,\geq} = \frac{v + pN_p}{N_s}$ is the equilibrium stock price. If $v \leq v^*$, then the equilibrium price $s_{nb,\leq}$ must satisfy:

$$s_{nb,\leq} = \frac{v}{N_s} + \frac{N_p}{N_s}(p - x + s_{nb,\leq}). \tag{3}$$

Solving for $s_{nb,\leq}$ yields

$$s_{nb,\leq} = \frac{v + N_p(p-x)}{N_s - N_p}. \qquad (4)$$

If the company exercises the buyback, then the stock price s_b is instead

$$s_b = \frac{v - (b-p)N_p}{N_s} = \frac{v + pN_p - bN_p}{N_s}. \qquad (5)$$

Clearly, the buyback only occur if the put is in the money, i.e., $v \leq v^*$, since $s_{nb,\geq} > s_b$. Furthermore, when the put is in the money, the buyback can only occur if the value of the stock is higher with the buyback than with paying out the put. This can happen if and only if $s_b \geq s_{nb,\leq}$ or

$$\frac{v + pN_p - bN_p}{N_s} \geq \frac{v + N_p(p-x)}{N_s - N_p}. \qquad (6)$$

This equation simplifies to

$$xN_s - pN_p - b(N_s - N_p) \geq v. \qquad (7)$$

∎

Corollary 3 *A buyback occurs only if the put is in the money and either b is sufficiently small or N_p is sufficiently high (close to N_s).*

A buyer may also be concerned about counter party risk. Hence, in the following Lemma, we look at when this would be of concern.

Lemma 5 *The company will not be able to pay all the put obligations if and only if $xN_p > v_\ell + pN_p$.*

Proof. The worst case for the company (and maximum payoff on the put option for the company) occurs when the project has a low value v_ℓ. It would not be able to pay the put option, if and only if, the share price drops to 0. The total liability is xN_p and the total assets are $v_\ell + pN_p$, which is the value of the project plus the put premiums. ∎

Condition C1$_\ell$: $v_\ell \leq xN_s - pN_p$ *(the cutoff is above the low value).*

Condition C1$_\mathbf{h}$: $xN_s - pN_p \leq v_h$ *(the cutoff is below the high value).*

Condition C1$_\ell$ avoids the trivial cases where the options are always out of the money and the investment bank would never want to buy them. Together with Condition C1$_\mathbf{h}$ allows us to analyze the case when the option is only in the money when the value is low. Thus, without buybacks in a high state the stock is worth $s = \frac{v_h + pN_p}{N_s}$ and in a low state the stock is worth $s = \max\{\frac{v_\ell + N_p(p-x)}{N_s - N_p}, 0\}$.

Condition C2: $xN_p \leq v_\ell + pN_p$ *(no bankruptcy).*

Condition C2 is consistent with the empirical finding that no issuing company went bankrupt. However, having such a risk only strengthens the argument that the trade is unprofitable for the buyer without gaining information in return.

Condition C3$_\ell$: $b < \frac{xN_s - pN_p - v_\ell}{(N_s - N_p)}$ *(put buyback is priced sufficiently low).*

Condition C3$_h$: $b > \frac{xN_s - pN_p - v_h}{(N_s - N_p)}$ *(high value is sufficiently high).*

Note that C3$_\ell$ and C3$_h$ can both hold together, however if C3$_\ell$ does not hold, then C3$_h$ holds. Likewise, if C3$_h$ does not hold, then C3$_\ell$ holds. In sum, at least one of the two conditions must hold.

Condition C4: $b > p$.

This condition follows from Lemma 2.

We now present the main result of the model section which describes three types of

equilibria that convey information to the buyer of the put option.

Proposition 1 *(i) If Conditions C1$_\ell$, C1$_h$, C2, C3$_\ell$, C3$_h$ and C4 hold, a double separating equilibrium (via purchase and buyback) exists if and only if*

$$\frac{\theta}{1-\theta} \geq \mu \cdot \frac{b-p}{p} + (1-\mu)\left(\frac{N_s(x-p)-v_\ell}{p\,(N_s - N_p)}\right) \geq \frac{1-\theta}{\theta}. \tag{8}$$

(ii) If Conditions C1$_\ell$, C1$_h$, C2, C3$_\ell$, C3$_h$, and C4 hold, a separating equilibrium only via buybacks exists if and only if

$$\frac{1-\theta}{\theta} \geq \mu \cdot \frac{b-p}{p} + (1-\mu)\left(\frac{N_s(x-p)-v_\ell}{p\,(N_s - N_p)}\right). \tag{9}$$

(iii) If Conditions C1$_\ell$, C1$_h$, C2, C4 hold, but Conditions C3$_\ell$ does not hold, a separating equilibrium via put options (but not buybacks) exists if and only if

$$\frac{\theta}{1-\theta} \geq \frac{N_s(x-p)-v_\ell}{p\,(N_s - N_p)} \geq \frac{1-\theta}{\theta}. \tag{10}$$

(iv) If Conditions C1$_\ell$, C2, C3$_\ell$, C3$_h$, C4 hold and C1$_h$ does not hold, a double separating equilibrium (via purchase and buyback) exists if and only if

$$\frac{1-\theta}{\theta} \leq \left[\frac{(N_s - N_p)}{(v_h - N_s(x-p))}\right] \cdot \left[\mu \cdot (b-p) + (1-\mu) \cdot \left(\frac{N_s(x-p)-v_\ell}{(N_s - N_p)}\right)\right] \leq \frac{\theta}{1-\theta}. \tag{11}$$

(v) If Conditions C1$_\ell$, C2, C3$_\ell$, C3$_h$, C4 hold and C1$_h$ does not hold, a separating equilibrium

only via buybacks exists if and only if

$$\left[\frac{(N_s - N_p)}{(v_h - N_s(x-p))}\right] \cdot \left[\mu \cdot (b-p) + (1-\mu) \cdot \left(\frac{N_s(x-p) - v_\ell}{(N_s - N_p)}\right)\right] \leq \frac{1-\theta}{\theta}. \tag{12}$$

(vi) If Conditions C1$_\ell$, C2, C4 hold, but Conditions C1$_h$ and C3$_\ell$ do not hold, a separating equilibrium via put options (but not buybacks) exists if and only if

$$\frac{\theta}{1-\theta} \geq \frac{v_h - N_s(x-p)}{N_s(x-p) - v_\ell} \geq \frac{1-\theta}{\theta}. \tag{13}$$

Proof. (i) We start by proving part (i). By Lemma 4, Condition C3$_\ell$ and C3$_h$ assure that a buyback will only occur for a low value. In Figure 3, Condition C3$_\ell$ assures that the company would choose left (buy) at nodes d and g, while Condition C3$_h$ assures that the company would choose right (not buy) at nodes e and h. Condition C4 assures that the decision at nodes c and f would consistent with the decision nodes a and b. This is because there is no gain of information for the company and if the company wanted to sell a put for a premium p, they would not want to buy it back for a price b strictly larger than p.

Given now the decisions at nodes c to h, we now compute the share price of the company under several options in order to check the incentive constraints such that the company chooses not to sell a put option at node a and chooses to sell a put option at node b.

h signal, no put option: A company with a signal of h that chooses not to sell a put option has an expected stock price of

$$s_h = \theta \frac{v_h}{N_s} + (1-\theta)\frac{v_\ell}{N_s}. \tag{14}$$

h signal, put option sale and separating buyback: If $C1_h$ holds, with chance θ, the value is v_h, and the stock price is worth $\frac{v_h + pN_p}{N_s}$. With chance $(1 - \theta)$, the value is v_ℓ, and the company has a μ chance of buying back the puts leading to a stock price of $\frac{v_\ell + N_p(p-b)}{N_s}$ and a $(1 - \mu)$ chance of being forced to pay out the put option (by Lemma 3, since $C1_\ell$ holds), which results in a stock price of $\frac{v_\ell + N_p(p-x)}{N_s - N_p}$, which is positive due to Condition C2. Overall, the expected stock price is:

$$s_{h,p,b} = \theta \frac{v_h + pN_p}{N_s} + (1 - \theta) \left[\mu \cdot \frac{v_\ell + N_p(p-b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p-x)}{N_s - N_p} \right]. \quad (15)$$

ℓ signal, no put option: Likewise, a company with a signal of ℓ that does not sell the put option will have an expected stock price of

$$s_\ell = (1 - \theta) \frac{v_h}{N_s} + \theta \frac{v_\ell}{N_s}. \quad (16)$$

ℓ signal, put option sale and separating buyback: A company with a low signal and a separating buyback will have an expected stock price of

$$s_{\ell,p,b} = (1 - \theta) \frac{v_h + pN_p}{N_s} + \theta \left[\mu \cdot \frac{v_\ell + N_p(p-b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p-x)}{N_s - N_p} \right]. \quad (17)$$

Hence, we can have a double separating equilibrium, where only the company with a high signal sells the puts and a company with a low value buys back the puts, if and only if $s_h \leq s_{h,p,b}$ (weakly preferred to sell a put option at node b) and $s_\ell \geq s_{\ell,p,b}$ (weakly preferred

to not sell a put option at node a). By substitution from equations (14)-(17), we have

$$\theta \frac{v_h}{N_s} + (1 - \theta) \frac{v_\ell}{N_s} \leq \theta \frac{v_h + pN_p}{N_s} + (1 - \theta) \left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} \right],$$
(18)

$$(1 - \theta) \frac{v_h}{N_s} + \theta \frac{v_\ell}{N_s} \geq (1 - \theta) \frac{v_h + pN_p}{N_s} + \theta \left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} \right].$$
(19)

These conditions can be simplified to

$$0 \leq \frac{\theta}{1 - \theta} + \frac{N_s}{pN_p} \cdot \left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s} \right],$$
(20)

$$0 \geq \frac{1 - \theta}{\theta} + \frac{N_s}{pN_p} \cdot \left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s} \right].$$
(21)

Combining yields

$$\frac{1 - \theta}{\theta} \leq \frac{N_s}{pN_p} \cdot \left[\frac{v_\ell}{N_s} - \mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} - (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} \right] \leq \frac{\theta}{1 - \theta}.$$
(22)

This reduces to inequality (8).

(ii) We now prove part (ii), which states constraints when a separating equilibrium only via buybacks exists. Like for part (i), Conditions C3$_\ell$, C3$_h$, and C4 assures that the decisions at nodes c to h will be consistent with a separating equilibrium via a buyback. For the decisions at nodes a and b to be consistent, we must have $s_\ell \leq s_{\ell,p,b}$ (weakly preferred to sell a put option at node b) and $s_h \leq s_{h,p,b}$ (weakly preferred to sell a put option at node

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a). By substitution from equations (14)-(17), we have

$$\theta\frac{v_h}{N_s} + (1-\theta)\frac{v_\ell}{N_s} \leq \theta\frac{v_h + pN_p}{N_s} + (1-\theta)\left[\mu \cdot \frac{v_\ell + N_p(p-b)}{N_s} + (1-\mu) \cdot \frac{v_\ell + N_p(p-x)}{N_s - N_p}\right],$$
(23)

$$(1-\theta)\frac{v_h}{N_s} + \theta\frac{v_\ell}{N_s} \leq (1-\theta)\frac{v_h + pN_p}{N_s} + \theta\left[\mu \cdot \frac{v_\ell + N_p(p-b)}{N_s} + (1-\mu) \cdot \frac{v_\ell + N_p(p-x)}{N_s - N_p}\right].$$
(24)

Since $\theta > \frac{1}{2}$, the second inequality (24) implies the first inequality (23). Hence, we have this type of equilibrium if and only if (9) holds.

(iii) We now prove part (iii). C1$_\ell$, C1$_h$, C2, C4 hold, but Conditions C3$_\ell$ does not hold,

By Lemma 4, the fact that Condition C3$_\ell$ does not hold assures that a buyback will not occur for a low value (and hence also not for a high value). This and Condition C4 assures that the decisions at nodes c to h will be consistent with a separating equilibrium without a buyback.

h signal, put option sale and no buybacks: If C1$_h$ holds, with chance θ, the value is v_h, and the stock price is worth $\frac{v_h + pN_p}{N_s}$. With chance $(1-\theta)$, the value is v_ℓ the company pays out the put option, which results in a stock price of $\frac{v_\ell + N_p(p-x)}{N_s - N_p}$, which is positive due to Condition C2. Overall, the expected stock price is:

$$s_{h,p,nb} = \theta\frac{v_h + pN_p}{N_s} + (1-\theta)\left[\frac{v_\ell + N_p(p-x)}{N_s - N_p}\right].$$
(25)

ℓ signal, put option sale and no buybacks: and after the sale of the put option an

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expected stock price of

$$s_{\ell,p,nb} = (1 - \theta)\frac{v_h + pN_p}{N_s} + \theta\left[\frac{v_\ell + N_p(p - x)}{N_s - N_p}\right]. \tag{26}$$

Hence, we can have a separating equilibrium without buybacks if and only if $s_h \leq s_{h,p,nb}$

(weakly preferred to sell a put option at node b) and $s_\ell \geq s_{\ell,p,nb}$ (weakly preferred not to

sell a put option at node a). By substitution from equations (14), (16), (25), (26) we have

$$\theta\frac{v_h}{N_s} + (1 - \theta)\frac{v_\ell}{N_s} \leq \theta\frac{v_h + pN_p}{N_s} + (1 - \theta)\left[\frac{v_\ell + N_p(p - x)}{N_s - N_p}\right] \tag{27}$$

$$(1 - \theta)\frac{v_h}{N_s} + \theta\frac{v_\ell}{N_s} \geq (1 - \theta)\frac{v_h + pN_p}{N_s} + \theta\left[\frac{v_\ell + N_p(p - x)}{N_s - N_p}\right] \tag{28}$$

Simplifying

$$\left[\frac{v_\ell}{N_s} - \frac{v_\ell + N_p(p - x)}{N_s - N_p}\right] \leq \frac{\theta}{(1 - \theta)}\frac{pN_p}{N_s}$$

$$\left[\frac{v_\ell}{N_s} - \frac{v_\ell + N_p(p - x)}{N_s - N_p}\right] \geq \frac{(1 - \theta)}{\theta}\frac{pN_p}{N_s}$$

These further simplify to inequality (10).

(iv) Here we prove Part (iv). The company can have a high value v_h that is also in the

money (since C1$_h$ does not hold) but we still have a double separating equilibrium. Again,

we must show that $s_\ell \leq s_{\ell,p,b}$ and $s_h \leq s_{h,p,b}$ and these are equivalent to (the difference is

the share price of a company selling puts in the high state is now worth $\frac{v_h + N_p(p - x)}{N_s - N_p}$ instead

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of $\frac{v_h + N_p p}{N_s}$):

$$\theta \frac{v_h}{N_s} \leq \theta \frac{v_h + N_p(p - x)}{N_s - N_p} + (1 - \theta)\left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s}\right],$$

(29)

$$(1 - \theta)\frac{v_h}{N_s} \geq (1 - \theta)\frac{v_h + N_p(p - x)}{N_s - N_p} + \theta\left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s}\right].$$

(30)

Combining yields inequality (11). Notice when v_h goes to v^*, (11) reduces to the condition when v_h is not in the money.

(v) Here we show part v. The difference between this part and part (ii) is that Condition $C1_h$ does not hold. Similar to the last part, we must use $\frac{v_h + N_p(p-x)}{N_s - N_p}$ instead of $\frac{v_h + N_p p}{N_s}$, but now in replace in inequality (24), which becomes:

$$(1 - \theta)\frac{v_h}{N_s} + \theta\frac{v_\ell}{N_s} \leq (1 - \theta)\frac{v_h + N_p(p - x)}{N_s - N_p} + \theta\left[\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} + (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p}\right].$$

Rearranging yields:

$$\theta\left[-\mu \cdot \frac{v_\ell + N_p(p - b)}{N_s} - (1 - \mu) \cdot \frac{v_\ell + N_p(p - x)}{N_s - N_p} + \frac{v_\ell}{N_s}\right] \leq (1 - \theta)\left(\frac{v_h + N_p(p - x)}{N_s - N_p} - \frac{v_h}{N_s}\right)$$

which simplifies to inequality (12).

(vi) We now prove part (vi). Again, we must use $\frac{v_h + N_p(p-x)}{N_s - N_p}$ instead of $\frac{v_h + N_p p}{N_s}$, but now in

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inequalities (27), (28). Doing so yields:

$$0 \leq \theta \left[\frac{v_h + N_p(p - x)}{N_s - N_p} - \frac{v_h}{N_s} \right] + (1 - \theta) \left[\frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s} \right], \tag{31}$$

$$0 \geq (1 - \theta) \left[\frac{v_h + N_p(p - x)}{N_s - N_p} - \frac{v_h}{N_s} \right] + \theta \left[\frac{v_\ell + N_p(p - x)}{N_s - N_p} - \frac{v_\ell}{N_s} \right]. \tag{32}$$

These further simplify to:

$$0 \leq \theta \left[-N_s(x - p) + v_h \right] + (1 - \theta) \left[-N_s(x - p) + v_\ell \right], \tag{33}$$

$$0 \geq (1 - \theta) \left[-N_s(x - p) + v_h \right] + \theta \left[-N_s(x - p) + v_\ell \right]. \tag{34}$$

Combining yields (13). ∎

While Condition C2 (no bankruptcy) is used in the Proposition, one can get similar qualitative results when C2 does not hold when the value is v_ℓ.

In summation of the Proposition, we find there are 3 types of equilibria in which the company that sells put options conveys information. The first, a double separating equilibrium conveys information in two stages: only companies with high signals are willing to sell the put options; and once the put options are sold, only companies that discover their value is low before the market does, are willing to buy the put options back. There is another possible single separating equilibrium in which the price of the buyback is too high and only companies with high signals are willing to sell the put options, but they are not willing to buy them back even if their value is low. The third is a single separating equilibrium in which the put option sales do not convey any information (a company is willing to sell the put independent of their signal), but the buyback conveys information

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because only a company that discovers its value is low before the market is willing to buy back the put options.

In the following three examples we show how the Proposition works in each of the types of equilibria.

Example 1 *Double Separating occurs when* $\theta = \frac{4}{5}$, $v_h = 200,000$, $v_\ell = 100,000$, $N_s = 1000$, $N_p = 500$, $x = 150$, $p = 20$, $\mu = 0.9$ *and* $b = 30$.

We then have constraint (8): $\frac{\theta}{1-\theta} \geq \mu \cdot \frac{b-p}{p} + (1-\mu)\left(\frac{N_s(x-p)-v_\ell}{p(N_s-N_p)}\right) \geq \frac{1-\theta}{\theta}$ simplify to $4 \geq \mu \cdot \frac{b-20}{20} + (1-\mu)\left(\frac{1000(150-20)-100,000}{20\cdot500}\right) \geq \frac{1}{4}$or $4 \geq \mu \cdot \frac{b}{20} + 3 - 4\mu \geq \frac{1}{4}$. Substituting for μ and b, yields $4 \geq 0.75 \geq \frac{1}{4}$.

Furthermore, C1$_\ell$ is satisfied since $v_\ell \leq xN_s - pN_p$ simplifies to $100,000 \leq 150 \cdot 1000 - 20 \cdot 500$); C1$_h$ is satisfied since $xN_s - pN_p \leq v_h$ simplifies to $150,000 - 10,000 \leq 200,000$; C2 is satisfied, since $xN_p \leq v_\ell + pN_p$ simplifies to $75,000 \leq 100,000 + 10,000$; C3$_\ell$ is satisfied since $b < \frac{xN_s-pN_p-v_\ell}{(N_s-N_p)}$ simplifies to $30 < \frac{150,000-10,000-100,000}{(1000-500)}$; C3$_h$ is satisfied, since $b > \frac{xN_s-pN_p-v_h}{(N_s-N_p)}$ simplifies to $b < \frac{150,000-10,000-200,000}{(1000-500)}$.

Example 2 *A separating equilibrium only via buybacks occurs when* $\theta = \frac{4}{5}$, $v_h = 200,000$, $v_\ell = 100,000$, $N_s = 1000$, $N_p = 500$, $x = 150$, $p = 20$, $\mu = 0.95$ *and* $b = 22$.

We then have constraint (9), $\frac{1-\theta}{\theta} \geq \mu \cdot \frac{b-p}{p} + (1-\mu)\left(\frac{N_s(x-p)-v_\ell}{p(N_s-N_p)}\right)$, simplify to $\frac{1}{4} \geq \mu \cdot \frac{b}{20} + 3 - 4\mu = 0.245$. Again the other constraints are satisfied.

Example 3 *A separating equilibrium via put options (but not buybacks) occurs when* $\theta = \frac{4}{5}$, $v_h = 200,000$, $v_\ell = 100,000$, $N_s = 1000$, $N_p = 500$, $x = 150$, $p = 20$, *and* $b = 100$.

We then have constraint (10), $\frac{\theta}{1-\theta} \geq \frac{N_s(x-p)-v_\ell}{p(N_s-N_p)} \geq \frac{1-\theta}{\theta}$, simplify to $4 \geq \frac{1000(150-20)-100,000}{20(500)} = 3 \geq \frac{1}{4}$.

Note that Conditions C1$_\ell$, C1$_h$, and C2 hold as before, but C3$_\ell$, $b < \frac{xN_s-pN_p-v_\ell}{(N_s-N_p)}$, does not hold since $100 > \frac{150,000-10,000-100,000}{(1000-500)}$

Notice that in these three examples, the equilibrium that we present is unique. There is no indifference on decision nodes (a)-(h). This uniqueness also holds whenever the inequalities (8)-(13) are strict.

For a separating equilibrium to exist, we need $N_s > N_p$ (i.e., the number of put options sold should strictly be smaller than the number of shares outstanding). This is consistent with the way that the boards of directors authorize put-option sales for ongoing open market repurchase programs. Also higher premiums p might require a higher strike price x in order to maintain the possibility of the separating equilibrium. This is clear because a company with a low signal is more inclined to sell put options with a higher premium p and a higher strike price x might be necessary to deter them from doing so. Further, a smaller value in the low state v_ℓ might require a higher premium p and/or a lower strike price x in order to maintain the possibility of the separating equilibrium. A smaller value in the low state (when the option is in the money) makes the expected value of the option higher; hence, the option should command a higher premium (or be adjusted by a lower strike price).

If there is a possibility of a buyback ($\mu > 0$ and Condition C1 holds), then there is a trade-off between μ and b. For a b sufficiently close to p and μ large, we get separation only in the second stage. A double separating equilibrium requires b to be in a mid-range for each μ: not so small as to entice a company with a low signal to sell puts, but not so

high as to deter a company with a high signal from selling puts or buying back the puts when the company's value is low.

This model shows that a financially strong company receives a reward for selling put options and certifying their quality, while financially weak companies choose not to participate because of large expected financial penalties of issuing the put option. This is an unusual way that information is revealed. In most examples of separating equilibria, a strong type must expend effort or spend cash in order to convey his or her strength. Here, the company conveys its strong financial future by selling the put option and receives cash flow for certifying its quality rather than enduring a cost from its action. However, the financially weak company finds the issuance expensive to mimic despite this possible reward.

This screening device allows the counterparties to separate the companies with positive signals from those with negative signals. From these companies with positive initial signals, the device allows the counterparties to separate those with an additional positive signal from those with an additional negative signal. This device represents a financial innovation by the investment banks.

While we don't explicitly model the bank (buyer of the put options), we can draw implications from the effect of the purchaser's behavior after purchasing a put option. These testable implications are: (1) the volume of shares transacted increases around the put option sale (it starts once it is clear the sale will go through), (2) there is an abnormal return on the share price after the put sale, and (3) the companies are likely to make a profit from the transaction, that is, premiums minus expected payouts are positive. Implication (1) is the result of the investment bank or its clients acting on the information gained from

the put sale. Implication (2) indicates that the information gained is valuable because the companies that are more likely to sell a put are those more likely to have a gain in share price. The reasoning behind implication (3) is similar to implication (2); those companies that sell put options need to be enticed to do so, therefore, they are not likely to lose money overall. Although we predict that the counterparty might be able to take advantage of the information gained by those companies not willing to sell put options, it is not empirically testable because we have no data on when those failed negotiations took place.

While in practice, options do not explicitly allow the sellers to buy them back, an optimally designed contract might include this "callability" as a feature. For example, companies could try to issue and then possibly retire puts whenever they acquire new substantial information. Microsoft (MSFT) issued puts more or less in every quarter for several years and did indeed buy back their put options in 2000 that saved them significant sums after new information indicated a downswing in price.[9]

As mentioned earlier, a separating equilibrium can still exist when a company makes zero profits in expectation. Then, given that the buyer is the one proposing the transaction, why

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[9]When the largest dollar amount of put options per quarter was issued by Microsoft (February 2000 was most likely the last month of issue), the stock price suffered the black swan event of both the dot-com crash (starting March 2000) and the Supreme Court ruling against Microsoft (April 3, 2000). During this tumultuous time, the investment bank allowed Microsoft to repurchase the put options at a loss of $1.4 billion (in the 2001 fiscal year). While substantial, this amount is in stark contrast to what might have happened if the bank didn't allow Microsoft to repurchase the put options. The per-share stock price fell from $111.87 in March 23, 2000, to $41.50 on December 20, 2000. Thus, out of the $12.2 billion potential repurchase obligation, Microsoft could have paid as much as $5.7 billion in the worst case or $2.4 billion using average stock prices.

Microsoft's 2000 Annual Report for the fiscal year ending on June 30, 2000, stated that "On June 30, 2000, warrants to put 157 million shares were outstanding with strike prices ranging from $70 to $78 per share. The put warrants expire between September 2000 and December 2002." Using the average stock price for this period of $58.85 and the mean strike price of $74, if the options were allowed to expire, Microsoft would have lost $2.4 billion. In the worst case scenario, using a strike price of $78 and a share price of $41.50, Microsoft would have lost $5.7 billion.

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does the company make a profit as the empirical evidence suggests? While not explicitly modelled, we offer several non-exclusive possible explanations.

Like in the ultimatum game (Güth, 1982), the proposer might not be able to fully exploit his or her bargaining power due to a fear of rejection by the other side and might be forced to divide the pie more evenly. Further, the buyer might not have full bargaining power and therefore might negotiate the transaction rather than dictate it with a take-it-or-leave-it offer. The pie then is not a zero-sum result because it includes profit made from trading on the information gained, so a non-actuarially fair price is a feasible solution.

Another reason for why the seller might profit is that there might be more than one type that the buyer wishes to screen for. This gives some sellers information rents. For instance, there are different levels of high types and the buyer might want to know which is which. To do so, the buyer has to reward the higher high types so they do not pretend to be lower high types.

Finally, there may be a cost of issuing the put option borne by the management. The profit on the transaction itself covers this cost.

Furthermore, we claim here that the selection of a transaction also entails having a reasonably large number of option contracts (rather than an option contract on a single share). The buyer might want the size of the bet contained in the put options to be fairly large. A larger bet gives the company incentives to both take measures to prevent mistakes (such as have the managers invest more time with the sale) and to invest in making a more accurate forecast through better information acquisition.

3   Data and Summary Statistics

3.1   Data Sources

We search for all companies that sold put options from January 1991 through December 2000 by using 10-K and 10-Q statements available on the Lexis-Nexis$^{\circledR}$ database for the whole period and on the SEC's EDGAR database from January 1994 through December 2000.[10] We find 383 companies that have at least one of the key "put" phrases in at least one of their financial reports. Of these, we drop companies that sold put options only on interest rate, foreign exchange, and/or debt securities. We are left with 53 companies that used their own stock as the underlying asset in the issuance of put options. For these remaining companies, we collect and analyze all of the 10-Q and 10-K reports from 1991 to 2012. These 53 companies came from 34 industries as indicated by their four-digit SIC codes. For these 53 companies, we looked for news articles and announcements in both Lexis-Nexis and Factiva for 60 days around the put option sales. From all sources, we do not find any announcements that released positive news around the put sales.

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[10]The period encompasses not only the years in which companies were highly active selling puts on their own stocks (see Gyoshev (2001) and Jenter et al. (2011)), but was also a relatively calm period between two recessions. We terminated our search period in 2000 when this calm period ended and where companies suspended their programs with the development of the prolonged bear market. We note, however, that put sales have been recently reintroduced by investment banks to a different set of companies. We are not using these sales since many of the programs are still ongoing and also many of the companies did not release the necessary information to determine the sales date. Although the Lexis-Nexis$^{\circledR}$ database started collecting the 10-K and 10-Q statements in 1988, the first company with a put options sale was IBM in 1992. On the other hand, the SEC's EDGAR database started in January 1994. We use the following search phrases: "put derivative", "put option", "equity put", "put feature", "stock put", "put provision", "put the shares", "sale of put", "sold put", "put sold", "put warrants", and "rights to put."

3.2 Transaction Dates

Only ten of the 53 companies report the exact date on which they sold put options for the first time. In order to find the date in the remaining cases, we look through all 10-K and 10-Q statements for references to the option expiration. Based on these references, we are able to estimate the date for an additional eight companies. Similarly, 11 companies report the month when they sold put options, and we infer the month for an additional 16 companies. Four companies report only the quarter, while the remaining four companies report only the year when they first issued put options.

The ten put contracts for which we know the exact sale date have expiration dates set 3, 6, 9, 12, 18, and 24 months after the sales. Using this knowledge, we are able to estimate the expiration date for eight other companies by combining information from different 10-Q or 10-K reports. For instance, the Clorox 10-Q report for the quarter ending on December 31, 1993, states that Clorox sold put options in the "first fiscal quarter of 1994" (between 7/1/93 and 9/30/93), while the Clorox 10-Q report for the quarter ending on March 31, 1994, states that "all put warrants expired unexercised on February 22, 1994." Therefore, we conclude that the date on which the contract was signed is six months prior to the expiration on August 22, 1993, since that is the only possible date that is within the specified dates and fits one of the possible customary contract lengths.

In addition, by using the 10-K and 10-Q reports for 20 companies, we are able to identify at least the quarter that the put option sale was made in. In 16 of those, we are able to accurately estimate the month by combining information from different 10-Q and 10-K reports in a manner similar to that described above.

The most complete information on the put option sales tends to be provided by the

first 10-Q or 10-K that reports the transaction. After the first report, the information gets less complete with each consecutive disclosure that prevents us analyzing subsequent sales.

3.3 Summary Statistics

In Table 1, we report the summary statistics for the put options issued by our sample companies. The majority of the companies, 32 of 53, issued European-style put options; only 11 issued American-style put options. Because only American-style options can be traded on the CBOE, it seems that few companies intended to place their put options publicly. This is directly confirmed by looking at the second column of Panel A in Table 1 where we report the type of buyers disclosed in the financial statements. Only one company publicly disclosed the sale of put options on an exchange. The rest sold their options to private counterparties. In most cases the identity of the buyer was not disclosed, but if disclosed, the buyer was usually either an investment bank or another institutional investor. More than 40% of the companies disclosed that their issues were long-term put options with maturities greater or equal to one year. These were not standard maturity lengths on the CBOE at the time.

<< Insert Table 1 here >>

We report the descriptive statistics for the time until disclosure in the fourth column of Panel A in Table 1. The median time from the date of the option sale to the date it was disclosed in the companies' financial statements is 99 days, while the average is 186 days. Only one company announced its intent to sell put options in advance of the deal. The maximum time between a deal transaction and announcement was a staggering 1,561

days, or more than four years.

Further, in Table 1, we examine both the initial and consecutive put option sales and report the extent to which the options were exercised or expired. We find that most of the options expired out of the money. In only two cases did companies state that all of the options were exercised (both these cases occurred when the company involved only issued one tranche of put options). In 32 cases, all of the options (for all the tranches) expired out of the money. In six cases, the put options for the last tranche only were settled early (including Microsoft that settled the option after 24th quarters of selling puts); and in eight cases, the last tranche of options were exercised with the initial tranches expiring worthless. Five of the companies did not report the outcome, which indicates that the put options expired worthless because otherwise they would have reported the sales as material events. We did not have any cases where the options were settled early or exercised and there was another tranche of put options sold afterwards.

4 Empirical Results

4.1 Abnormal Stock Performance

Table 2 reports the average cumulative abnormal returns (CAR) for the 18 companies with an identifiable date for their first put option sale. Even though Table 1 shows that companies report the sale after more than six months, the average CAR for a two-day window after the date of the sale is slightly more than 2% (This is statistically significant at the 5% level despite the small sample size.). Moreover, the CAR for the 60-day window

is 9.08% and is also statistically significant at the 5% level.[11] Figure 4 provides a graph of the CAR.

<< Insert Figure 4 here >>

Further, we find that the stock price performs negatively in the 60-day period before the put option sale. Our understanding from speaking with practitioners is that the sale of put options is a long drawn-out process that takes between one and three months. As we indicated in the model section, the company's managers engage in selling put options only if they feel the stock is undervalued. From the moment that negotiations of a put option sale are initiated until just before the completion date, the random-walk nature of the stock prices yields three basic scenarios: the stock could go up, down, or stay at the current price level. Once the sale is near completion, the managers still consider the sale only in the latter two scenarios. Hence, because the stock performance of those companies that have begun negotiations might go up during the negotiations, conditional on the sale, the stock's performance should be negative. This is a form of survivorship bias.[12]

<< Insert Table 2 here >>

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[11] The one-year buy-and-hold abnormal return is computed using the Lyon, Barber, and Tsai (1999) methodology and is 11.67% with a p-value of 0.03045.

[12] Note this negative performance opens the possibility that there is mean-reversion in the stock prices around the put option sale. To distinguish between our explanation and mean reversion, we take each of the 18 companies selling put options with identified dates and match it with all 26,500 CRSP companies. If company A sold a put option on March 1, 1997, and experienced an abnormal return of x% for the 60 days prior, we choose the closest 100 companies by their return y% (close defined by the smallest $(x - y)^2$). We observe that the sample that we get is not mean reverting, because the average return of those companies that sell put options is 9% while the return in the matched sample is close to zero. These returns are significantly different at the 1% level (Wilcoxon test, $p = 0.000$).

This negative stock performance is also consistent with Stephens and Weisbach (1998) who find that share repurchases are negatively related to prior stock-price performance.

We recognize that event studies have potential weaknesses such as the cross-sectional correlation of the abnormal returns associated with clustering event dates (see Kliger and Gurevich, 2014, chapter 6, page 65–83, Kolari and Pynnönen, 2010). Our event dates are not clustered– they have a mean day difference of 128.9 and a median day difference of 83. By generating 100,000 random samples of event days over a similar period, we find a mean day difference of 128.167 and a median day difference of 92.4. Furthermore, we find that 32,291 of these samples have a larger difference between the mean and median than the difference from our event dates.[13]

4.2   Abnormal Stock Trading Volumes

Abnormal trading volumes perhaps positively influence the stock price and generate the positive abnormal returns in the short event windows. Figure 5 is generated by taking each company's daily volume and dividing it by the daily volume on day -60. This method normalizes the average volume across this time period to one. We then take the average of these adjusted volumes over all 18 companies. This method is a crude way to examine trading volume while treating each company equally independent of its size. The graph shows that the volume increases by 40% before the transaction date and stays relatively high until about ten days after the transaction date before drifting down. Consequently, we surmise that most of the increased volume occurs before the stock price starts increasing.

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[13]The list of event dates are: 1992-09-16, 1993-03-30, 1993-08-22, 1994-04-04, 1994-06-26, 1994-08-03, 1994-08-07, 1996-01-22, 1996-03-03, 1996-07-16, 1997-07-13, 1997-09-01, 1997-09-18, 1997-10-23, 1997-11-05, 1998-04-26, 1998-09-15, and 1998-09-17.

This 40% increased volume could be a sign that the counterparties are accumulating shares as the transaction becomes more likely and doing so to a large extent without showing their hand.

<< Insert Figure 5 here >>

The cumulative abnormal relative volume (CARV) in Table 3 shows a similar story.[14] Although the overall volume significantly decreases from days -60 to -1, the volume is abnormally high from -10 to -1. It remains high between days 0 and 10. The overall abnormal volume does not remain statistically significant if we extend it from 10 to 60 days.[15] Note that the companies themselves did not purchase shares during this timespan (there is no substantial decrease in the number of shares outstanding and treasury shares).[16]

<< Insert Table 3 here >>

4.3   Structural Breaks in Stock Prices

We test if a structural break exists in the average abnormal returns around the date of the put option sales (where a structural break is a sharp unexpected directional change in

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[14]See Ajinkya and Jain (1989), Campbell and Wasley (1996) and Cready and Ramanan (1991) for how abnormal trading volume is computed.

[15]There was no such volume changes in the option markets. This is not surprising given that the overall volume of the put options on the stock was roughly 1% to 10% that of its volume. Hence, if someone wanted to make a profit from a rising stock price without significantly influencing the market, it would be easier with stocks rather than with options.

[16]We have computed the change in the shares outstanding using CRSP's monthly data and find the maximum change was less than 1% of average daily volume. Stephens and Weisbach (1998) show that this method yields a higher figure for repurchases than the three Compustat measures that they examine.

the trend). Such a structural break is an indication that there is an endogenous change produced by the sale of the put options. Therefore, in this subsection, we follow Andrews (1993) and Andrews and Ploberger (1994) to test for an endogenous structural break in the stock prices. We compute the bootstrapped p-value following Hansen (2000).

We start by testing for a structural break in the average abnormal returns of the 18 companies on the exact date of the put option sales. As reported in Panel A of Table 4, the Chow (1960) breakpoint test rejects the null hypothesis that no structural break exists at the exact date of the transaction (day 0) at the 1% level (p = 0.0022).

<< Insert Table 4 here >>

To better understand the nature of this structural break, we try to find the most likely structural break point from days -25 to 25 by making use of stock prices from days -60 to 60 (under the assumption of at most one structural break). In Panel B of Table 4 we report that the structural break is seven days after the sale of the put options. The p-values for the SupF statistics (Andrews, 1993) as well as for the ExpF and AveF statistics (Andrews and Ploberger, 1994) are statistically significant at the 5% level. Hence, we find supporting evidence that the purchaser of the put options is not only trading on information but doing so skillfully and not making the trading immediately transparent to the market.

For robustness, we test for a structural break in Panels C and D of Table 4 for the ten companies with reported sales dates only and also find that the break remains seven days afterwards (but it is not statistically significant). When we test for a structural break in the eight remaining companies with inferred transaction dates, we find the structural break

is at the day of the sale and is significant at the 5% level. This result gives support for our technique of inferring transaction dates.

Overall, the timing and the statistical significance of the structural break confirms a sharp unexpected directional change in the trend of the stock prices. Jenter et al. (2011) suggest instead that the market upswing is exogenous and that the company managers are using insider information to correctly time this upswing (See Chan et al., 2007, for why pseudo-market timing is unlikely to be an explanation). The location of our structural break indicates that their timing seems to indeed be impeccable especially in the face of potentially long-lasting negotiations. Moreover, Jenter et al. (2011) state that "discussions with market participants suggest that such offers were extended to all large companies with share repurchase programs and high stock market liquidity." This statement implies that the investment bank initiates the timing of the negotiations rather than the seller.

Another plausible explanation has the causality reversed. Rather than put sales being placed right before the upswing, the upswing comes right after the put sale. Given that the sales have not been publicly disclosed, the likely source of an upswing in this causality direction is the active buying of the company's stock by the purchaser of the put options. This finding also supports our explanation that the reason why the put option transaction is initiated is to acquire and trade on information.

4.4 Structural Breaks in Stock Trading Volumes

An analysis of the trading volume around the event day could demonstrate in retrospect the degree of abnormal activity that results from the private information of the parties in the put option sale. As with stock prices, we test for structural breaks in the daily

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trading volumes of the selling companies' stock around the put option sales. Using similar techniques to those used for stock prices in subsection 4.3, we test for a structural break in the stock volumes at the event day. We make adjustments for our sample companies by accounting for market volume and report three analyses for patterns of relative trading volumes.

Panel A of Table 5 reports a structural break, which is statistically significant at the 1% level with p = 0.0001 (for all methods we use). Panel B of the same Table shows the results of the tests for structural breaks in the stock volumes for any day between -25 and 25 around the event day. We find that the most likely structural break is at day -19, which is statistically significant at the 1% level with p < 0.0001 (for all methods we use). In Panel B of Table 5, we report a second structural break in the time frame of -19 to 60 at day 12, which is statistically significant at the 5% level with p = 0.0176 (for all methods we use). As explained above the put-sale negotiation process is a one to three month long process. These statistical results are consistent with an informed party starting to trade on the information obtained during the negotiation process 19 days before the transaction is completed. This trading is skillful because it does not change the trend of the stock price until seven days after the put option sale where the stock price's structural break occurs. The results are also consistent with the informed party reducing purchases at day 12 after the sale where there is another structural break in the volume.

As reported in Table 2, over the 10-day period following the put option sales the average abnormal return is negative at -1.39%, but over the 60-day period following the put option sales the average abnormal return is positive at 9%, yet the high volume decreases at date 12. The 60-day period's abnormal return is significantly different from zero at the 5%

level (p=0.04, t-test). Our claim is that the increased price is not a mere artifact of the increased trading, but a reflection of the information learned by one party. Hence, the sustained price is consistent with our claim that the investment banks or their clients are screening the companies in order to gain non-public information and are profitably trading on that information.

<< Insert Table 5 here >>

Overall these results support the existence of both an abnormal return and an abnormal trading volume around the put option sales.

4.5 Evidence from Trading by Insiders

In this section, we find additional evidence in support of the theory that the management of the company is indeed informed about the undervaluation of the stock. Company insiders (upper management as well as shareholders with a larger than 5% stake) must report to the SEC on form 13-D any transactions of the company's stock as well as type: purchased (P) or sold (S) on the open market, options that are exercised (M), or company stock or options that are awarded (A) to them. This report includes the day that the transaction occurred. (See Bonaimé and Ryngaert, 2013, Ben-Rephael et al., 2014, and Bonaimé, 2015, for analyzing 13-D transactions with relation to share repurchases.) We find only one insider that was not upper management at the time of the transactions but was in the same year prior to the transactions.[17]

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[17]All of his transactions occurred more than 60 days prior to the put sale and are not included in the analysis.

We break the dates of such transactions into three ranges: *before*, *during*, and *after*. These ranges are determined by the structural breaks in the volumes found in section 4.4, that is, *before* is defined as -60 to -20 trading days before the sale, *during* is defined as days -19 to 12, and *after* is defined as days 13 to 60. We then look at how many transactions fall into each range and perform a binomial test on whether the proportion of transactions is in accordance with the number of days in the ranges. The results of these tests are in Table 6.

<<<Insert Table 6>>>

We find that A and S transactions in *during* are significantly less than the combination of *before* and *after,* at the 1% and 10% level, respectively. In addition, P transactions in *during* are significantly more than the combination of *before* and *after,* at the 1% level. We also find that M and S transactions in *after* are significantly less than in *before*, at the 1% and 10% levels, respectively. In addition, we find that A, M, and S transactions in *during* are significantly less than *before*, at the 1%, 1% and 5% levels, respectively, while P transactions in *during* were significantly more than in *before* at the 10% level. Finally, we find that A transactions in during are significantly less than in after and that P transactions in during were significantly more than in after, both at the 1% level.

These results are consistent with our hypothesis that insiders are informed: An informed insider sells less and purchases more on the open market in *during*. Since the stock price still increases in *after*, we expect that the insider will sell less than in *before*. Again since the stock price increases in *after*, we expect that an informed insider will delay the exercise

of call options.[18]

We also note that the company determines the A transactions. There are three possible scenarios. First, the company prefers to save money and thus does not want to award stock or options when they expect the stock price to increase. Second, the managers of the company want to award themselves stock or options at the lowest possible price and do so. Third, the legal department of the company (or fear of legal action) stops the managers from awarding themselves stock or options close to a material sale of puts. In the first case, we expect awards to be smaller in *during* and possibly smaller in *after*. In the second case, we expect awards to be higher in *during*. In the third case, we would expect awards to be smaller only in *during* and possibly higher in *after*. Thus, we find support for the first and third possibilities.

We note that Lie (2005) and Heron and Lie (2007) find evidence that during the period of our study the awarding of call options were retroactively set to coincide with lower stock prices. This is the opposite result from what we find: precisely when the price is lowest is when there is the least awarding of options. However, the explanation for this discrepancy is clear. The put options sold and the awarding of call options are a matter of record. Therefore if they coincide, then this could raise suspicions that could alert the SEC to their illicit behavior. Heron and Lie (2009) estimate that 29% of all firms were involved in such illegal manipulation. Thus, in view of this literature, our third possibility seems most likely.

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[18]If they know with certainty the stock price will go up and the amount, then they are indifferent as to when they exercise their executive call options. However, since this increase is only expected and not certain, it is better to wait. Take for instance an option whose strike price is at the stock price in *during*. If there is a 90% chance the stock will continue to go up and a 10% chance it will go down, the optimal strategy is to wait to see the result and then exercise the option.

4.6   Evidence from Institutional Filings of Trading

<<< Insert Table 7 >>>>

In this section, we examine the filings of 13F forms around the put option sales. The SEC requires both institutional investors and insiders to report stock transactions. In Table 7, Panels A and B, we look at which institutions increase and which decrease their holdings, respectively. By comparing this amount to the abnormal volume, we can see if a particular institutional investor causes a large percentage change. On average, the largest increase in holdings for an institution is 12% of the abnormal volume, while the share for all institutional investors on average is 41% of the abnormal volume. This share makes it unlikely that an institutional investor caused the abnormal volume. Furthermore, when we compare this to institutional selling, then it seems even more unlikely. The largest decrease for an institution is equal to -12% with the total decrease due to institutional investors equal to -55%. Because these numbers are similar, the concept that the institutions themselves were profiting from the information advantage gained from buying the put options is unlikely. As a further check, in panel C, we examine which institutions were doing the buying and selling and find little relationship.

4.7   Potential Realized Profits from Trading on Information.

As shown in subsections 4.3 and 4.4, there is a structural break in stock prices and two structural breaks in volume (an increase followed by a decrease). We postulate that the purchaser of the put options might be making use of its private information gained from the purchase to accumulate shares of the underlying stock. Naturally, if indeed such an

action is taking place, then what are the potential profits? Of our 18 companies (out of the 53) for which we have accurate information on sales dates, 15 have increases in volume (around the transaction date) and three have decreases in volume. Of these 15 companies, 11 have price increases while four have price decreases.

For all 11 companies with volume and price increases, the total potential profit is $717 million. For the three companies with volume increases and price decreases, the total potential loss is $70 million. Thus, a hypothetical party could have made $647 million on these initial put purchases (net of put costs this should be close to 98% of the sum).

We compute the abnormal trading activity by multiplying the abnormal volume by the number of days it occurs. We estimate the price gain as the difference between the average stock prices around the put sale and the average stock price from 50 to 60 days after the sale. The potential profit is then the abnormal trading activity multiplied by the price gain.

As an example, one of the companies that has both an increase in volume and an increase in price is Premisys Communications Inc. Premisys disclosed a put transaction in their 10-K for the fiscal year ending on June 26, 1998. Premisys sold 10,000 contracts of put options for $1.75 million at a strike price of $10.625 per share for 100 shares of their common stock "PRMS" for a total of options on 1 million shares. If one entity accounted for the abnormal volume (approximately 15 million shares), then that entity made around $80 million. If this entity was the party that bought the options from Premisys, then it

paid only $1.75 million for the information leading to this $80 million gain.[19]

4.8 Hedging versus Profitable Trading on Non-Public Information

The owners of put options are only exposed to the upside risk to profit if the share price decreases. Hence, the purchasers might not even want to hedge this risk. In the Premisys example, the potential profits from purchasing stock around the sale were more than 40 times the premium. But hedging of the puts by the purchasers is inconsistent with causing the abnormal volume. The magnitudes of the abnormal volume that we report in Table 3 and Figure 5 are also inconsistent with the hedging explanation. In an attempt to explain this inconstancy, we reread all of the 10-Q and 10-K reports for the 18 companies with reported or assumed put sale dates for all available dates from 1991 to now in order to examine the possibility of hedging further. We report the results in Table 8.

<< Insert Table 8 here >>

Of the 18 companies, only six report all of the information that is required to accurately estimate the profits reported in Table 8. The total put premium for those six companies is $4,709,904 written on 2,255,000 shares.

We use the Black–Scholes–Merton formula (Black and Scholes, 1973, and Merton 1976) to compute the hedge ratio and the corresponding number of shares that are necessary

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[19]The average volume before the structural break was 595,934 per day, the average volume around the put option sale between the two structural breaks in the volume series was 1,098,285, which gives as an abnormal volume of 502,351 for the 31 days between the two structural breaks. The average price between the structural breaks was $9.27 and the average price between days 50 and 60 days after the sale was $14.34. So the difference is $5.07, which gives an abnormal profit of around $80 million = $5.07 * 502,351 * 31.

to hedge these put options. The average hedge ratio is 0.6537. Assuming that the purchaser wants to be delta neutral and wants to hedge, then the amount by which they are over-hedging is on average 2,247%. This amount of over-hedging can only be interpreted as speculation or profitable trading on non-public information. Furthermore, the total potential profit made by the put purchaser of $62.5 million cannot be attributed to the coincidence of hedging $4.7 million purchased put options.

The important point to remember is that these put options are zero-sum games where the company has an informational advantage. However it can still be worthwhile for the purchaser to play this game if the purchase gains from this acquired information. As our model indicates the information may be acquired by the purchaser in two ways: (1) when the company sells the put options, it indicates to the purchaser that the company has bullish forecasts. (2) the purchaser can later suggest to the company to buy back the put options. If the company refuses, then the purchaser gets the information that the management is still bullish. If the company agrees, then the purchaser gets the information that the company is bearish. We see some evidence of these two forms of acquiring information in that with rare exceptions the contracts expired worthless. This supports (1). In addition, of the remaining cases where the contracts did not expire worthless, 6 out of 16 were settled early and 10 out of 16 were held to maturity. This supports (2) in that if the purchaser offered to settle during a downward trend of the stock, we would see some settlements when the company was indeed bearish. We would also see holding to maturity (and exercised) when the company was bullish, but prices were either not as high as expected or higher than the offer made to the company yet still low enough to leave the put option in the money. Finally, both early settlements and holding to maturity were in the last tranche of

put sales, indicating that after both these had happened, the overall company outlook was bearish.

5   Policy Implications and Concluding Remarks.

Jenter et al. (2011) offer an explanation for why put option sales occur right before increases in stock prices, namely, that the managers are excellent at timing their put option sales. We offer another plausible explanation: purchasers use the put option sales as a screening mechanism to acquire information. By making use of this information to purchase stocks, the purchasers cause the stock price to increase. In other words, the causation is in a different direction from Jenter et al. (2011). We find support for the idea that put option sales trigger increases in stock prices and increases in trading volumes, instead of stock prices causing the initiation of the put sales.[20] This provision of information story for put sales is consistent with Bonaimé (2015), who finds evidence that share repurchases act as signals.

We develop a theoretical model that shows how purchasers of put options from companies can gain information. If then the buyers of the put options start purchasing stock, this could be a trigger for an overall stock price increase. We find empirical evidence (adjusted for market risk and volume) in support of this trigger explanation.

A party that uses option purchases appears to bypass the illegal aspect of gaining insider information. Theoretically, a trader wants to gain insider information because this

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[20]An endogenous price increase should occur shortly after the put option sale while any exogenous price increase should occur later (unless the price has already incorporated it). Jenter et al.'s (2011) explanation is that the time of the price change is exogenously predicted by the manager as opposed to our explanation that the timing of the price change is endogenously set by the manager through the sale of the puts.

information allows the trader to predict stock-price movements and realize abnormal profits. In put option purchases, investment banks do not directly gain any insider information on performance, but they do indirectly gain the opinion of the company's management on the future performance of the stock price. Only the managers with positive outlooks are willing to sell put options to the investment banks. Furthermore, these investment banks have this information exclusively in their possession on average for more than six months, as per the current disclosure regulations.

While we present one explanation for why an investment bank or their clients would buy a put option directly from a company, there are alternative explanations. First, managers are overconfident about their company's future prospects.[21] Given this overconfidence, managers tend to underprice the options, and the investment bank exploits this underpricing. If the company's stock return abnormally declines following the sale of the put options, then this decline might indicate management overconfidence. However, for a sample of 18 companies that sell put options, we find a positive 60-day average cumulative abnormal return of 10.4% after the initial sale that is inconsistent with management overconfidence.

Another possibility is that the counterparties are hedging against declines in the company's stock price. The support for this explanation is that most of these put option transactions occurred between 1992 and 2000, which was a period in the midst of a prolonged bull market. The argument against hedging is the increased volumes and abnormal returns around the put option sales that point to increased share acquisition with the knowledge that the company is optimistic about the future price. Still, it could be that those

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[21]See Hirshleifer, Low, and Teoh (2012) for both an overview of overconfidence and a reason why managerial overconfidence as a characteristic could be beneficial to the company.

purchasing put options are encouraged to buy shares rather than that they are hedging shares already owned; however, these volumes are higher than the number of put options. While we cannot completely rule out hedging shares already owned or hedging future share purchases, our findings still suggest that it is unlikely to be the whole story.

Answering the question in the title of this paper is important. If acts by large market participants seem irrational, then there are two possible explanations. One is that we do not know the entire picture and the second is that the parties are actually making big mistakes. We learned from the 2007-2009 financial crisis that if the latter is true then allowing such parties to make such mistakes can have damaging consequences. However, in our paper, we see the former possibility and discover that the investment banks could be rational: they might be trading on insider information obtained in a seemingly legal way or receiving commissions by acting as an intermediary whereby allowing another party to make such a gain. This explanation leads to the policy recommendation to shut down that loophole.

Hence, from the policy perspective our results shed light on that absence of immediate disclosure currently allowed in the US markets. The lack of regulations allows both companies and investment banks and their constituents to profit from trading in company-issued derivatives at the expense of broad market participants. However, even if we mandate full and immediate disclosure of all put option sales pursued by companies, then front-running (as indicated by the increased volume starting before the put sale) would still exist. The key instead would be to make private sales of put options illegal to be replaced by exchange-traded put options, which Angel et al. (1997) argues can fulfill any legitimate firm's need for private put options. Requiring exchange-traded sales will prevent screening by buy-

ers, but will still allow signaling by the companies, which would be seen by the market as preventing investors from privately profiting from information gained from such signals.

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