

Is Market Timing Good for Shareholders?*

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ABSTRACT

We challenge the view that equity market timing always benefits shareholders. By distinguishing the effect of a firm's equity decisions from the effect of mispricing itself, we show that market timing can decrease shareholder value. Additionally, the timing of equity sales has a more negative effect on existing shareholders than the timing of share repurchases. Our theory can be used to infer firms' maximization objectives from their observed market timing strategies. We argue that the popularity of stock buybacks and the low frequency of seasoned equity offerings are consistent with managers maximizing current shareholder value.

JEL codes: G30, G32, G35

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The question of whether managers can time the market in making share repurchase and equity issuance decisions has been hotly debated in the literature.¹ Yet, a more important question that has not been addressed before is whether managers should want to time the market. In this paper, we aim to fill this gap in the literature by analyzing wealth transfers between a firm's selling, ongoing, and new shareholders that are caused by market timing.² Surprisingly, we find that in many instances successful market timing does not benefit existing shareholders. Furthermore, shareholders fare worse when the manager issues overpriced equity than when she repurchases undervalued stock.

Our main insight is that current/existing shareholders are net sellers of a firm's stock and are affected by mispricing even if a firm does not issue or repurchase equity. For example, current shareholders are already better off during a temporary overpricing because some of them are able to sell the stock at a higher price. To accurately assess the effect of market timing, therefore, one needs to measure the incremental changes in shareholder value that are caused by repurchase and issuance decisions. Instead, financial economists have traditionally thought about the combined effect of stock mispricing and firms' actions triggered by this mispricing.

When we measure the net effect of firm's market timing, we find that the casual intuition is often wrong. For example, we show that a firm selling overpriced shares can hurt its existing shareholders rather than investors buying these shares. This is because by issuing additional equity, the firm conveys negative information to the market, which decreases the stock price. Furthermore, the firm is now competing with its own shareholders for potential buyers of the stock. As a result, a firm's shareholders are able to sell fewer overpriced shares than they

¹Brockman and Chung (2001) and Dittmar and Field (2014) conclude that managers exhibit substantial timing ability in executing repurchases. In survey of executives, Graham and Harvey (2001), and Brav, Graham, Harvey, and Michaely (2005) find that the perception of mispricing is one of the most important factors driving repurchase and issuance decisions. Additionally, a large literature documents stock return and operating performance patterns that could be symptomatic of market timing (Baker and Wurgler (2000), Jenter, Lewellen, and Warner (2011), Ikenberry, Lakonishok, and Vermaelen (1995), Pontiff and Woodgate (2008), and Loughran and Ritter (1995)). Baker, Ruback, and Wurgler (2007) provide a thorough overview of this literature. The market timing interpretation of these results is disputed by Eckbo, Masulis, and Norli (2000), Butler, Grullon, and Weston (2005), and Dittmar and Dittmar (2008).

²Throughout the paper, we focus on the distributional effects of market timing and do not consider situations where it creates or destroys total value (e.g., by affecting a firm's investment policy as in Myers and Majluf (1984), Heinkel (1982), Brennan and Kraus (1987), Leland and Pyle (1977), Williams (1988) and Morellec and Schurhoff (2011)).

otherwise might and also must sell them at a lower price. Both of these effects make the sellers worse off, and we show that this loss is larger than the potential gain to the ongoing shareholders. In contrast, if the firm buys back its undervalued stock, current shareholders generally benefit at the expense of new investors because the latter are able to buy fewer underpriced shares and must buy them at a higher price.

We develop our argument by building a theoretical model in the rational expectations framework. In the model, we require only that prices reflect all publicly available information—i.e., the investors recognize that the repurchase or equity sale conveys news about stock mispricing—and that the market clears additional demand for or supply of shares from the firm.³ A firm manager is endowed with private information and can use it to trade on the firm’s behalf. All shareholders and new investors are fully rational: they can learn from the firm’s decisions and trade their stock accordingly. Because some firms in the economy issue or repurchase equity for non-informational reasons, the equilibrium is not fully revealing and informed managers can take advantage of stock mispricing.

We show that the result of a firm’s equity market timing on existing shareholders can be described by three effects—which we label as the quantity effect, the price effect, and the long-term gain effect. The quantity effect appears because a firm’s additional demand for shares must be accommodated by either current shareholders or new investors. For example, suppose that, in a typical year, current shareholders sell 1,000 shares to new investors. If the firm decides to repurchase 100 shares during this year, it is plausible that current shareholders will have to sell 1,050 shares and new investors will buy only 950. The quantity effect in this example reduces the wealth of selling shareholders and new investors by the amount of mispricing multiplied by 50 shares. Because the quantity effect is a result of adverse selection, it negatively affects all uninformed parties.

An important piece of intuition comes from the price effect, which takes place because a firm’s decision to repurchase or issue stock conveys new information to the market and permanently affects the stock price. Unlike the quantity effect, the price effect creates asymmetric

³Specifically, we do not require any temporary market imperfections, such as liquidity dry-ups (e.g., Hameed, Kang, and Viswanathan (2010)) or price pressure (see, e.g., Meidan (2005)).

changes in the wealth of the firm's current shareholders and new investors. For example, the price drop at the announcement of a seasoned equity offering (SEO) protects new investors from buying into an overpriced firm, but at the same time it also decreases the expected profit of selling shareholders.

Finally, the long-term gain effect applies to those investors who hold the firm's stock until all information is revealed, i.e., ongoing shareholders and new investors who join the firm. In particular, a share repurchase conducted by an informed manager generates the trading profit for a firm and allows its stockholders to sell shares at a higher price in the future. Importantly, the extent to which current shareholders benefit from this effect depends on the magnitude of net selling because some stockholders liquidate their positions before the long-term gain is realized. For example, the empirical literature documents that stock mispricing often does not get corrected for several years after repurchases and issuances (see, e.g., Ikenberry, Lakonishok, and Vermaelen (1995), and Loughran and Ritter (1995)).

The model generates two new results. First, we show that current shareholders prefer share repurchase timing to new issuance timing. This result is driven by the price effect. Because current shareholders are net sellers, they benefit when the firm corrects underpricing but sometimes prefer to leave overpricing uncorrected. We demonstrate that the manager who wants to maximize current shareholder value will use share repurchases more often than new equity sales. In particular, she may repurchase stock when it is fairly priced or even somewhat overpriced, but will not always issue overvalued equity.⁴ Repurchases by informed managers will then be followed by a smaller magnitude of abnormal returns and generate a smaller average profit than new equity sales. Therefore, the continuing popularity of stock buybacks that do not appear to exploit large undervaluation can be rationalized by the preference of managers for current shareholders. To the best of our knowledge, this explanation for repurchases has not been previously explored in the literature, and we view it as complementary to the commonly cited motives of redeploying excess cash, managing earnings,

⁴Here it is important to see the difference between our study and the much simpler idea that share repurchases raise the price for selling shareholders. First, the remaining shareholders are negatively affected by excessive repurchases or repurchases made during the overpricing. More important, by creating an additional demand for stock, a share repurchase changes the number of the firm's selling and remaining shareholders.

improving alignment between management and shareholders, and counteracting dilution from equity-based compensation plans.⁵

Second, we show that in many circumstances current shareholders are worse off from market timing. One such circumstance is when a firm issues overvalued stock and the mispricing is relatively small. In this case, the decrease in wealth of selling shareholders caused by the price and quantity effects is larger than the long-term gains to ongoing shareholders, so that current shareholders are collectively worse off. Further, *market timing of any kind* can decrease shareholder value when the share turnover is relatively high. Suboptimality of timing derives from stock repurchases hurting shareholders even if the equity price goes up. Indeed, the high share turnover strips current shareholders of long-term gains, and because of the repurchase they sell more undervalued shares to the firm. We show that in this situation current shareholders prefer a manager who never times the equity market to a manager who systematically responds to mispricing by issuing shares and repurchasing stock.

Determining how different shareholder groups are affected by market timing is not only interesting in and of itself; it can also give us insights into the firm's implicit value maximization objectives. By observing *how* the manager of a particular firm uses her information to time the market, it is possible to infer what shareholder group's wealth the manager really cares about. Given the theoretical predictions of the model, the data suggest that an average large U.S. firm times the market as if it were trying to create value for *current* shareholders. First, there are larger post-event abnormal returns following equity issuances than following repurchases. Specifically, over the period 1982-2012, the average three-year abnormal return after seasoned equity offerings is -12.8% , but it is only 3.2% after repurchases. Second, the average measure of profit from SEO timing is considerably larger than the profit from repurchase timing. We document this result by using a new empirical measure of profit from market timing, calculated as the additional return earned from equity timing by a non-selling shareholder with one share of stock. The difference between issuance and repurchase profits captures the imbalance in timing by a particular firm, with positive values indicating a relative preference by the manager for current shareholders. We find that an SEO adds on average

⁵See, e.g., Kahle (2002), Grullon and Michaely (2004), and Huang and Thakor (2013).

0.37% in return to ongoing shareholders, while a repurchase adds only 0.04%. Further, it appears that repurchases are more frequent than SEOs, with 37.7% of all firm-years posting a repurchase and 4.2% having an SEO. These results do not support the view that the average firm acts in the interest of ongoing or future shareholders, but are consistent with current shareholder value maximization.

Our study contributes to the theoretical literature on share issuance and repurchase decisions under asymmetric information. There are two main differences from prior work. First, most earlier studies do not focus on the welfare of existing and new shareholders, which is at the heart of our theoretical analysis.⁶ Instead, related studies usually derive the manager's optimal policy given a particular objective function, such as maximizing a weighted average of the current market price and expected intrinsic value (e.g., Persons (1994) and Ross (1977)). In comparison with the approach in these papers, the maximization problem for current shareholders in our model has variable weights; i.e., the manager's timing affects not only the prices, but also the number of current shareholders who sell stock at each date. Second, the prior literature often assumes that shareholders and other investors are passive. This assumption ignores the fact that shareholders and investors are able to learn from the firm's decisions and optimally rebalance their portfolios.

Signaling with both issuance and repurchases is explored in a number of structural dynamic models. For example, Hennessy, Livdan, and Miranda (2010) build a dynamic equity signaling model, where signaling is achieved through higher leverage and, consequently, higher bankruptcy costs. Bolton, Chen, and Wang (2013) assume that firms exploit the opportunity to issue equity at a lower cost, but they also assume an exogenous time-varying cost of financing. In the model of Constantinides and Grundy (1989), a manager can use a positive signal conveyed by repurchases to issue equity-like securities. These studies are not primarily concerned with the wealth transfers between different groups of investors.

Two studies give special attention to conflict of interests between different groups of shareholders in repurchases. Brennan and Thakor (1990) show that repurchases lead to a wealth

⁶Lucas and McDonald (1990) recognize that shareholders may disagree about the desired equity issue policy. However, they further assume that there is a sufficient number of long-term shareholders so that management acts in their interest.

transfer from uninformed to informed shareholders. They argue that because the costs of gathering information are larger for small shareholders, a repurchase is expected to benefit large shareholders. Unlike Brennan and Thakor (1990), we assume that all of a firm's investors and current shareholders have the same information and that only the manager has access to private information. In another study, Oded (2005) shows that repurchases can hurt those shareholders who need to sell the mispriced stock after a liquidity shock.

Some studies reach different conclusions than ours because they assume that equity timing originates from differences in beliefs among investors rather than from information (Huang and Thakor (2013) and Yang (2013)). Firms can also take advantage of aggregate market mispricing (Baker and Wurgler (2002)) or react with their repurchase and issuance decisions to a change in the overall business environment (Dittmar and Dittmar (2008)). In contrast, the predictions of our model are based on mispricing of individual firms.

The rest of this paper is organized as follows. The next section provides an illustrative example. Section II solves for the equilibrium in the presence of informed trading by a firm and analyzes wealth transfers between current shareholders and new investors. The data sources and empirical results are described in Section III. The final section offers concluding remarks.

I. The Case of Netflix SEO

To understand how market timing can make shareholders worse off, consider a seasoned equity offering by Netflix, Inc. that was announced on April 27, 2006. The CEO and co-founder of Netflix, Reed Hastings, was then planning to issue 3.5 million shares or approximately 6.3% of 55.5 million outstanding shares, and the shares traded at the 52-week high of \$31.48. When the SEO was announced, stock price decreased and shares were issued at \$30.00 on April 28. Overall, it seemed that the issue was timed well because the shares had dropped to \$22.21 (-29.4%) within just one year of the announcement. Does it mean that Mr. Hastings created value for his shareholders by market timing?

To answer this question, we need to analyze what would have happened had the CEO not

issued overvalued shares. A simple calculation shows that the price would have dropped even lower to \$21.72.⁷ This implies that, because of the well-timed SEO, a shareholder who did not sell her stock lost 49 cents *less*. For most shareholders, however, this difference in price was of little consequence because they did not keep shares for long.⁸ Based on evidence in Section III, we can conservatively estimate that 30% of the firm’s stock is sold to new investors during the year. This implies that ongoing shareholders gained approximately \$19.0 million via the long-term gain effect.

This gain was offset, however, by the fact that the announcement of the SEO accelerated the price fall, resulting in selling shareholders receiving \$1.48 *less* per share (-\$27.1 million total) via the price effect. Further, shareholders lost an additional \$13.6 million via the quantity effect, assuming they have absorbed half of the supply of overpriced shares from the SEO. Therefore, although the timing of share issuance resulted in some gain in the long-term price, the net effect on shareholders was negative (-\$21.7 million).⁹

II. MODEL

A. Setup

In this section, we build a model of market timing based on the rational expectations framework of Grossman (1976). All investors believe that the economy is populated with a proportion $\lambda < 1/2$ of firms that are controlled by informed managers who are able to time the market (“timing firms”), and a proportion $1 - \lambda$ of firms that sell and repurchase equity for reasons that are unrelated to misvaluation (“non-timing firms”). For example, firms might repurchase stock to distribute excess cash, manage earnings, adjust leverage, increase the pay-performance sensitivity of employee contracts, or counteract the dilution from exercises

⁷The no-arbitrage relation implies that the total market value of the firm after the issue is equal to the market value before the issue plus the funds raised $\$22.21 \cdot (1.063) = P_2 + 0.063 \cdot \30 .

⁸With a daily trading volume of 1.5 million, one share of Netflix changed hands on average seven times during 2006.

⁹An interesting question is how a CEO who expects a significant price decline can help his shareholders. Overall, it is probably best to have them sell their holdings. With the share turnover as large as that of Netflix stock, this is achieved by doing precisely nothing as shareholders quickly dispose of stock on their own. This issue became relevant once again in 2015 when Netflix shares soared, puzzling even the CEO himself. Hastings was quoted saying “When the stock was half this price I described it as euphoric. So it’s a mystery to me...,” hinting at a significant overpricing. (Source: MarketWatch.com. <http://www.marketwatch.com/story/even-netflix-ceo-is-baffled-by-high-stock-price-2015-07-16>)

of employee stock options (Grullon and Michaely (2004), Skinner (2008), and Babenko (2009)). Similarly, new equity issuance can be motivated by the need to finance new investment.¹⁰

The demand for shares by non-timing firms that issue and repurchase equity for exogenous reasons is normally distributed

$$F \sim N(\mu_u, \sigma_u^2). \quad (1)$$

Positive values of F indicate stock buybacks and negative values capture stock issuances. To convey the main idea in the most transparent manner, we make a simplifying assumption that the exogenous distribution of demand by the uninformed managers in non-timing firms is the same as the distribution of demand by the informed managers. This assumption helps us to significantly simplify the learning problem by individuals who observe firm action F , but do not know whether the firm is timing the market or acting for exogenous reasons.¹¹

Each timing firm is endowed with a risk-neutral manager who receives imperfect private information about the firm value at date 1 and also can trade shares on the firm's behalf. The true per share value of the firm is drawn from a normal distribution and is realized at date 2

$$P_2 \sim N(\bar{P}, \sigma_p^2). \quad (2)$$

The manager has a noisy signal v about the future firm value

$$v = P_2 + \varepsilon, \text{ where } \varepsilon \sim N(0, \sigma_\varepsilon^2). \quad (3)$$

Note that the long-term price can change if the manager repurchases or issues stock; we denote this price by P'_2

$$P'_2 = P_2 + \frac{F(P_2 - P_1)}{N - F}, \quad (4)$$

where N is the initial number of outstanding shares, and P_1 is the market price of the stock at date 1. We assume that a firm's decision to repurchase or issue equity and the market-clearing price are fully observable by everyone in the market. Note, however, that whether

¹⁰DeAngelo, DeAngelo, and Stulz (2010) find that, without SEO offer proceeds, 63% of issuers would run out of cash the year after an SEO. Additionally, Hertz, Huson, and Parrino (2012) find that timing of SEOs can be determined by market perception of a potential overinvestment problem, as opposed to equity mispricing.

¹¹Appendix A provides the fixed-point solution for parameters μ_u and σ_u^2 that satisfy this assumption. Dropping this restriction does not affect our conclusions, but it results in cumbersome calculations.

investors observe repurchases and equity issuances is not important in our setting since the same information can be inferred from the market price. In this way, our model differs from the one used by Oded (2005), who assumes that both prices and repurchases are unobservable and that investors submit their bids for stock through an auction in which a firm receives priority over other participants.

There are n current shareholders holding the firm's shares and m outside investors interested in buying the firm's stock. For example, one may think of a limited shareholder base as in Merton (1987), although the number of shareholders or investors can be as large as needed.¹² All shareholders and potential investors are rational and can trade in the firm's stock at any point in time. Shareholders and new investors maximize their expected wealth given the available information, but also have preferences for buying or selling shares, modeled through the following objective function

$$EU_i \equiv \max_{X_i} E(W_i|F) - \frac{\theta}{2} (X_i - Q_i)^2, \quad (5)$$

$$\text{where } W_i = (N_i + X_i) P'_2 - X_i P_1. \quad (6)$$

Here $i \in \{1, 2, \dots, n + m\}$ indexes different investors, with $i \in \{1, \dots, n\}$ referring to current shareholders and $i \in \{n + 1, \dots, n + m\}$ to new investors, W_i is the investor's wealth, N_i is the initial number of shares held by the investor, and X_i is the optimal demand for shares at date 1. Specifically, at date 1 investor i buys X_i shares at the price P_1 and sells all his holdings $N_i + X_i$ on the final date at the price P'_2 .

The quadratic term in the objective function (5) is introduced for modeling convenience. It serves two purposes: to induce shareholders and new investors to trade and to ensure that the demand for stock is finite in equilibrium. Q_i is the investor's preference for buying shares (i.e., the number of shares the investor would buy absent any new information), and the parameter θ captures the elasticity of the investor's demand.

Our assumption of the utility function (5) is identical to directly specifying the investor's

¹²In our model, each shareholder can hold a different number of shares, so that the number of current shareholders does not need to coincide with the number of outstanding shares.

optimal demand as

$$X_i^* = Q_i + \frac{E(P_2'|F) - P_1}{\theta} \approx Q_i + \frac{E(P_2|F) - P_1}{\theta}. \quad (7)$$

The first term, Q_i , is the investor's status quo demand for stock, and the second term is the additional demand triggered by the information contained in the firm's trade, similar to the one in the model by Grossman (1976). Because the investor's profit decreases in price P_1 , the demand by individual investors is downward sloping in equilibrium, and the market can clear.¹³

In line with actual experience and to ensure that the shareholder base changes over time, we assume that the average parameter Q_i is positive for new investors who prefer to buy the firm's stock (e.g., to complement and diversify their portfolios) and negative for current shareholders who prefer to sell the stock (e.g., for liquidity or diversification reasons). If this assumption were not true, trading would be possible only between current shareholders. Section III.A provides empirical evidence supporting the validity of this assumption. We normalize the average Q_i of all individual investors and shareholders to zero, so that the equilibrium market-clearing price when the firm is not trading in its stock is $P_1 = \bar{P} = E(P_2)$.¹⁴

Next, we specify the equilibrium and examine how the welfare of current shareholders is affected by the firm's market timing strategies.

B. Symmetric Market Timing: Implications for Current Shareholders

We first analyze the basic case in which the manager maximizes the expected profit from trading F shares conditional on her signal. A priori this seems to be a natural choice of the objective function since it leads to a symmetric market timing strategy: repurchase stock when it is undervalued and issue stock when it is overvalued. It is also consistent with the usual assumption in the literature that the manager cannot tender her own shares during a

¹³The downward-sloping demand functions can also be justified by differences in shareholder beliefs (Bagwell (1991) and Huang and Thakor (2013)), the investor trades being processed sequentially through the limit order book (Biais, Hillion, and Spatt (1995)), or the firm's stock having no close traded substitutes (Wurgler and Zhuravskaya (2002)). Empirical evidence in support of downward-sloping demand functions is provided in Greenwood (2005) and Shleifer (1986).

¹⁴Note that if the average Q_i were not zero or there were a non-zero demand by an uninformed firm, F , the market would still clear, but at a different price P_1 .

repurchase or participate in a seasoned equity offering (e.g., Morellec and Schurhoff (2011) and Constantinides and Grundy (1989)) and wants to maximize the value of a fixed equity stake. We allow the manager to be strategic in her trades; i.e., she takes into account the effect of her trade on the stock price,

$$\max_F E[(P_2 - P_1(F))F|v]. \quad (8)$$

The following proposition describes the resulting equilibrium.

Proposition 1. *Suppose the manager maximizes the expected trading profit. There exists a unique linear rational expectations equilibrium with the price and demand for shares given by*

$$P_1 = \bar{P} + \beta F, \quad (9)$$

$$F^* = \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2} \frac{v - \bar{P}}{2\beta}, \quad (10)$$

$$X_i^* = Q_i - \frac{F}{n+m}, \quad (11)$$

where $\beta > 0$ is a constant given in the Appendix.

The intuition for Proposition 1 is as follows. First, if the firm places a positive order F for stock, the equilibrium price increases because investors infer that with some probability the order is coming from an informed manager and thus signals positive information. This feature of the model is similar to that of the extant repurchase signaling literature on stock repurchases can signal positive information to investors (see, e.g., Vermaelen (1981), Ofer and Thakor (1987), Hausch and Seward (1993), Persons (1994), and Buffa and Nicodano (2008)).

Second, the firm's optimal demand for shares F^* is directly proportional to stock mispricing and increases with the precision of the manager's signal. Therefore the optimal market timing strategy for a profit-maximizing manager is symmetric, with the manager being equally likely to time share repurchases and equity sales. Finally, the individual demand for shares X_i^* decreases with the firm's order size F . This is because, for the market to clear, a firm's trade must be accommodated by uninformed shareholders and new investors. Uninformed individuals are willing to take the other side of the firm's trade because the equilibrium price

is such that they make up for their losses from trading against timing firms with gains from trading with non-timing firms.

The next proposition compares the observable characteristics of stock repurchases and equity sales for this equilibrium.

Proposition 2. *Assume that the manager maximizes the expected trading profit. Then the following claims hold.*

(i) *The frequency and volume of share repurchases are equal, respectively, to those of share issuances*

$$\Pr(F^* > 0) = \Pr(F^* < 0), \quad (12)$$

$$E[F|F^* > 0] \Pr(F^* > 0) = E[-F|F^* < 0] \Pr(F^* < 0). \quad (13)$$

(ii) *The profit from share repurchase timing is equal to the profit from share issuance timing*

$$E[(P_2 - P_1)F|F^* > 0] = E[(P_2 - P_1)F|F^* < 0]. \quad (14)$$

(iii) *The price drift following share repurchases is equal, in absolute value, to the price drift following equity issuances*

$$|E[P_2 - P_1|F^* > 0]| = |E[P_2 - P_1|F^* < 0]|. \quad (15)$$

We now analyze how the firm's market timing affects its existing shareholders. We are interested in whether a particular firm should want to time the market and do not consider how timing by this firm affects shareholders of other firms or the whole economy.

Recall that, when the firm times the market, the i -th shareholder wealth is given by (6). When the firm does not time the market, the wealth can be calculated as $(N_i + Q_i)P_2 - Q_i\bar{P}$. That is, the shareholder buys Q_i shares at price \bar{P} and can later sell these shares along with original N_i shares at price P_2 . Therefore the change in wealth of shareholder i caused by the firm's market timing is

$$\Delta W_i = \underbrace{(N_i + X_i)P_2' - X_iP_1}_{\text{wealth with timing}} - \underbrace{((N_i + Q_i)P_2 - Q_i\bar{P})}_{\text{wealth without timing}}. \quad (16)$$

We can rewrite this expression in the more intuitive form

$$\Delta W_i = \underbrace{(X_i - Q_i)(P_2 - P_1)}_{\text{quantity effect}} + \underbrace{Q_i(\bar{P} - P_1)}_{\text{price effect}} + \underbrace{(N_i + X_i)(P'_2 - P_2)}_{\text{long-term gain}}. \quad (17)$$

It follows then that the effect on shareholders of trading by a firm in its own stock can be described by three terms: a quantity effect, a price effect, and a long-term gain effect. The first term in (17) captures the *quantity effect*, which occurs when shareholders change their demand for stock as a result of the firm's timing actions. The number of shares traded by individuals can be affected because they infer information from the firm's decisions and also because the market needs to clear additional trades by the firm. Since shareholders sell more stock when the price is expected to increase and less when it is expected to decrease, the quantity effect is on average negative. The second term in (17) is the *price effect*, which occurs when the firm's timing actions change the stock price and shareholders buy or sell stock at this new price. Because current shareholders are net sellers (negative Q_i on average), the price effect is positive for stock repurchases and negative for stock issuances. Finally, the third term is the *long-term gain effect*. It captures the fact that shareholders who hold the stock until its true value is revealed benefit from the appreciation in the long-term price.

It is the quantity and price effects that distinguish our approach from previous studies. For example, it is well understood that successful market timing increases the long-term price. However, this does not necessarily imply that a manager working in the interest of all ongoing shareholders should want to time the market (as suggested by Baker and Wurgler (2002)), because the number of ongoing shareholders depends on the manager's decision. In essence, when the manager times the market she is altering the effective investor horizons and the stock price in a way that is counter to shareholder value maximization.

The wealth implications of market timing depend on the number of current shareholders who remain with the firm and benefit from the long-term gain. We first consider the case in which the aggregate number of shares that current shareholders normally sell (and new investors buy), $Q^+ \equiv \sum_{i=n+1}^{n+m} Q_i$, is moderate. For brevity, we will refer to Q^+ as the share turnover.

Proposition 3. Denote by $W = \sum_{i=1}^n W_i$ the current shareholder value and assume that the share turnover is moderate, i.e., $Q^+ < \bar{Q}$, where

$$\bar{Q} = \frac{N}{2} \frac{m}{n+m}. \quad (18)$$

Then the following claims hold.

(i) Issuance of overvalued stock decreases shareholder value when overpricing is small. Specifically, there exists a threshold \bar{v}

$$\bar{v} \equiv \bar{P} - \frac{Q^+ N}{2\gamma(\bar{Q} - Q^+)}, \quad (19)$$

such that for $\bar{P} > v > \bar{v}$,

$$E(W|v, v < \bar{P}, F^* < 0) < E(W|v, v < \bar{P}, F = 0). \quad (20)$$

(ii) Share repurchase of undervalued stock always increases shareholder value.

(iii) Given a fixed magnitude of mispricing $|v - \bar{P}|$, current shareholders gain more when the manager times share repurchases than when she times equity sales

$$\begin{aligned} E(W|v, v > \bar{P}, F^* > 0) - E(W|v, v > \bar{P}, F = 0) > \\ E(W|v, v < \bar{P}, F^* < 0) - E(W|v, v < \bar{P}, F = 0). \end{aligned} \quad (21)$$

(iv) In expectation, current shareholders benefit from market timing, i.e.,

$$E(W|F^*) > E(W|F = 0). \quad (22)$$

This proposition is central to our study and discusses the implications of the symmetric market timing strategy for shareholder value. The proof of the proposition exploits the fact that, in a given firm, the sum of all dollar gains and losses by shareholders and new investors must be zero.

The results can be summarized as follows. When the share turnover is small, many current shareholders remain with the firm until the true value is realized, and therefore they capture the benefits of timing through the long-term gain effect. However, current shareholders are affected differentially by share repurchases and equity sales. Share repurchases of undervalued

stock always make them better off. But new share sales of overvalued stock can make them worse off. To understand the intuition behind the latter result, recall that current shareholders are net sellers. When a firm issues equity, shareholders who are competing with the firm end up selling fewer overpriced shares. Additionally, they sell those shares at a lower price. The expected losses of selling shareholders are partially offset by the long-term gains of the ongoing shareholders. The proposition shows that current shareholders as a group are worse off in the region of small overvaluation, where the price and quantity effects dominate the long-term gain effect.

The last result in the proposition shows that, in comparison with a manager who does nothing, current shareholders prefer a manager who always repurchases stock whenever her information is positive and issues shares whenever her information is negative. Because repurchases increase price P_1 , and equity sales decrease it, and because the market timing strategy is symmetric with respect to stock mispricing, it must be that the price effect averages out for current shareholders. Given a low share turnover, the current shareholders capture most benefits of market timing.¹⁵

As we show below, this result reverses for large turnover. In particular, when the turnover is above a certain threshold, the repurchase of undervalued stock by the manager can also decrease shareholder value.

Proposition 4. *If the share turnover is large, i.e., $Q^+ > \bar{Q}$, then:*

(i) *Issuance of overvalued stock always decreases shareholder value*

$$E(W|v, v < \bar{P}, F^* < 0) < E(W|v, v < \bar{P}, F = 0). \quad (23)$$

(ii) *A share repurchase of undervalued stock decreases shareholder value when underpricing is large; i.e., there exists a threshold \bar{v}*

$$\bar{v} \equiv \bar{P} + \frac{Q^+ N}{2\gamma(Q^+ - \bar{Q})}, \quad (24)$$

¹⁵In Appendix B, we discuss how the results of Proposition 3 change if we consider how market timing affects the full objective function of current shareholders, U , instead of shareholder value, W . Intuitively, because by trading on the firm's behalf the manager conveys new information to the market, shareholders adjust their demand for the firm's stock and deviate from their preferred trades, Q_i . Therefore, they experience additional disutility from market timing.

such that for $v > \bar{v} > \bar{P}$,

$$E(W|v, v > \bar{P}, F^* > 0) < E(W|v, v > \bar{P}, F = 0). \quad (25)$$

(iii) If $Q^+ > 2\bar{Q}$, then, in expectation, current shareholders are worse off with market timing, i.e.,

$$E(W|v, F^*) < E(W|v, F = 0). \quad (26)$$

The proposition posits that, when the share turnover is high, current shareholders are worse off when the manager times the equity market. Specifically, shareholder wealth always decreases with the issuance of overvalued stock. Shareholder wealth also decreases with the repurchase of undervalued stock if mispricing is large. The cutoff for mispricing, \bar{v} , decreases in λ . This means that more repurchases destroy shareholder value when there are few informed firms in the market and the positive price effect of repurchases is small. Overall, shareholders in a high-turnover firm prefer a manager who does nothing to the manager who systematically uses private information when issuing and repurchasing stock.

Intuitively, market timing is value destroying because the high share turnover strips current shareholders of most long-term gains associated with market timing. When many new investors purchase the firm's shares, they are the ones who benefit from the long-term price appreciation. When the long-term gain is small, shareholder wealth is primarily affected through the quantity and price effects. The price effect is symmetric with respect to repurchases and issuances and is therefore zero in expectation. In contrast, the quantity effect makes shareholders worse off because they sell more shares during underpricing and fewer shares during overpricing.

C. Optimal Market Timing Strategy for Current Shareholders

Thus far we have focused on the effects of a symmetric market timing strategy on a firm's current shareholders. We now derive the optimal market timing strategy by a manager maximizing the current shareholder value.¹⁶ Relying on the results from the previous section,

¹⁶Appendix B shows that the results are qualitatively similar if the manager maximizes the current shareholders' full objective function. In this case, the optimal market timing strategy is less sensitive to the manager's information because, intuitively, the manager would like to minimize the shareholders' disutility associated with deviations of their trades from initial preferences.

we conjecture that for the high turnover case the linear equilibrium does not exist. This is because only repurchase timing (positive F) can potentially improve shareholder welfare when the turnover is high, whereas issuance timing cannot. We therefore concentrate on the case when the turnover is moderate, $Q^+ < \bar{Q}$.

Recall that under a symmetric timing strategy (i.e., the strategy that maximizes the trading profit of the informed firm and calls for a repurchase when the stock is undervalued and share issuance when it is overvalued), current shareholders can be made worse off. Specifically, we established in Proposition 3 that a share issuance by the firm when its stock is overpriced can hurt its current shareholders. We therefore anticipate that a manager creating value for current shareholders would favor market timing with share repurchases rather than with equity sales. The next proposition establishes this result formally.

Proposition 5. *Suppose the manager wants to maximize current shareholder value, W , and the share turnover is not large, $Q^+ < \bar{Q}$.*

Then, for any mispricing, $v - \bar{P}$, the equilibrium price, the firm's demand, and individuals' demand for stock are

$$P_1 = \bar{P} - \alpha + \beta F. \tag{27}$$

$$F^* = \bar{F} + \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2} \frac{v - \bar{P}}{2\beta}, \tag{28}$$

$$X_i^* = Q_i - \frac{F}{n + m}, \tag{29}$$

where constants $\bar{F} > 0$, $\alpha > 0$, and $\beta > 0$ are given in the Appendix.

The important result established by this proposition is that a manager who wants to maximize current shareholder value repurchases more (and issues less) stock than the one who wants to maximize the trading profit. In particular, the optimal timing strategy calls for repurchasing a positive number of shares, \bar{F} , and then amending the demand in a way that is proportional to mispricing. Note also that the equilibrium price P_1 is adjusted downward because investors realize that the manager over-repurchases. In particular, when the manager

neither repurchases nor issues equity ($F = 0$), the price is below \bar{P} . Note, however, that because the optimal demand for stock by the firm increases with mispricing, a larger repurchase still conveys better news.

Having derived the optimal market timing strategy for a manager who wants to create value for the firm's existing shareholders, we can now examine the frequency and volume of stock repurchases and equity sales, the profit from stock repurchases and equity sales, and post-event stock returns.

Proposition 6. *Assume that the manager wants to maximize current shareholder value. Then the following claims hold.*

(i) *The frequency and volume of share repurchases are larger, respectively, than those of equity issuances*

$$\Pr(F^* > 0) > \Pr(F^* < 0), \quad (30)$$

$$E[F|F^* > 0] \Pr(F^* > 0) > E[-F|F^* < 0] \Pr(F^* < 0). \quad (31)$$

(ii) *The profit from share repurchases is smaller than that from equity issuances*

$$E[(P_2 - P_1)F|F^* > 0] < E[(P_2 - P_1)F|F^* < 0]. \quad (32)$$

(iii) *The price drift following repurchases is smaller, in absolute value, than that following equity issuances*

$$|E[P_2 - P_1|F^* > 0]| < |E[P_2 - P_1|F^* < 0]|. \quad (33)$$

As established in the previous proposition, managers acting in the interest of current shareholders conduct repurchases even if they do not believe that the stock is significantly undervalued. In contrast, they issue equity highly selectively. From this observation it follows that the profit conditional on share repurchase is smaller than the profit conditional on equity issuance. The proposition further states that the average post-event stock returns must be higher following an equity sale than following a share repurchase. This is because the magnitude of stock mispricing needed to trigger an equity sale is much larger than the one required for a stock repurchase.

These results are important in light of some stylized empirical facts, such as a relatively low frequency of SEOs, a high frequency of stock buybacks, and the evidence that some repurchases are conducted at prices seemingly above fundamental values. For example, managers announcing new stock repurchase programs often claim that their goal is to enhance shareholder value, yet it is not unusual to observe low stock returns after a repurchase. In particular, Bonaime, Hankins, and Jordan (2014) find that managers repurchase when stock prices are high and valuation ratios (book-to-market and sales-to-price) are unfavorable; they conclude that managers do not appear to successfully time the market with share repurchases.

Our theory provides a simple new explanation for this circumstance. The extant literature focuses on other reasons for doing buybacks, which are outside the scope of our model, such as distributing unneeded cash and managing earnings per share. Equivalently, the lack of a large volume of SEOs is usually explained by large underwriting fees and other fixed costs.

Before closing this section, we would like to discuss the dynamic extension for the model. The model developed in this paper is static because we wanted to preserve tractability and present results in the simplest possible way. Perhaps the important answered question is whether results could be extended to the dynamic case when the firm has multiple occasions to repurchase and issue mispriced stock. We hypothesize that the answer to this question is positive. Intuitively, what is best for all current shareholders is also best for each of them individually. Therefore, as long as some of the original shareholders are still with the firm, the asymmetric market timing strategy that maximizes shareholder value in every “one-shot” game also maximizes the ex-ante value at the time of firm IPO.

III. Empirical Analysis

In this section, we use data to validate our assumption that current shareholders are net sellers of a firm’s stock and then test the main predictions of the model by analyzing the volume and frequency of repurchases and equity issuances, post-event stock returns, and the profit from market timing.

A. Are Current Shareholders Net Sellers?

Our model relies on the important assumption that current shareholders are net sellers. Although this assumption is natural, two situations, issuance of new shares and short selling, merit discussion. First, the additional issuance of shares by the firm may result in current shareholders increasing their holdings. Note that this is consistent with our model since we only require shareholders to be net sellers in an inactive firm. Second, shares can be sold short by new investors, particularly by institutions that have negative information or beliefs. This may temporarily increase the holdings of stock by current shareholders. However, one does not expect institutions to short-sell stock most of the time, and even when they do so on occasion, it is unlikely that all new investors as a group (including new retail investors) will sell the firm's stock. It is therefore likely that current shareholders remain net sellers in this situation as well.

To evaluate whether data support our assumption of net selling by current shareholders and to assess the magnitude of such selling, we empirically examine trades by one group of current shareholders – institutions. We focus on institutional investors because data on their positions are readily available, unlike, e.g., data on retail investors. One caveat, of course, is that we capture trading by only one group of current shareholders, and there are likely to be systematic differences between institutions and other investors. Nevertheless, other groups of current shareholders, such as private equity, venture capitalists/founders, and firm employees, may have an even greater need for diversification and therefore a greater tendency to sell the stock.

The data are obtained from the institutional holdings database (Thomson Reuters) for the period January 1980 to December 2014. Each quarter t we consider all institutions with non-zero holdings of a firm's stock and define them as current shareholders. We then calculate the changes in the number of shares held by these institutions from this quarter to the next and sum across all institutions that had stock at date t . If the resulting number is negative, it means the current (institutional) shareholders sell the security as a group during this quarter and we classify them as net sellers. As an alternative, we repeat the same procedure at the

annual frequency and also for a subset of firms where institutions represent a meaningful group of shareholders owning at least 5% of all outstanding shares.

The results are reported in Table 1. Most of the time (61.1% of all quarters and 76.7% of all years), the current institutional shareholders are net sellers. The percentage of net sellers is even higher if we focus on a sample where institutions own at least 5% of stock (70.1% of all quarters and 80.9% of all years). On average, institutions sell between 11.8 and 22.0% of their holdings each quarter and between 30.3 and 59.5% each year, and these numbers are statistically different from zero. Thus the empirical results strongly support our assumption that current shareholders are net sellers and they sell significant amounts.

B. Data and Main Variables

Next, we analyze volume, frequency, post-event stock returns, and the profit from market timing to see whether they can be rationalized based on managers' preference for current shareholders. We use standard measures of volume and post-event abnormal stock returns. However, in our search of the academic literature, we could not find any measures of profit from market timing. Therefore we motivate and develop a new measure that empirically assesses the success of market timing strategies.

Our sample includes the universe of Compustat firms with non-missing balance sheet data for the period 1982-2012. We start in 1982 because the safe harbor provisions under the Securities and Exchange Act were adopted at this time and firms could repurchase stock without facing any legal uncertainty. Because we want to capture the post-announcement price drift, not including the price effect, and because of the noncommittal nature of open market share repurchase announcements (see, e.g., Ikenberry, Lakonishok, and Vermaelen (1995)), we use actual repurchase data instead of the announcement data.

Following Stephens and Weisbach (1998), we proxy for share repurchases with the monthly decreases in split-adjusted shares outstanding reported by the Center for Research in Security Prices (CRSP). This method assumes that the firm has not repurchased any shares if the number of shares increased or remained the same during the month. We take the last day of the month as the repurchase date and calculate the stock return over a period of either one or

three years from that date. The fraction of shares repurchased in each month is the number of shares repurchased during the month divided by the number of shares outstanding at the end of the previous month.

A potential problem with this measure is that it tends to underestimate the amount of true share repurchases (see, e.g., Jagannathan, Stephens, and Weisbach (2000)). For example, if a company buys back stock and issues equity during the same month, we can record a zero repurchase. This is particularly important for small firms because they tend to issue more equity through broad-based equity compensation programs (Bergman and Jenter (2007)) and also do more SEOs. We therefore also employ a commonly used alternative approach to calculate the actual repurchases by using the Compustat quarterly data on the total dollar value spent on repurchases. These data can contain information unrelated to repurchases of common stock (see, e.g., Kahle (2002)). Nevertheless, the advantage of Compustat repurchase data is that they are not systematically understated and provide the least biased estimate of true repurchases (Banyi, Dyl, and Kahle (2008)). Using Compustat data to calculate the number of shares repurchased each quarter, we divide the total dollar amount spent on repurchases during a quarter by the average monthly stock price.

The sample of SEOs is from the Securities Data Company (SDC) new issues database. We look only at primary issues of common stock. Although the SDC database provides the exact stock issuance date, we use the last day of the calendar month as the issuance date in calculating the one-year and three-year stock returns after an SEO. This procedure ensures that post-SEO stock returns are directly comparable to post-repurchase returns.

We also compute the new equity issuances using the changes in the number of shares outstanding. Similar to the calculation of our repurchase measure, we track the increases in the total number of shares each month. The advantage of this measure is that it captures, in addition to SEOs, other ways in which firms sell shares. According to Fama and French (2005), the issuance of stock through SEOs constitutes only a small fraction of the total issuance activity, and is smaller in magnitude than the issuance of stock due to mergers financing. For example, Fama and French (2005) report that approximately 86% percent of

all firms issued some form of equity over the period 1993 to 2002. This number contrasts sharply with the low frequency of SEOs over the same period. It may be argued that M&A activity financed by stock is one of the ways in which firms time the equity market. For example, Shleifer and Vishny (2003) present a model showing how rational managers can use stock as a means of payment in mergers and acquisitions to take advantage of stock mispricing, and Loughran and Vihj (1997) find evidence of negative long-run abnormal returns for bidders making stock acquisitions.

However, a disadvantage of this measure is that it includes the issuance of shares that is not triggered by the firm, but occurs because firm investors chose a particular action and thereby cause the equity issuance. For example, convertible debt holders can choose to convert their debt into equity. Similarly, firm employees can buy the company stock through employee stock purchase plans or exercise their stock options, which leads to an increase in the number of outstanding shares. There are two reasons why such items should not be included in the total share issuance. First, since investor-initiated issuance is not directly triggered by the firm manager, we cannot infer whether the manager intended to time the market. Second, the benefits from market timing of employee stock option exercises and other similar investor actions do not accrue to firm shareholders, but benefit employees, bondholders, or other parties. Therefore, the wealth transfers induced by market timing would be different than those we discussed in the context of the model. To mitigate these concerns, we follow McKeon (2013) and exclude equity issuance with monthly proceeds below 1% of market value of equity.¹⁷

C. Market Timing Profit Measure

Our measures of profit from market timing aim to capture the additional abnormal return earned by a shareholder with a fixed number of shares because of equity market timing. In our model, it is equivalent to the long-term gain per dollar invested in stock.

For each month, we calculate the proportion of equity repurchased during a month, α_i ,

¹⁷McKeon (2013) works with quarterly data and classifies issuances that are greater than 3% of the market value of equity as firm-initiated. Since we use monthly data, we chose a 1% cutoff.

and then multiply it by either one- or three-year post-repurchase risk-adjusted returns, r_i . We then sum the resulting measures over the 12 months of the year to obtain the total,

$$\text{Repurchase timing} = \sum_{i=1}^{12} \alpha_i r_i. \quad (34)$$

For example, if a manager buys back 5% of the firm's outstanding shares in May, and shares appreciate by 10% from June to May of the following year, the measure of repurchase timing will be equal to 0.5%.

Although the construction of measures of profit from market timing may seem intuitive, let us explain why it makes sense from a theory perspective. Intuitively, the additional return earned on one share of stock as the result of market timing is given by the difference between the realized stock return and the return if the firm not issued or repurchased any stock. The latter return is unobservable, but it can be inferred from the realized return and the cash going out of the firm (into the firm) at the time of stock repurchase (stock issuance).

Specifically, consider a manager who repurchases a fraction α of her firm's stock at today's price P_1 , expecting the stock to appreciate to P_2 in the future. Even if the manager's expectation were correct, the future price will change to P'_2 as a result of the repurchase itself. If the real policy of the firm is independent of repurchases and issuances, then the non-arbitrage relation between prices implies

$$(1 - \alpha)P'_2 = P_2 - \alpha P_1. \quad (35)$$

Empirically, we observe the actual price, P'_2 , but not what the price would be had the manager not repurchased any shares. Therefore, we infer P_2 using the expression (35) and obtain the additional return from repurchase as

$$\text{Repurchase timing} = \frac{P'_2 - P_2}{P_1} = \alpha \left(\frac{P'_2 - P_1}{P_1} \right). \quad (36)$$

Prior to calculating the market timing measures, we adjust the raw stock returns for risk using the Fama and French 100 portfolios formed on size and book-to-market deciles. Each month, we match firms in our sample to the comparable size and book-to-market portfolios based on the break points available on Kenneth French's web site and calculate the difference

in buy-and-hold returns for our firms and these portfolios.¹⁸ Using a risk-adjustment measure is justified by our theoretical model, in which mispricing is based on firm-specific information and therefore is cross-sectional by design. Note, however, that the risk adjustment necessarily removes the aggregate component, or “whole-market” mispricing, from our timing measure. Therefore, such measures cannot be used to identify whether executives can predict the long-term market trends.

Sales timing is defined in a similar manner to repurchase timing, with the difference that we track the proportion of equity sold each month, s_i ,

$$\text{Sales timing} = - \sum_{i=1}^{12} s_i r_i. \quad (37)$$

Note that timing measures can be positive or negative, with larger positive values indicating more successful timing by the firm. We also calculate repurchase and sales timing measures using quarterly data.

D. Empirical Results for Profit from Market Timing

Panel A of Table 2 presents the summary statistics for the total profit from market timing, calculated as the additional return earned by shareholders when the company sells or repurchases a fraction of its stock.

It appears from the table that, on average, firms time the market well. For example, the average additional return from timing equity sales and repurchases is positive 0.25% over a one-year period (t-stat = 14.16) and the corresponding number for a three-year period is 0.67% (t-stat = 19.76). Because many firm-years do not have a single repurchase, SEO, or equity sale, we also present the summary statistics only for those observations that have a timing event (Panel B of Table 2). Naturally, when we condition on these events, the profit from market timing becomes larger. We find that timing with repurchases and sales provides an additional return of 0.42% over a one-year period, which means that an average firm trading 10% of its equity earns approximately 4.2% in abnormal returns for the following year.

¹⁸This method is preferred over risk adjustment using the market model since using cumulative abnormal returns over a long period may yield positively biased test statistics (Barber and Lyon (1997)).

We next analyze whether profit from market timing comes primarily through share repurchases or issuances. As is evident from Table 3, the profit from stock repurchases appears to be considerably smaller than the profit from SEOs and other equity sales. For example, the average profit from repurchase timing is only 0.04% per year (t-stat = 4.94) when we use the CRSP-based measure, and 0.06% (t-stat = 6.34) when we use the Compustat-based measure, whereas the average profit is 0.37% (t-stat = 2.49) for SEO timing. Because SEOs represent only a small proportion of newly issued equity, we also repeat the estimation using the measure based on general equity sales (increases in the number of outstanding shares). This measure produces similar results, with robust evidence of successful market timing of equity sales with one- and three-year horizons. Specifically, the profit from timing equity sales is 0.66% per year and is statistically different from zero (t-stat = 13.24). The difference between profit from repurchase and profit from issuance timing appears even more striking if we compare the medians instead of the means.

In Panel B of Table 3, we present the formal tests for the difference in means (t-test) and medians (non-parametric Wilcoxon sum rank test) between the profit from repurchase timing and issuance timing. We observe that both the average and median profits from issuance timing are significantly different from those from repurchase timing. This result does not depend on whether we measure issuance using the seasoned equity offerings from SDC or equity sales based on the increases in shares outstanding. Overall, we find that issuance timing is more profitable than repurchase timing. In conjunction with our theory, this implies that managers act as if they were maximizing value for current shareholders: they repurchase too often and issue equity selectively.

E. Empirical Results for Post-Event Returns and Volume

We next present the summary statistics for the post-event abnormal stock returns (Panel A of Table 4). Firms in our sample experience 1.30% in buy-and-hold abnormal returns (BHARs) the year after the repurchase and 3.22% three years after the event.¹⁹ SEOs tend to be

¹⁹The abnormal returns after the repurchases in our sample are not directly comparable to those in previous studies (e.g., Ikenberry, Lakonishok, and Vermaelen (1995) because we look at actual repurchases rather than at announcements of intent to buy back the stock).

followed by a larger magnitude of BHARs, earning -2.27% the following year or -12.80% over three years. Following equity sales, the risk-adjusted returns are also negative, on average, at -1.72% in the year following the event.

Recall from Proposition 6 that if managers maximize current shareholder value, we would expect to see smaller post-event returns (in absolute magnitude) following repurchases than following issuances. In general, we find that to be the case, but the difference does not appear to be statistically significant, with exception of the difference in average BHARs after SEOs and repurchases over a one-year period (Panel B of Table 4). However, we do find that in all cases the difference in median BHARs following an event is both statistically and economically significant. Overall, our results are broadly consistent with current shareholder value maximization.

A potential alternative explanation for these return dynamics comes from the investment literature. Specifically, it is known that sales of equity often precede new capital investment and can be used to finance the exercise of real options (see, e.g., DeAngelo, DeAngelo, and Stulz (2010)). In turn, the exercise of real options may decrease the systematic risk of the firm and result in lower expected returns. This could be because options are exercised in anticipation of the low cost of capital (Cochrane (1991)) or because the exercise transforms riskier options into less risky assets in place (Carlson, Fisher, and Giammarino (2006)). Therefore, if we fail to adjust properly for the change in expected returns, we may mistakenly attribute the evidence of post-issuance abnormal returns to mispricing. Although the risk-adjustment technique that we employ does not match firms on investment rates, we anticipate that the bias associated with risk adjustment due to the exercise of real options is small. First, the connection between investment and returns may be pronounced for equity issuance, but it is more difficult to build a similar risk-based explanation for stock repurchases. Second, as Lyandres, Sun, and Zhang (2008) explain, new investment is often financed by methods other than SEOs, such as initial public offerings (IPOs), straight debt, and convertible debt.

To see whether our results for equity sales and SEOs are driven by different real investment dynamics in these firms, we sort all firms in our sample by their investment rates, defined

as capital expenditures in the year of the SEO divided by the beginning-of-year book assets. Table 5 shows our results. The pattern that timing with general equity sales results in a higher profit than timing with share repurchases is evident across all groups of investment rates, and the difference does not vary consistently with investment rates. Similarly, profit from SEO timing is larger than the profit from repurchase timing in the lowest and highest investment samples. For stock returns, investment also does not appear to be a major explanation. This suggests that our results are unlikely to be driven solely by expected return dynamics due to investment.

As indicated by many empirical studies preceding ours, the evidence of significant long-term BHARs after SEOs and repurchases may be indicative of market inefficiency. For example, in their study of post-SEO announcement returns, Loughran and Ritter (1995) argue that, following the announcement, the market does not revalue the stock appropriately, and the stock is still substantially overvalued when the issue occurs. Similarly, Ikenberry, Lakonishok, and Vermaelen (1995) attribute the positive price drift after share repurchases to market underreaction. Taken together with the model, our findings suggest that investors may underestimate the proportion of firms that are informed and time the market, leading to the underreaction to repurchase or issuance news and long-term returns.

Next, we show the statistics for volume and frequency of stock repurchases and issuances (see Table 6). Perhaps unsurprisingly, few firms conduct an SEO in a given year; the average frequency of these events is 4.20% in our sample. Consistent with Fama and French (2005), general equity sales are much more common, with the average firm having a 35.63% propensity to sell equity during a year. Stock repurchases, however, occur more frequently than both SEOs and general equity sales, with the probability of a buyback at 37.72% per year. Likewise, the average annual inflation-adjusted volume of repurchases is larger than that of SEOs (\$30.41 million vs. \$6.21 million). However, the volume of general equity sales is also large at \$43.58 on average. In sum, the evidence on volume of issuances and repurchases is mixed, whereas the frequency of events of the two types is consistent with managers acting in the interest of current shareholders.

IV. Conclusion

We examine the conflicts of interest between shareholders and new investors in a firm's market timing decisions. By recognizing that a firm's shareholders are affected by stock mispricing even in the absence of share repurchases and equity sales by the firm, we disentangle the effects of exogenous mispricing and firm actions on existing shareholders. Using this insight, we show theoretically that a market timing strategy that exploits under- and over-pricing of a firm's stock can reduce the wealth of the current shareholders. Additionally, current shareholders are relatively better off with share repurchase timing than with share issuance timing.

According to the theory developed in this paper, if managers act in the interest of existing shareholders, share repurchases should be more frequent than equity sales, repurchases should be followed by a lower magnitude of abnormal returns, and shareholders will earn a smaller profit from repurchase timing than from issuance timing. Our empirical findings provide support for these predictions, which suggests that most managers in the United States appear to be looking out for their firms' current shareholders.

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Appendix A. Proposition Proofs

Proof of Proposition 1.

Applying the projection theorem for a normal distribution, we obtain the conditional mean of P_2 given a managerial signal

$$E(P_2|v) = \bar{P} + \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2} (v - \bar{P}). \quad (38)$$

We conjecture that the equilibrium price is as follows

$$P_1 = \bar{P} + \beta F, \quad (39)$$

and solve for parameter β in the equilibrium. Substituting the conjecture for P_1 into the manager's problem (8), and taking the first-order condition with respect to F , yields

$$F^* = \frac{E(P_2|v) - \bar{P}}{2\beta} = \gamma (v - \bar{P}), \quad (40)$$

where

$$\gamma = \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2} \frac{1}{2\beta}. \quad (41)$$

The second-order condition is satisfied whenever $\beta > 0$. For individuals who observe a firm's trade F , the conditional mean of P_2 is

$$E(P_2|F) = \lambda E(P_2|F, \text{info}) + (1 - \lambda) E(P_2|F, \text{no info}) = \bar{P} + 2\lambda\beta F. \quad (42)$$

The equilibrium price is set by the market clearing condition. Using $\sum_{i=1}^{n+m} Q_i = 0$ and the individual demand functions (7), we can write this condition as

$$F + \sum_{i=1}^{n+m} X_i^* = F + (n+m) \frac{E(P_2|F) - P_1}{\theta} = 0. \quad (43)$$

It follows that the individual investors share the extra demand from the firm equally, i.e.,

$$X_i^* = Q_i - \frac{F}{n+m}. \quad (44)$$

Substituting (42) into condition (43), we obtain the market clearing price

$$P_1 = \bar{P} + \left(\frac{\theta}{n+m} + 2\lambda\beta \right) F. \quad (45)$$

Comparing this expression to conjecture (39), we can solve for parameter β

$$\beta = \frac{\theta}{(n+m)(1-2\lambda)}. \quad (46)$$

Note that the second-order condition requires that λ (proportion of firms that are believed to repurchase or sell stock for information reasons) is less than $\frac{1}{2}$. Whenever $\lambda > 1/2$, the linear equilibrium does not exist.

Finally, we solve for parameters μ_u and σ_u^2 , such that the distribution of demand by informed managers is identical to that by managers who repurchase or issue equity for exogenous reasons. Specifically, the mean and variance of the demand by uninformed managers solve a fixed-point problem

$$\begin{aligned} \text{Var}(F^*|\mu_u, \sigma_u^2) &= \sigma_u^2, \\ E(F^*|\mu_u, \sigma_u^2) &= \mu_u. \end{aligned} \quad (47)$$

Using (40), we obtain

$$\mu_u = 0, \quad (48)$$

$$\sigma_u^2 = \frac{(n+m)^2(1-2\lambda)^2\sigma_p^4}{4\theta^2(\sigma_p^2 + \sigma_\varepsilon^2)}. \quad (49)$$

Therefore, given any observed value F , the individuals will attribute probability λ that the firm is informed and probability $1 - \lambda$ that it is uninformed.

Proof of Proposition 2.

(i) The probability of a stock repurchase minus the probability of an equity sale is

$$\Pr(F^* > 0) - \Pr(F^* < 0) = \int_0^\infty f(x) dx - \int_{-\infty}^0 f(x) dx = 0. \quad (50)$$

where $x = v - \bar{P}$ and $f(x)$ is the normal distribution density function with zero mean and variance $\sigma^2 \equiv \sigma_p^2 + \sigma_\varepsilon^2$. Similarly, we can calculate the difference in total volume

$$\begin{aligned} \text{Volume(Rep)} - \text{Volume(Iss)} &= E[F|F^* > 0] \Pr(F^* > 0) - E[-F|F^* < 0] \Pr(F^* < 0) \\ &= \int_0^\infty \gamma x f(x) dx - \left(- \int_{-\infty}^0 \gamma x f(x) dx \right) = 0. \end{aligned} \quad (51)$$

(ii) Using (38)-(40), we can write the manager's trading profit conditional on signal as

$$\Pi(x) = \beta\gamma^2 x^2. \quad (52)$$

Profit from repurchases minus profit from equity sales is then

$$\frac{\int_0^\infty \Pi(x) f(x) dx}{\int_0^\infty f(x) dx} - \frac{\int_{-\infty}^0 \Pi(x) f(x) dx}{\int_{-\infty}^0 f(x) dx} = 2\beta\gamma^2 \left(\int_0^\infty x^2 f(x) dx - \int_{-\infty}^0 x^2 f(x) dx \right). \quad (53)$$

Because of the symmetry of the normal distribution, the expression above is equal to 0.

(iii) The expected post-event price drift given managerial signal can be written as

$$R(x) = E(P_2|v) - P_1 = \beta\gamma x. \quad (54)$$

The absolute value of the expected price drift after a repurchase minus that after an equity issuance is

$$\left| \frac{\int_0^\infty R(x) f(x) dx}{\int_0^\infty f(x) dx} \right| - \left| \frac{\int_{-\infty}^0 R(x) f(x) dx}{\int_{-\infty}^0 f(x) dx} \right| = 2\beta\gamma \left(\int_0^\infty x f(x) dx + \int_{-\infty}^0 x f(x) dx \right) = 0. \quad (55)$$

Proof of Proposition 3.

(i) Note that any repurchase or equity issuance by an informed manager in a given firm represents a zero-sum game between the firm's current shareholders and new investors. Thus it suffices to prove that new investors can profit from equity issuance timing. From (6), the wealth of new investor i who holds no shares initially is

$$W_i \equiv X_i (P'_2 - P_1). \quad (56)$$

Recall that the manager issues shares ($F < 0$) during the overpricing ($v < \bar{P}$). Given a particular signal of the manager v , the change in expected wealth of all new investors after stock issuance by the firm is

$$\sum_{i=n+1}^{n+m} E [W_i^{F<0} - W_i^{F=0}|v] = \sum_{i=n+1}^{n+m} E [X_i (P'_2 - P_1) - Q_i (P_2 - \bar{P}) |v]. \quad (57)$$

Here the expectation is taken over the noise term in the manager's signal, ε . To prove that current shareholders are worse off, we need to show that the sum above is positive. Using the

expression for the long-term price (4), we obtain

$$\sum_{i=n+1}^{n+m} E [W_i^{F<0} - W_i^{F=0}|v] = \sum_{i=n+1}^{n+m} E \left[X_i \left(P_2 + \frac{F(P_2 - P_1)}{N - F} - P_1 \right) - Q_i (P_2 - \bar{P}) |v \right]. \quad (58)$$

Substituting the equilibrium price P_1 , individual demand functions X_i , and conditional expectation $E [P_2|v]$, and using notation for mispricing $x = v - \bar{P} < 0$, we can rewrite

$$\sum_{i=n+1}^{n+m} E [W_i^{F<0} - W_i^{F=0}|x] = \frac{\beta\gamma x}{N - \gamma x} [2\gamma x (Q^+ - \bar{Q}) - Q^+ N], \quad (59)$$

where Q^+ is the aggregate demand of new investors and \bar{Q} is given by (18). The expression (59) is positive (current shareholders are worse off) when

$$2\gamma x (Q^+ - \bar{Q}) < Q^+ N. \quad (60)$$

Because $x < 0$ and $Q^+ < \bar{Q}$, the condition above is satisfied when mispricing is not too large. Therefore, we establish that current shareholders are worse off with equity issuance timing by an informed manager (and the new investors are better off) when

$$\bar{v} < v < \bar{P}, \quad (61)$$

where

$$\bar{v} \equiv \bar{P} + \frac{Q^+ N}{2\gamma (Q^+ - \bar{Q})}. \quad (62)$$

(ii) For the case of share repurchases of undervalued equity, the expression for change in wealth of new investors is given by (59) with $x > 0$. Since $Q^+ < \bar{Q}$, it is negative. Therefore, according to the zero-sum argument the current shareholder value always increases.

(iii) To establish that current shareholders prefer share repurchases to equity issues, we write the difference between new investors' wealth with repurchase timing and issuance timing, for a given magnitude of mispricing, $|x| = |v - \bar{P}|$, and show that it is negative. Specifically,

$$\begin{aligned} & \sum_{i=n+1}^{n+m} E [W_i^{F>0} - W_i^{F=0}|v, v > \bar{P}] - \sum_{i=n+1}^{n+m} E [W_i^{F<0} - W_i^{F=0}|v, v < \bar{P}] = \quad (63) \\ & = \frac{\beta\gamma|x|}{N - \gamma|x|} [2\gamma|x| (Q^+ - \bar{Q}) - Q^+ N] - \frac{\beta\gamma|x|}{N + \gamma|x|} [2\gamma|x| (Q^+ - \bar{Q}) + Q^+ N]. \end{aligned}$$

The expression above is negative when

$$2\gamma^2 x^2 (Q^+ - \bar{Q}) < Q^+ N^2. \quad (64)$$

The last condition is true because $Q^+ < \bar{Q}$.

(iv) To see that market timing increases current shareholder value in expectation, it is sufficient to show that the new investors' wealth, averaged over all possible values of mispricing x , decreases. Integrating (59) over states x gives the expected change in wealth from market timing for new investors

$$\beta \int_{-\infty}^{\infty} \frac{2(\gamma x)^2 (Q^+ - \bar{Q}) - Q^+ N \gamma x}{N - \gamma x} f(x) dx. \quad (65)$$

Using the symmetry of the normal distribution, we can rewrite this value as

$$\begin{aligned} & \beta \int_0^{\infty} \left(\frac{2(\gamma x)^2 (Q^+ - \bar{Q}) + Q^+ N \gamma x}{N + \gamma x} + \frac{2(\gamma x)^2 (Q^+ - \bar{Q}) - Q^+ N \gamma x}{N - \gamma x} \right) f(x) dx \\ &= 2N\beta \int_0^{\infty} \frac{(\gamma x)^2 (Q^+ - 2\bar{Q})}{(N + \gamma x)(N - \gamma x)} f(x) dx. \end{aligned} \quad (66)$$

Since $Q^+ < \bar{Q}$, it is negative. Therefore, it must be that current shareholder value increases.

Proof of Proposition 4.

(i) We have shown in the proof of Proposition 3 that current shareholder wealth decreases with the timing of equity issuance when

$$\sum_{i=n+1}^{n+m} E [W_i^{F<0} - W_i^{F=0}|x] = \frac{\beta\gamma x}{N - \gamma x} [2\gamma x (Q^+ - \bar{Q}) - Q^+ N] > 0. \quad (67)$$

Because for issuance $x < 0$ (overvaluation), current shareholders are worse off when

$$2\gamma x (Q^+ - \bar{Q}) < Q^+ N,$$

which is always satisfied because $Q^+ > \bar{Q}$.

(ii) For share repurchases of undervalued stock, we have $x > 0$. From (59), the current shareholder value decreases with repurchase timing if

$$2\gamma x (Q^+ - \bar{Q}) > Q^+ N. \quad (68)$$

Since $Q^+ > \bar{Q}$, this condition is satisfied when mispricing is large, i.e., $v > \bar{v}$, where

$$\bar{v} \equiv \bar{P} + \frac{Q^+ N}{2\gamma(Q^+ - \bar{Q})}. \quad (69)$$

(iii) For new investors, the expected change in wealth from market timing is given by (66), and it is positive when $Q^+ > 2\bar{Q}$. Therefore, it must be that current shareholder value is lower with market timing.

Proof of Proposition 5.

The problem of maximizing current shareholder value is equivalent to minimizing value for new investors with respect to F . Using expression for P'_2 , we have

$$\min_F \sum_{i=n+1}^{n+m} E[X_i(P'_2 - P_1) | v] = \min_F N \sum_{i=n+1}^{n+m} X_i \frac{(E(P_2|v) - P_1)}{N - F}. \quad (70)$$

We start with a linear conjecture for the equilibrium price schedule

$$P_1 = \bar{P} - \alpha + \beta F. \quad (71)$$

It is easy to check that the solution exists only if

$$(2\bar{Q} - Q^+) \left(N - 2\gamma x - \frac{\alpha}{\beta} \right) > 0. \quad (72)$$

Using (71) and demand functions for individual investors (11), the objective function (70) can be simplified to

$$\min_F \left(Q^+ - \frac{Fm}{n+m} \right) \frac{(2\gamma x + \frac{\alpha}{\beta} - F)}{N - F} \simeq \min_F \left(Q^+ - \frac{Fm}{n+m} \right) \frac{(2\gamma x + \frac{\alpha}{\beta} - F)}{N}. \quad (73)$$

Solving for optimal demand by the manager gives

$$F^* = \frac{n+m}{2m} Q^+ + \gamma x + \frac{\alpha}{2\beta}. \quad (74)$$

For individuals who observe the firm's trade F , the conditional mean of P_2 is

$$E(P_2|F, \text{info}) = \bar{P} - \alpha - \beta Q^+ \frac{n+m}{m} + 2\beta F, \quad (75)$$

$$\begin{aligned} E(P_2|F) &= \lambda E(P_2|F, \text{info}) + (1 - \lambda) E(P_2|F, \text{no info}) \\ &= \bar{P} - \lambda\alpha - \lambda\beta Q^+ \frac{n+m}{m} + 2\lambda\beta F. \end{aligned} \quad (76)$$

The equilibrium price is found from the market clearing condition, which can be written as

$$P_1 = \frac{\theta F}{n+m} + E(P_2|F) = \left(\frac{\theta}{n+m} + 2\lambda\beta \right) F + \bar{P} - \lambda\alpha - \lambda\beta Q^+ \frac{n+m}{m}. \quad (77)$$

We compare the expression above to the price conjecture (71) and solve for α and β

$$\beta = \frac{\theta}{(n+m)(1-2\lambda)} > 0, \quad (78)$$

$$\alpha = \frac{\lambda\theta Q^+}{(1-\lambda)(1-2\lambda)m} > 0. \quad (79)$$

Substituting parameters in (74) yields

$$F^* = \bar{F} + \gamma(v - \bar{P}), \quad (80)$$

$$\bar{F} = \frac{Q^+}{1-\lambda} \frac{n+m}{2m}. \quad (81)$$

Since new investors on average buy the stock, $Q^+ > 0$, it follows that $\bar{F} > 0$. Finally, using the fixed-point argument we derive the parameters μ_u and σ_u^2 that result in the identical distribution of the issuance/repurchase actions by informed and uninformed managers. Following the same steps as in the first proposition, we obtain

$$\mu_u = \frac{Q^+}{1-\lambda} \frac{n+m}{2m}, \quad (82)$$

$$\sigma_u^2 = \frac{(n+m)^2 (1-2\lambda)^2 \sigma_p^4}{4\theta^2 (\sigma_p^2 + \sigma_\varepsilon^2)}. \quad (83)$$

Proof of Proposition 6.

(i) The probability of a stock repurchase is larger than the probability of an equity sale because

$$\Pr(F^* > 0) - \Pr(F^* < 0) = \int_{-\frac{\bar{F}}{\gamma}}^{\infty} f(x) dx - \int_{-\infty}^{-\frac{\bar{F}}{\gamma}} f(x) dx = 1 - 2\Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) > 0, \quad (84)$$

where $f(x)$ is the normal distribution density function with zero mean and variance $\sigma^2 \equiv \sigma_p^2 + \sigma_\varepsilon^2$. Similarly, we show that the difference in total volume of stock repurchases and equity sales is positive

$$\begin{aligned} \text{Volume(Rep)} - \text{Volume(Iss)} &= E[F|F^* > 0] \Pr(F^* > 0) - E[-F|F^* < 0] \Pr(F^* < 0) \\ &= \int_{-\frac{\bar{F}}{\gamma}}^{\infty} (\bar{F} + \gamma x) f(x) dx + \int_{-\infty}^{-\frac{\bar{F}}{\gamma}} (\bar{F} + \gamma x) f(x) dx \\ &= \bar{F} > 0. \end{aligned} \quad (85)$$

(ii) A manager's trading profit when she maximizes current shareholder value is

$$\Pi(v) = E[(P_2 - P_1)F|v]. \quad (86)$$

Substituting the expressions for the firm's optimal demand for shares, F^* , and the equilibrium price schedule, P_1 , we have

$$\Pi(x) = \beta \left(\gamma^2 x^2 + 2\lambda\gamma\bar{F}x - \bar{F}^2(1 - 2\lambda) \right), \quad (87)$$

We need to show that the expected profit from timing repurchases minus expected profit from timing equity sales is negative. From Proposition 5, we know that the firm will repurchase shares if and only if $x > -\frac{\bar{F}}{\gamma}$. Therefore, repurchases are less profitable than issuances when

$$\frac{\int_{-\frac{\bar{F}}{\gamma}}^{\infty} \Pi(x) f(x) dx}{\int_{-\frac{\bar{F}}{\gamma}}^{\infty} f(x) dx} - \frac{\int_{-\infty}^{-\frac{\bar{F}}{\gamma}} \Pi(x) f(x) dx}{\int_{-\infty}^{-\frac{\bar{F}}{\gamma}} f(x) dx} < 0. \quad (88)$$

Simplify this expression by using the following three properties of the standard normal distribution with cumulative density function $\Phi(x)$:

$$\begin{aligned} \int_A^B x^2 f(x) dx &= \frac{\sigma^2}{\sqrt{2\pi\sigma^2}} \left(-Be^{-\frac{B^2}{2\sigma^2}} + Ae^{-\frac{A^2}{2\sigma^2}} \right) + \sigma^2 (\Phi(B/\sigma) - \Phi(A/\sigma)), \quad (89) \\ \int_A^B x f(x) dx &= -\frac{\sigma^2}{\sqrt{2\pi\sigma^2}} \left(e^{-\frac{B^2}{2\sigma^2}} - e^{-\frac{A^2}{2\sigma^2}} \right), \\ \int_A^B f(x) dx &= \Phi(B/\sigma) - \Phi(A/\sigma). \end{aligned}$$

By substituting (87) and using (89), it is possible to show that (88) is satisfied for $\lambda < 1/2$,

$$-\Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) - (1 - 2\lambda) \frac{\bar{F}}{\gamma\sigma} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\bar{F}}{\gamma\sigma}\right)^2} < 0. \quad (90)$$

(iii) The post-event price drift given managerial signal v is

$$R(x) = E(P_2|v) - P_1 = \beta(\gamma x - \bar{F}(1 - 2\lambda)). \quad (91)$$

Recall that the manager repurchases when $x > -\frac{\bar{F}}{\gamma}$. Therefore, we can show using (89) that

the expected stock returns conditional on issuance and repurchase are, respectively,

$$\frac{\int_{-\infty}^{-\frac{\bar{F}}{\gamma}} R(x) f(x) dx}{\int_{-\infty}^{-\frac{\bar{F}}{\gamma}} f(x) dx} = -\frac{\beta\gamma\sigma}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\bar{F}}{\gamma\sigma}\right)^2} / \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) - \beta\bar{F}(1-2\lambda) \quad \text{and} \quad (92)$$

$$\frac{\int_{-\frac{\bar{F}}{\gamma}}^{\infty} R(x) f(x) dx}{\int_{-\frac{\bar{F}}{\gamma}}^{\infty} f(x) dx} = \frac{\beta\gamma\sigma}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\bar{F}}{\gamma\sigma}\right)^2} / \left(1 - \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right)\right) - \beta\bar{F}(1-2\lambda). \quad (93)$$

The difference is

$$-\frac{\beta\gamma\sigma}{\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\bar{F}}{\gamma\sigma}\right)^2} \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) / \left(1 - \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right)\right) < 0$$

The expected stock return following a stock issuance is always negative, while it can be positive or negative following a repurchase. Since $\bar{F} > 0$, it must be that $\Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) < 1/2$ and we have

$$1 - \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right) > \Phi\left(-\frac{\bar{F}}{\gamma\sigma}\right). \quad (94)$$

Therefore, the absolute value of expected price drift following a repurchase is always smaller than the value of expected price drift following equity issuance.

Appendix B. Current Shareholders' Welfare Analysis

Here we discuss the implications of a symmetric market timing strategy for the welfare of current shareholders measured by their objective function (5). We then analyze the optimal market timing strategy of an informed manager who aims to maximize this objective function.

Recall that an equity issue of overvalued stock can decrease shareholder value. We show below that a similar claim can be made for the expected utility of shareholders. Specifically, we decompose the change in current shareholders' expected utility into a change in their expected wealth and a change in costs associated with deviation from desired positions

$$\sum_{i=1}^n E [U_i^{F<0} - U_i^{F=0}|v] = \sum_{i=1}^n E [W_i^{F<0} - W_i^{F=0}|v] - \sum_{i=1}^n E \left[\frac{\theta}{2} (X_i - Q_i)^2 |v \right]. \quad (95)$$

As we show in Proposition 3, the first term is negative when the stock overpricing is small. To see that the change in utility is negative as well, note that by timing a firm creates additional disutility for current shareholders because their demands deviate from the initial preferences, i.e., $X_i \neq Q_i$ if $F \neq 0$. Therefore, the second term is negative, and current shareholders are worse off from equity issuance of overvalued stock. Using a similar line of reasoning, one can show that all claims of Proposition 4 also hold if we consider shareholders' utility function instead of wealth.

Next we show that when the share turnover is low, current shareholders prefer share repurchase timing over issuance timing. From the proof of Proposition 3, we have the following relation between the current shareholders' expected wealth changes with repurchase and issuance timing

$$\sum_{i=1}^n E [W_i^{F>0} - W_i^{F=0}|v, v > \bar{P}] > \sum_{i=1}^n E [W_i^{F<0} - W_i^{F=0}|v, v < \bar{P}]. \quad (96)$$

Note also that the costs incurred by shareholders, $\frac{\theta}{2} (X_i - Q_i)^2$, are symmetric with respect to mispricing, $v - \bar{P}$; that is

$$E \left(\frac{\theta}{2} (X_i - Q_i)^2 |v \right) = \frac{\theta \gamma^2 (v - \bar{P})^2}{2(n+m)^2}. \quad (97)$$

Therefore, when we subtract the respective costs from both sides of (96), the inequality

remains unchanged, and we have

$$\sum_{i=1}^n E [U_i^{F>0} - U_i^{F=0} | v, v > \bar{P}] > \sum_{i=1}^n E [U_i^{F<0} - U_i^{F=0} | v, v < \bar{P}]. \quad (98)$$

We now analyze the optimal market timing strategy of a manager who wants to maximize the expected utility of shareholders. This objective function is equivalent to minimizing the sum of the wealth of new investors and costs of suboptimal trades for current shareholders

$$\min_F N \sum_{i=n+1}^{n+m} X_i \frac{(E(P_2|v) - P_1)}{N - F} + \frac{\theta F^2}{2(n+m)^2}. \quad (99)$$

Using the linear conjecture for the equilibrium price schedule

$$P_1 = \bar{P} - \alpha + \beta F, \quad (100)$$

we can further rewrite the objective function as

$$\min_F \left(Q^+ - \frac{Fm}{n+m} \right) \frac{(2\gamma\beta x + \alpha - \beta F)}{N} + \frac{\theta F^2}{2(n+m)^2}. \quad (101)$$

Taking the first-order condition with respect to F , we obtain

$$F^* = \frac{\alpha + \frac{n+m}{m} Q^+ \beta + 2\gamma\beta x}{2\beta + \frac{\theta N}{m(n+m)}} \equiv \hat{F} + \hat{\gamma}x. \quad (102)$$

Since the manager's demand is linear in mispricing, we have

$$E(P_2|F) = \bar{P} - \lambda\alpha - \lambda\beta Q^+ \frac{n+m}{m} + F \left(2\beta\lambda + \frac{\lambda\theta N}{m(n+m)} \right). \quad (103)$$

The equilibrium price is found from the market clearing condition

$$P_1 = \frac{\theta F}{n+m} + E(P_2|F) = \left(\frac{\theta}{n+m} + 2\lambda\beta + \frac{\lambda\theta N}{m(n+m)} \right) F + \bar{P} - \lambda\alpha - \lambda\beta Q^+ \frac{n+m}{m}. \quad (104)$$

We now compare this expression with the price conjecture (71) and solve for α and β

$$\beta = \frac{\theta \left(1 + \frac{\lambda N}{m} \right)}{(1-2\lambda)(n+m)} > 0, \quad (105)$$

$$\alpha = \frac{\lambda Q^+ \theta \left(1 + \frac{\lambda N}{m} \right)}{(1-\lambda)(1-2\lambda)m} > 0. \quad (106)$$

Substituting the solution back into (102) yields

$$\hat{F} = \bar{F} \frac{m + \lambda N}{m + \frac{1}{2}N} < \bar{F}, \quad (107)$$

$$\hat{\gamma} = \gamma \frac{m + \lambda N}{m + \frac{1}{2}N} < \gamma, \quad (108)$$

where \bar{F} is given by (81). Note that $\hat{F} > 0$.

Table 1. Net Sales of Shares by Current Shareholders.

The sample is obtained from the institutional holdings database (Thomson Reuters), which collects data from 13F filings and covers the period from January 1980 to December 2014. Panel A shows the total number of observations, the number of observations with net sales by institutions, and the proportion of observations with net sales for the full sample of firms and for firms with at least 5% institutional ownership at the quarterly and annual frequencies. We measure net sales based on the changes in the number of shares held by institutions (adjusted for splits). For each firm-period, we consider all institutions with non-zero holdings of the security in the previous period, and then subtract their previous-period holdings from their current-period holdings to obtain the change. We then sum changes for all institutions in a given firm-period. A positive number for a given firm-period means that the current (institutional) shareholders buy the security as a group during this period, while a negative number indicates that they sell the security as a group (counted as a “net seller” in Panel A). Panel B shows the summary statistics for the change in the holdings by institutions.

Panel A. Proportion of firms where current shareholders are net sellers

Variable	Full sample			Firms with institutional ownership > 5%		
	Total	Net sellers	Net sellers/ total	Total	Net sellers	Net sellers/ total
Firm-quarters	1,200,178	733,585	0.611	716,220	501,772	0.701
Firm-years	296,062	227,006	0.767	176,952	143,209	0.809

Panel B. Institutional holdings and change in holdings

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th	T-test
Quarterly Δ ownership, normalized by average ownership	1,200,178	-0.220	0.570	-0.867	-0.024	0.072	-423.67***
Quarterly Δ ownership, normalized by last quarter ownership	1,200,178	-0.118	0.331	-0.606	-0.023	0.075	-391.01***
Annual Δ ownership, normalized by average ownership	296,062	-0.595	0.839	-2.000	-0.222	0.122	-385.79***
Annual Δ ownership, normalized by last year ownership	296,062	-0.303	0.525	-1.000	-0.203	0.133	-314.29***
Institutional holdings/outst. shares (firm-years)	256,500	0.292	0.294	0.003	0.189	0.766	N/A

Table 2. Summary Statistics on Total Profit from Market Timing.

The sample covers the period 1982-2012. Panel A presents statistics for all firm-years with non-missing data, where the firm-years with no timing events (share repurchase, equity sale, or SEO) are coded as zero. Panel B displays the summary statistics only for those firm-years where there was at least one timing event. The numbers in the table are the additional returns (in %) earned by a shareholder with a fixed number of shares because of market timing efforts by the firm. Timing SEOs and repurchases is equal to the sum of (1) the post-SEO risk-adjusted return in %, calculated over a period of one or three years, and multiplied by the proportion of newly issued equity (as identified in the SDC New Issues database) and (2) the post-repurchase risk-adjusted return in %, calculated over a horizon of one or three years after a decrease in shares outstanding (as identified in the CRSP monthly database), and multiplied by the fraction of equity repurchased. Timing sales and repurchases is equal to the sum of (1) the risk-adjusted return in %, calculated over a period of one or three years after an increase in shares outstanding (as identified in the CRSP monthly database; following McKeon (2013), only observations with a monthly increase in shares outstanding over 1% are considered), and multiplied by the fraction of equity issued and (2) the post-repurchase risk-adjusted return in %, calculated over a horizon of one or three years after a decrease in shares outstanding (as identified in the CRSP monthly database), and multiplied by the fraction of equity repurchased. The last column in the table gives t-test statistics for the difference of the mean from zero.

Panel A. Total profit from market timing (all firm-years)

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th	T-test
Timing repurchases and SEOs (1-year)	137,778	0.031	2.570	-0.345	0	0.313	4.44***
Timing repurchases and SEOs (3-year)	114,369	0.151	4.746	-0.748	0	0.588	10.78***
Timing repurchases and sales (1-year)	137,778	0.250	6.566	-1.235	0	2.268	14.16***
Timing repurchases and sales (3-year)	114,369	0.667	11.421	-2.035	0	4.490	19.76***

Panel B. Total profit from market timing (firm-years with timing events)

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th	T-test
Timing repurchases and SEOs (1-year)	56,233	0.075	4.021	-1.667	-0.003	2.047	4.44***
Timing repurchases and SEOs (3-year)	45,607	0.379	7.510	-3.464	-0.013	4.694	10.79***
Timing repurchases and sales (1-year)	82,188	0.420	8.498	-2.921	0.015	5.049	14.16***
Timing repurchases and sales (3-year)	66,085	1.155	15.006	-5.089	0.052	10.255	19.78***

Table 3. Profit from Market Timing with Equity Issuances and Share Repurchases.

Panel A presents the summary statistics for timing measures; Panel B displays the two-sample t-test for the difference in means and the non-parametric Wilcoxon rank-sum test for the difference in medians. *Timing SEOs* is equal to the post-SEO risk-adjusted return in %, calculated over a period of one or three years and multiplied by the proportion of newly issued equity (as identified in the SDC New Issues database). *Timing sales* is equal to the risk-adjusted return in %, calculated over a period of one or three years after an increase in shares outstanding (as identified in the CRSP monthly database), and multiplied by the fraction of equity issued. Following McKeon (2013), only observations with a monthly share increase over 1% are considered. *Timing repurchases* is equal to the post-repurchase risk-adjusted return in %, calculated over a period of one or three years after a decrease in shares outstanding (as identified in the CRSP monthly database), and multiplied by the fraction of equity repurchased. *Timing repurchases Compustat* is equal to the post-repurchase risk-adjusted stock return in %, calculated over a period of one or three years and multiplied by the fraction of equity repurchased (as identified from the Compustat quarterly database).

Panel A. Profit from market timing by type (firm-years with timing events)

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th	T-test
Timing SEOs (1-year)	5,782	0.371	11.361	-9.077	0.645	10.442	2.49**
Timing SEOs (3-year)	4,725	2.765	19.316	-14.033	2.765	22.004	9.84***
Timing sales (1-year)	49,088	0.660	11.049	-5.520	0.287	8.599	13.24***
Timing sales (3-year)	39,070	1.845	19.646	-9.104	0.786	16.951	18.56***
Timing repurchases (1-year)	51,971	0.040	1.853	-1.304	-0.004	1.253	4.94***
Timing repurchases (3-year)	42,136	0.101	4.448	-2.910	-0.020	2.556	4.64***
Timing repurchases (Compustat) (1-year)	38,148	0.055	1.706	-1.293	-0.006	1.317	6.34***
Timing repurchases (Compustat) (3-year)	32,876	0.130	3.939	-2.846	-0.033	2.719	5.99***

Panel B. Difference in profit from market timing (firm-years with timing events)

Variable	Diff. in means	Diff. in medians	T-test in means	T-test for diff. in medians	Wilcoxon z-statistic for diff. in medians
Timing SEOs minus repurchases (1-year)	0.331	0.648	5.97***	17.94***	17.94***
Timing SEOs minus repurchases (3-year)	2.665	2.785	23.33***	31.44***	31.44***
Timing sales minus repurchases (1-year)	0.620	0.290	12.61***	43.21***	43.21***
Timing sales minus repurchases (3-year)	1.744	0.805	17.74***	54.40***	54.40***

Table 4. BHARs Following Equity Issuances and Share Repurchases.

The numbers in the table are the risk-adjusted returns in %, calculated over a period of one or three years after the timing event. To make the adjustment for risk, we use the Fama and French 100 portfolios formed on size and book-to-market deciles. Each month, we match firms in our sample to the comparable size and book-to-market portfolios based on the break points available on Kenneth French's web site and calculate the difference in buy-and-hold returns for our firms and these portfolios. The last column in the table gives t-test statistics for the difference of the mean from zero.

Panel A. Stock returns after market timing by type

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th	T-test
BHAR after SEO (1 year)	5,782	-2.270	46.010	-52.173	-6.556	47.994	-3.75***
BHAR after SEO (3 year)	4,725	-12.800	85.192	-100.56	-25.963	81.000	-10.34***
BHAR after sale (1 year)	49,088	-1.721	52.803	-56.394	-8.321	54.824	-7.22***
BHAR after sale (3 year)	39,070	-2.684	109.20	-104.40	-22.857	110.69	-4.86***
BHAR after repurchase (1 year)	51,971	1.304	43.336	-46.075	-3.357	49.164	6.71***
BHAR after repurchase (3 year)	41,136	3.217	100.49	-93.944	-12.703	109.53	6.57***
BHAR after repurchase (Compustat) (1 year)	38,148	1.022	43.140	-44.547	-3.602	47.831	4.63***
BHAR after repurchase (Compustat) (3 year)	32,876	1.991	98.019	-93.836	-12.924	104.86	3.68***

Panel B. Difference in stock returns after market timing

Variable	Diff. in means	Diff. in medians	T-test for diff. in means	Wilcoxon z-statistic for diff. in medians
$ \text{BHAR}_{\text{SSEOs}} - \text{BHAR}_{\text{repurchases}} $ (1-year)	0.965	9.913	1.56	15.67***
$ \text{BHAR}_{\text{SSEOs}} - \text{BHAR}_{\text{repurchases}} $ (3-year)	9.582	38.629	6.31***	25.74***
$ \text{BHAR}_{\text{sales}} - \text{BHAR}_{\text{repurchases}} $ (1-year)	0.417	11.679	1.36	37.31***
$ \text{BHAR}_{\text{sales}} - \text{BHAR}_{\text{repurchases}} $ (3-year)	-0.533	35.560	-0.72	45.74***

Table 5. Investment Patterns and Market Timing.

The numbers in the table are the risk-adjusted returns in %, calculated over a horizon of one or three years after the timing event. To make the adjustment for risk, we use the Fama and French 100 portfolios formed on size and book-to-market deciles. Each month, we match firms in our sample to the comparable size and book-to-market portfolios based on the break points available on Kenneth French's web site and calculate the difference in buy-and-hold returns for our firms and these portfolios. The last column in the table gives t-test statistics for the difference of the mean from zero.

	Low investment rate			Medium investment rate			High investment rate		
	Mean	Median	T-test	Mean	Median	T-test	Mean	Median	T-test
Timing SEOs (1-year)	0.391	0.680	1.53	-0.087	0.647	-0.29	0.771	0.705	3.15***
Timing SEOs (3-year)	2.674	2.606	5.57***	1.415	2.688	2.43**	3.762	3.214	8.18***
Timing sales (1-year)	0.824	0.335	8.47***	0.532	0.267	6.40***	0.732	0.327	8.21***
Timing sales (3-year)	2.121	0.892	11.31***	1.669	0.752	10.08***	1.973	0.816	10.84***
Timing repurchases (1-year)	0.035	-0.005	2.40**	0.058	-0.004	3.99***	0.003	-0.005	0.17
Timing repurchases (3-year)	0.114	-0.025	2.93***	0.092	-0.020	2.42**	0.122	-0.020	2.98***
Timing repurchases (Compustat) (1-year)	0.067	-0.008	4.34***	0.082	-0.004	5.45***	0.009	-0.008	0.62
Timing repurchases (Compustat) (3-year)	0.149	-0.042	3.89***	0.115	-0.025	3.17***	0.116	-0.028	2.98***

	Low investment rate			Medium investment rate			High investment rate		
	Mean	Median	T-test	Mean	Median	T-test	Mean	Median	T-test
BHAR after SEO (1 year)	-2.870	-6.326	-3.15***	-0.277	-6.649	-0.21	-3.410	-8.004	-3.13***
BHAR after SEO (3 year)	-11.647	-21.908	-6.15***	-8.573	-26.393	-3.07***	-17.131	-31.839	-7.89***
BHAR after sale (1 year)	-1.789	-8.784	-4.21***	-1.297	-8.537	-2.98***	-2.647	-9.782	-5.98***
BHAR after sale (3 year)	-4.345	-23.546	-4.53***	-2.165	-23.730	-2.12**	-2.506	-25.422	-2.41**
BHAR after repurchase (1 year)	1.433	-4.215	4.15***	1.963	-3.253	5.50***	-0.008	-4.614	-0.02
BHAR after repurchase (3 year)	2.119	-13.951	2.49**	3.450	-12.875	3.86***	4.196	-13.508	4.32***
BHAR after repurchase (Compustat) (1 year)	1.222	-3.760	3.24***	1.809	-2.446	4.86***	-0.085	-4.644	-0.21
BHAR after repurchase (Compustat) (3 year)	1.143	-13.698	1.28	2.591	-11.168	2.84***	2.250	-13.707	2.22**

Table 6. Volume of Equity Issuances and Share Repurchases.

The table presents summary statistics for volume and frequency of stock repurchases and equity sales over the period 1982-2012. All firm-year observations are included in the sample. Fraction of firm-years with SEOs (sales, repurchases) is the number of firm-year observations with at least one SEO event (with equity sale identified from the CRSP monthly, with share repurchase identified from the CRSP monthly), divided by the total number of firm-year observations. Dollar volume is adjusted for inflation using CPI index and the numbers are presented in 2010 dollars. Fraction of equity issued in SEO is calculated using the SDC New Issues database, with only primary issues included. Fraction of equity issued in sale is calculated using the increases in shares outstanding, as identified in the CRSP monthly database. Following McKeon (2013), only observations with a monthly share increase over 1% are considered. Fraction of equity issued is calculated using decreases in shares outstanding, as identified in the CRSP monthly database.

Variable	Obs.	Mean	St. dev.	10 th	Median	90 th
Fraction of firm-years with SEOs (%)	137,778	4.197	N/A	N/A	N/A	N/A
Fraction of firm-years with sales (%)	137,778	35.628	N/A	N/A	N/A	N/A
Fraction of firm-years with repurchases (%)	137,778	37.721	N/A	N/A	N/A	N/A
Annual volume of SEOs (in 2010 \$M')	137,778	6.207	60.544	0	0	0
Annual volume of sales (in 2010 \$M')	137,778	43.580	221.46	0	0	61.456
Annual volume of repurchases (in 2010 \$M')	137,778	30.409	180.150	0	0	26.023
Annual volume of repurchases (Compustat) (in 2010 \$M')	137,778	32.279	214.254	0	0	0