Is Market Timing Good for Shareholders?*

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ABSTRACT

Firms commonly transact in their own mispriced stock using private information. We challenge the view that this activity, known as equity market timing, 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 expected shareholder wealth and welfare. Further, market timing has a more negative effect on existing shareholders when the share turnover is high. The effect of timing is asymmetric: shareholders prefer that the firm corrects underpricing rather than overpricing. Our theory can be used to infer firms' maximization objectives from their observed market timing strategies.

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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 because collectively they own all stock and have nobody to buy more shares from. Therefore, they 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 simply 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 incremental 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 actually 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 current stock price. Furthermore, the firm is now competing with its

[1] Brockman 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).

[2] Throughout the paper, we focus solely 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), Morellec and Schurhoff (2011), and Waruswitharana and Whited (2015)).

own shareholders for potential buyers of the stock. As a result, a firm's shareholders are able to sell fewer overpriced shares than they otherwise might and also must sell them at a lower price. Both of these effects make the sellers worse off, and we show that in many situations this loss is larger than the potential gain to the ongoing shareholders.

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 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 of market clearing: 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 changes in the wealth of the firm's current shareholders and new investors. For example, the

[3]Specifically, 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)).

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 well-timed equity transaction 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 mispricing is corrected and the long-term gain is realized. For example, the empirical literature documents that stock mispricing often persists for several years after repurchases and issuances (see, e.g., Ikenberry, Lakonishok, and Vermaelen (1995), and Loughran and Ritter (1995)).

The model generates two novel 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.As a result, 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. 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, improving alignment between management and shareholders, and counteracting dilution from equity-based compensation plans.[4]

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

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. 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.[5] Finally, in addition to wealth implications, market timing can affect investor welfare through their ability to execute trades and diversify risk.

Observed market timing practices can provide a useful insight into the implicit maximization functions of corporate managers. Indeed, 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 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 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. Finally, we find that firms with the high share turnover engage in less market timing of any kind, and in particular issue equity

[5]The model demonstrates that shareholders can be better or worse off as a result of having an informed manager timing the market. However, unlike claimed by Sloan and You (2015), the initial stock price cannot change. If investors recognize ex-ante that the manager has timing ability, then the manager is unable to make money by timing.

only when the firm's stock is greatly overpriced. All 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 firm 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. Lucas 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 always acts in their interest. 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)).[6] 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.[7]

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 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.

[6] Signaling with both issuance and repurchases is explored in a number of structural models, such as Hennessy, Livdan, and Miranda (2010) and Bolton, Chen, and Wang (2013). In the model of Constantinides and Grundy (1989), a manager can repurchase stock and use a positive signal conveyed by the repurchase to issue equity-like securities.

[7] Some studies reach different conclusions than ours because they assume that equity timing originates from differences in beliefs (Huang and Thakor (2013) and Yang (2013)), aggregate market mispricing (Baker and Wurgler (2002)), or a change in the overall business environment (Dittmar and Dittmar (2008)).

The rest of this paper is organized as follows. The next section develops the main argument and then solves for the equilibrium using the rational expectations framework. The data sources and empirical results are described in Section II. The final section offers concluding remarks.

I. MODEL

A. Wealth Implications of Market Timing

In this section, we develop the benchmark model and analyze how market timing by a firm affects its existing shareholders. We define the quantity, price, and long-term gain effects, and explain the role of share turnover. To keep the exposition clear, we do not solve for the pricing equilibrium until the next section.

Consider a firm's manager who receives private information about the true firm value P_2 and can trade F shares on the firm's behalf at the current market price $P_1(F)$. Positive values of F indicate stock buybacks and negative values capture stock issuances. Firm's actions are observed by all market participants. If the manager repurchases or issues stock at date 1, then the stock price at date 2 is P_2'

$$P_2' = P_2 + \frac{F\,(P_2 - P_1)}{N - F}, \tag{1}$$

where N is the initial number of outstanding shares.

The manager's trade must be cleared by existing shareholders and new investors. There are n current shareholders each holding N_i 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. 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. Index $i \in \{1, ..., n+m\}$ denotes different investors, with $i \in \{1, ..., n\}$ referring to current shareholders and $i \in \{n+1, ..., n+m\}$ to new investors.

Each of the current shareholders and new investors has demand for firm shares $X_i(F)$, which can be written in a general form

$$X_i = Q_i + Z_i(F), \tag{2}$$

with $Z_i(0) = 0$. Appendix A provides several examples of the objective functions that can give rise to the above demand schedules.

The first term, Q_i, is the investor's status quo demand for stock, whereas the second term is the additional demand that arises because of market clearing and because individuals infer the information from the firm's actions. We normalize the sum of all individual Q_i to zero so that the market clears when the manager is not trading.[8] Further, we assume that current shareholders as a group are net sellers, i.e., the average parameter Q_i is negative for current shareholders who prefer to sell the stock (e.g., for liquidity or diversification reasons) and positive for new investors who prefer to buy the firm's stock (e.g., to complement and diversify their portfolios).[9]

For illustrative purposes, let us make a simplifying assumption that $Z(F)$ is the same for all individuals. Market clearing requires that the sum of all individual trades and the firm's trade is equal to zero

$$\sum_{i=1}^{n+m} Q_i + (n+m) Z(F) + F = 0. \tag{3}$$

Because the first term above is equal to zero, it follows that the individual investors share the extra demand from the firm equally, i.e.,

$$X_i = Q_i - \frac{F}{n+m}. \tag{4}$$

We next analyze the wealth implications of equity market timing for shareholders by comparing their wealth with timing to the wealth without timing. When the firm times the market, the wealth of a shareholder who 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' can be written as

$$W_i = (N_i + X_i) P_2' - X_i P_1. \tag{5}$$

[8] Note that if the average Q_i were not zero, the market would still clear, but at a different price P_1.

[9] The net selling assumption is in line with actual experience because current shareholders as a group have nobody to buy the stock from. If it were not true, trading would be possible only between current shareholders. Section II.A provides empirical evidence supporting the validity of this assumption.

When the firm does not time the market ($F = 0$), the wealth is $(N_i + Q_i)\,P_2 - Q_i\overline{P}$. That is, the shareholder buys Q_i shares at price $\overline{P} = E(P_2)$ 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

$$\Delta W_i = \underbrace{(N_i + X_i)\,P_2' - X_i P_1}_{\text{wealth with timing}} - \underbrace{\left((N_i + Q_i)\,P_2 - Q_i\overline{P}\right)}_{\text{wealth without timing}}. \tag{6}$$

We can rewrite this expression in the more intuitive form

$$\Delta W_i = \underbrace{(X_i - Q_i)\,(P_2 - P_1)}_{\text{quantity effect}} + \underbrace{Q_i\left(\overline{P} - P_1\right)}_{\text{price effect}} + \underbrace{(N_i + X_i)\left(P_2' - P_2\right)}_{\text{long-term gain}}. \tag{7}$$

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 (7) 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. Because uninformed shareholders trade against the firm's manager, they sell more stock when the price is expected to increase and less when it is expected to decrease, so that the quantity effect is on average negative. The second term in (7) 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. Appendix B contains the actual example of new stock issuance by Netflix, Inc., which quantifies the three wealth effects.

Substituting (1) and (4) into (7) and summing over all shareholders, we obtain the shareholder wealth change as a result of the firm's action

$$\sum_{i=1}^{n} \Delta W_i = Q^+\left(P_1 - \overline{P}\right) + \left(P_2' - P_2\right)\left(\overline{Q} - Q^+\right), \tag{8}$$

where

$$\overline{Q} = N\frac{m}{n+m}, \tag{9}$$

and $Q^+ = -\sum_{i=1}^{n} Q_i > 0$ is the aggregate number of shares that current shareholders normally sell (and new investors buy); for brevity, we will refer to Q^+ as the share turnover.

The result in (8) is general and is central to our study. The first term represents the aggregate price effect, which can be positive or negative. Because current shareholders are net sellers, they have a preference for share repurchases that tend to increase stock price P_1 over $\overline{P}$. The second term captures the long-term gain net of the quantity effect, with $P_2' - P_2$ representing a per share gain from timing. This term is positive when many current shareholders remain with the firm in the long-term, i.e., when the share turnover is low.

Two conclusions follow from examination of (8). First, as long as the share turnover is low, i.e., $Q^+ < \overline{Q}$, the current shareholders, in expectation, are better off with market timing. This follows because the positive price effect for share repurchases and the negative price effect for stock issuances average out to zero, whereas the expected appreciation in the long-term price, $E(P_2' - P_2)$, is positive for the informed manager. In contrast, in firms with a high stock turnover, $Q^+ > \overline{Q}$, current shareholders prefer a manager who does nothing to the one who actively times the equity market.

To illustrate the economic mechanism and to provide a microfoundation for shareholder demand for stock, we work out three examples with different individual motives for trade, which can produce low, intermediate, and high turnover (see Appendix A). When shareholders are passive, i.e., $Q_i = 0$ for all i, the share turnover Q^+ is zero, and shareholders, in expectation, are better off because of market timing. When, in contrast, liquidity shocks require shareholders to sell at least half of their holdings (assuming $m = n$), the turnover Q^+ is sufficiently high to guarantee that shareholders are negatively affected by equity market timing. Finally, to illustrate the example of intermediate turnover, we show that the mean-variance shareholder preferences can lead to the turnover being exactly equal to threshold $\overline{Q}$. In the latter case, shareholders are, in expectation, indifferent between the firm with the timing manager and the firm where the manager does nothing. Shareholders, however, are not immune to the effects of timing. Because of the price effect, they are worse off conditional on the equity issuance and are better off conditional on the repurchase.

Our second conclusion is that, given the same magnitude of mispricing, current shareholders tend to prefer stock buybacks to equity issuances. This is because managerial equity transactions at least partially reveal private information and move prices closer to the fundamentals, so that the announcement of a repurchase is accompanied by the appreciation in the current stock price, P_1.

In cases when two terms in (8) have opposite signs (e.g., equity issuance when the turnover is low), it is impossible to determine the net effect of market timing without deriving the exact pricing equilibrium. The problem is that the appreciation in the long-term price because of market timing, $P_2' - P_2$, is linked to the quality of managerial information and her repurchase/issuance strategy, as well as to the sensitivity of the stock price, P_1, to the managerial equity transactions. In turn, the market price reaction to equity transactions depends on the investors' perception of the managers' actions.

B. Rational Expectations Equilibrium

We next enhance the model using the rational expectations framework of Grossman (1976). The goal is to derive the pricing equilibrium, including the information structure and equity market timing strategy of the manager, the investors' optimal response to the manager's actions, and the resulting equilibrium price.

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 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]

[10]DeAngelo, DeAngelo, and Stulz (2010) find that, without SEO offer proceeds, 63% of issuers would run out

The true per share value of the firm is drawn from a normal distribution and is revealed at date 2

$$P_2 \sim N(\overline{P}, \sigma_p^2). \tag{10}$$

A firm is endowed with a risk-neutral manager who receives a noisy signal v about the future firm value[11]

$$v = P_2 + \varepsilon, \text{ where } \varepsilon \sim N(0, \sigma_\varepsilon^2). \tag{11}$$

To understand the effect of timing on shareholders, we first consider a manager who follows a simple *symmetric* market timing strategy, which calls for repurchasing stock when it is undervalued and issuing stock when it is overvalued. Specifically, the manager maximizes the "profit" $(P_2 - P_1)\,F$ from her trade or, equivalently, the long-term gain, $P_2' - P_2$, to $N - F$ remaining shareholders. She is strategic in her trades; i.e., she takes into account the effect of her trade on the current stock price,

$$\max_F E\left[\left(P_2' - P_2\right)(N - F)\,|v\right]. \tag{12}$$

Our choice of the maximization function guarantees that the manager's equity transactions are symmetric with respect to mispricing and therefore, as we demonstrate below, the linear equilibrium exists. This is mostly for modeling convenience and is consistent with the manager maximizing the ex-post value to ongoing shareholders. The next section adopts an alternative assumption that the manager's objective is to maximize the wealth of current shareholders.[12]

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 investors observe repur-

of cash the year after an SEO. Additionally, Hertzel, 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.

[11] Because of the normal distribution, variables P_2 and F are unbounded. Although normality is a common and convenient assumption used in the rational expectations framework, it can result in the singularity problem because of the potentially negative firm value or an excessive repurchase. We address this issue in the proof of Proposition 3.

[12] Note that maximizing *ex-ante* value to ongoing shareholders (as in Baker and Wurgler (2002) and Sloan and You (2015)) is not a well-defined problem because the number of ongoing shareholders depends on the manager's action; e.g., there are fewer ongoing shareholders after a repurchase. 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. Another possibility is that the manager cares about the long-term price per share P_2' (as in, e.g., Morellec and Schurhoff (2011) and Constantinides and Grundy (1989)). The latter objective function results in an identical maximization problem to (12) when F is much smaller than the total number of shares, N, or when mispricing is small.

chases and equity issuances is unimportant in our setting since the same information can be perfectly 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.

We assume that the demand for shares by non-timing firms (that issue and repurchase equity for exogenous reasons) is normally distributed

$$F \sim N(0, \sigma_u^2). \tag{13}$$

To convey the main idea in the most transparent manner, we also make a simplifying assumption that the variance of demand by the non-timing firms is the same as the variance of demand by the timing firms. 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.[13]

For all shareholders and new investors, we assume the demand/supply functions that allow us to solve for the linear equilibrium[14]

$$X_i = Q_i + \frac{E\left(P_2|F\right) - P_1}{\theta}. \tag{14}$$

The following proposition describes the resulting equilibrium.

Proposition 1. *Suppose the manager maximizes (12). There exists a unique linear rational expectations equilibrium with the price and demand for shares given by*

$$P_1 = \overline{P} + \beta F, \tag{15}$$

$$F^* = \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2} \frac{x}{2\beta}. \tag{16}$$

where $\beta > 0$ is a constant given in the Appendix, $x = v - \overline{P}$ denotes mispricing, and the optimal demand by shareholders is given by (4).

[13] Appendix B provides the fixed-point solution for parameter σ_u^2 that satisfies this assumption.

[14] For the market to clear, it is important that the demand by individual investors decreases in price. The 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).

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. The intuition is similar to that in the signaling literature—repurchases can convey 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, it may be somewhat counterintuitive that, according to condition (4), 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. *Suppose the manager maximizes (12). Then the following claims hold.*
(i) The frequency and volume of share repurchases are equal, respectively, to those of share issuances

$$\Pr(F^* > 0) = \Pr(F^* < 0), \tag{17}$$

$$E[F|F^* > 0]\Pr(F^* > 0) = E[-F|F^* < 0]\Pr(F^* < 0). \tag{18}$$

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

$$E[(P_2 - P_1)F|F^* > 0] = E[(P_2 - P_1)F|F^* < 0]. \tag{19}$$

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

following equity issuances

$$|E[P_2 - P_1 | F^* > 0]| = |E[P_2 - P_1 | F^* < 0]|. \tag{20}$$

According to (8), the wealth implications of market timing in general depend on the number of current shareholders who remain with the firm. We therefore first consider the case in which the share turnover, Q^+, is low.

Proposition 3. *Denote by* $W = \sum_{i=1}^{n} W_i$ *the current shareholder value and assume* $Q^+ < \overline{Q}$*. Then the following claims hold.*

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

$$E(\Delta W | F^*) > 0. \tag{21}$$

(ii) Share repurchase of undervalued stock always increases shareholder value, i.e., for any $x > 0$*,*

$$E(\Delta W | x, F^* > 0) > 0. \tag{22}$$

(iii) Issuance of overvalued stock decreases shareholder value for $x < 0$*,*

$$E(\Delta W | x, F^* < 0) < 0, \tag{23}$$

except when both the share turnover satisfies $Q^+ < \overline{Q}/2$*, and overpricing is large, i.e.,*

$$x < -\frac{Q^+ N}{\gamma\left(\overline{Q} - 2Q^+\right)}. \tag{24}$$

The results can be summarized as follows. When the share turnover is small, more current shareholders stay with the firm until the true value is realized, and therefore they capture the benefits of timing through the long-term gain effect. 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. Current shareholders therefore prefer a manager who always repurchases stock whenever her information is positive and issues shares whenever her information is negative to a manager who does nothing.

However, current shareholders are affected differentially by share repurchases and equity sales. In fact, 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 are competing with the firm and 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 with equity issuance, except when both overpricing is large and the share turnover is small.[15]

Next, we show that when the turnover is high, shareholders are, on average, worse off from market timing. Even repurchases of undervalued stock can decrease shareholder value in this case.

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

(i) In expectation, current shareholders are worse off with market timing, i.e.,

$$E\left(\Delta W | F^*\right) < 0. \tag{25}$$

(ii) Issuance of overvalued stock always decreases shareholder value, i.e., for any $x < 0$,

$$E\left(\Delta W | x, F^* < 0\right) < 0. \tag{26}$$

(iii) Share repurchase of undervalued stock increases shareholder value for $x > 0$,

$$E\left(\Delta W | x, F^* > 0\right) > 0, \tag{27}$$

[15] In case of Netflix SEO discussed in the Appendix, shareholders are worse off because condition (iii) in the proposition is satisfied. Specifically, the turnover, Q^+, is 30% of shares outstanding, whereas $\overline{Q}/2$ is 25%. Furthermore, we learn from the proposition that Netflix shareholders would be worse off from new equity issuance timing regardless of the magnitude of overpricing.

except when underpricing is large, i.e.,

$$x > \frac{Q^+ N}{\gamma \left(2Q^+ - \overline{Q}\right)}. \tag{28}$$

The proposition posits that, when the share turnover is high, current shareholders are overall worse off when the manager times the equity market. Specifically, shareholder wealth always decreases with the issuance of overvalued stock, and it also decreases with the repurchase of undervalued stock if mispricing is large. The cutoff for mispricing (28) is inversely proportional to γ, which increases in λ. This means that more repurchases destroy shareholder value when there are fewer 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 whose goal is to maximize the current shareholder value. Because the previous section shows that for $Q^+ > \overline{Q}$ it is impossible to increase shareholder value with timing stock issuances, we concentrate solely on the case when the turnover is low, $Q^+ < \overline{Q}$.

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 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 low, $Q^+ < \overline{Q}$. Then, for a small mispricing, x, the equilibrium price and the firm's demand for stock are given by*

$$F^* = \overline{F} + \Gamma x, \tag{29}$$

where constants $\overline{F} > 0$ and $\Gamma > 0$ 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, $\overline{F}$, and then amending the demand in a way that is proportional to mispricing. Additionally, because Γ decreases and $\overline{F}$ increases with shareholder turnover, the manager's strategy is more biased in favor of repurchases and less sensitive to private information when the turnover is large.

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 maximizes current shareholder value. Then the following claims hold.*

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

$$\Pr\left(F^* > 0\right) \quad > \quad \Pr\left(F^* < 0\right), \tag{30}$$

$$E\left[F|F^* > 0\right]\Pr\left(F^* > 0\right) \quad > \quad E\left[-F|F^* < 0\right]\Pr\left(F^* < 0\right). \tag{31}$$

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

$$E\left[\left(P_2 - P_1\right) F | F^* > 0\right] < E\left[\left(P_2 - P_1\right) F | F^* < 0\right]. \tag{32}$$

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

$$\left|E\left[P_2 - P_1 | F^* > 0\right]\right| < \left|E\left[P_2 - P_1 | F^* < 0\right]\right|. \tag{33}$$

As established in the 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.

D. Welfare Implications of Equity Transactions

Our previous analysis lacks in two dimensions. First, it only applies to shareholders of timing firms; however in non-timing firms, shareholders too are affected because any equity transaction by a firm manager moves the current price and triggers wealth transfers. Second, so far we have focused only on expected wealth, while shareholders' welfare can also be affected through their ability to trade in the preferred direction or diversify risks.

To make the argument more precise, consider shareholders of a non-timing firm. By taking the expectation of expression (8) over all possible realizations F, we obtain the expected change in shareholder wealth

$$E(\Delta W) = \left(\overline{Q} - Q^{+}\right) E\left(P_2' - P_2\right). \tag{34}$$

Note further that the equilibrium price as given by (15) applies to both timing and non-timing firms and that, because non-timing firms have no information, $E(P_2) = \overline{P}$. Therefore, we can rewrite the above expression as

$$E(\Delta W) = -\beta\left(\overline{Q} - Q^{+}\right) \underbrace{E\left(\frac{F^2}{N-F}\right)}_{>0}. \tag{35}$$

The wealth implications are the mirror image of the corresponding result for shareholders in timing firms. For low turnover, $Q^{+} < \overline{Q}$, shareholders with the uninformed managers are worse off from timing. This is because the manager's trades are not based on information, but the market price moves against her trade. As a result, shareholders' long-term gain, net of the quantity effect, is negative. For a higher turnover, shareholders of non-timing firms are better off because their quantity effect is positive and it dominates the long-term gain effect. Therefore, timing by the managers of informed firms has a redistributive wealth effect among all shareholders and new investors.

Market timing can also hinder the ability of investors to trade in the desired direction as it disturbs their original demand functions. However, by making the stock prices more informative, it can reduce the risk in shareholders' portfolios. We find that whether the overall effect is positive or negative depends on the shareholder motives for trade. Take, for example, two utility specifications considered in Appendix A. Given the mean-variance preferences (40), shareholders in expectation neither lose nor gain (in terms of their wealth) from equity market timing. However, the conditional variance of their wealth is lower with timing because the informed trading by the manager reduces the uncertainty about future firm value. Given the liquidity-based preferences, shareholders experience an additional disutility from timing because of costs associated with the deviation from their desired trading positions.

II. 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 because current shareholders cannot buy shares from anyone else, 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 to obtain the total change in ownership. 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. The net selling for firm k is defined as the change in institutional ownership normalized by the average institutional ownership

$$NETSELL_k = \frac{\Sigma_i \left(n_{ikt} - n_{ikt-1}\right)}{\left(\Sigma_i n_{ikt} + \Sigma_i n_{ikt-1}\right)/2}, \tag{36}$$

where index i denotes different institutional investors. Alternatively, we normalize by the last year institutional ownership as follows

$$NETSELL\ RATE_k = \frac{\Sigma_i \left(n_{ikt} - n_{ikt-1}\right)}{\Sigma_i n_{ikt-1}}. \tag{37}$$

One advantage of the second measure is that it can be interpreted as a percentage of original holdings sold by current shareholders each period. However, because we do not have data on all firm investors and because in some years institutional ownership may be very low, this measure is more easily affected by outliers.

We also repeat the same procedure at the annual frequency and 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 though 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 Vijh (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.[16]

Our measures of profit from market timing 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, $b_i > 0$, or issued, $b_i < 0$, during a month, and then multiply it by either one- or three-year post-event risk-adjusted returns, r_i. We then sum the resulting measures over the 12 months of the year to obtain the total,

$$\text{Timing} = \sum_{i=1}^{12} b_i r_i. \tag{38}$$

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

[16]McKeon (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.

will be equal to 0.5%. 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. Details on the construction of measures are in Appendix C.

C. 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.

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.

D. 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.[17] SEOs tend to be 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.

[17]The 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).

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.

E. Market Timing Events and Net Selling

Because our model is closely linked to net selling by current shareholders, we additionally examine the key characteristics of market timing events in the samples of firms with a high and low net selling. Table 7 presents the characteristics of market timing events in samples of firms sorted by share turnover. First, consistent with the current shareholder value maximization, the high-turnover firms issue and repurchase equity less often than the low-turnover firms. As established in Proposition 4, market timing of any kind, and especially issuance timing, can hurt shareholders when the share turnover is high. Indeed, we find that the frequency of SEOs is approximately 35% lower for firms in the top quartile of share turnover than for those in the bottom quartile (3.90% vs. 2.56%). Similarly, the frequency of repurchases is 24% lower in the high-turnover firms.

Second, it follows from Proposition 4 that repurchases of highly undervalued stock decrease shareholder wealth when the turnover is high. Therefore, if the manager maximizes the current shareholder value, an average repurchase by the high-turnover firm should be less profitable than a repurchase by the low-turnover firm. Consistent with this prediction, we find that the profit from share repurchase timing is 14 basis points higher for the low-turnover firms. Similarly, the average BHAR following repurchases is -3.08% in the high-turnover firms, whereas it is 4.09% in the low-turnover firms. Further, we observe that SEOs and other equity sales become highly selective as the share turnover increases. This is reflected in the high profits from market timing and low stock returns after equity issuance. For example, for the profit from equity sales for the low-turnover firms is -0.63%, compared to 2.81% for the high-turnover firms. Overall, the evidence on market timing events across firms with different share turnover is consistent with the current shareholder value maximization.

III. 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.

Our study produces additional empirical implications that we leave for future work. First, companies that are constrained in either issuing new equity or in paying dividends must resort to trading their equity only in one direction, which can increase or decrease shareholder value, respectively. For example, the manager timing only with new equity issuances can hurt shareholder value more than the average manager. Second, the preference for repurchase timing has implications for capital structure. In particular, a shareholder-maximizing market timing firm is more likely to have a higher leverage ratio. Third, the timing strategies can be linked to the managerial compensation. For example, the manager with unvested shares is more likely to care about the long-term value of the stock and engage in the symmetric timing strategy.

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Appendix A. Microfounding Shareholder Demand

Here we work out the three examples of shareholder trading preferences that are consistent with demand function (2). The examples result in different turnover and therefore produce distinct implications of market timing for current shareholders.

I. *Passive shareholders.* $Q_i = 0$, for $\forall i$. Therefore $Q^+ = 0$ and $E[\Delta W|F] > 0$. Shareholders' aggregate wealth increases with successful equity market timing.

II. *Impatient shareholders.* Shareholders receive a liquidity shock prompting them to sell αN_i fraction of their holdings, or αN in aggregate. The change in shareholder wealth is then

$$E[\Delta W|F] = \alpha N \left(P_1 - \overline{P}\right) + \left(P_2' - P_2\right)\left(\overline{Q} - \alpha N\right), \tag{39}$$

which implies that shareholders are worse off, in expectation, whenever $\alpha > m/(m+n)$. For example, if $m = n$, shareholders are worse off because of market timing if they must sell more than half of their shares before mispricing is corrected.

III. *Risk-sharing with mean-variance preferences.* Consider individuals with mean-variance preferences and coefficients of risk aversion ρ_i, who initially have heterogenous holdings of stock N_i

$$\max_{X_i} E(W_i|F) - \frac{\rho_i}{2} Var(W_i|F). \tag{40}$$

Their optimal demand for stock is

$$X_i = \frac{E(P_2'|F) - P_1}{\rho_i Var(P_2'|F)} - N_i, \tag{41}$$

which, after using the market clearing condition, simplifies to

$$X_i = \underbrace{\frac{\vartheta}{\rho_i} N - N_i}_{Q_i} - \underbrace{\frac{\vartheta}{\rho_i} F}_{Z_i(F)}, \text{ with } \vartheta = 1/\sum_i^{m+n} \frac{1}{\rho_i}. \tag{42}$$

By substituting demand X_i into (7) and summing over shareholders, we can see that current shareholders gain the amount

$$E[\Delta W|F] = \left[\frac{N \sum_i^m \frac{1}{\rho_i}}{\sum_i^{m+n} \frac{1}{\rho_i}}\right]\left(P_1 - \overline{P}\right), \tag{43}$$

$$\text{or } E[\Delta W|F] = \frac{Nm}{m+n}\left(P_1 - \overline{P}\right), \text{ if } \rho_i = \rho, \tag{44}$$

i.e., the quantity and long-term gain effects exactly offset each other, so that shareholders are only affected by the firm's market timing through the price effect, but do not gain or lose from timing in expectation.

Appendix B. The Case of Netflix SEO

Consider as an example a seasoned equity offering by Netflix, Inc. that was announced on April 27, 2006. The CEO, 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 price 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?

A simple calculation shows that the price would have dropped even lower to \$21.72, implying that a shareholder who did not sell her stock lost 49 cents *less*. Specifically, the 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 $\$22.21 \cdot (1.063) = P_2 + 0.063 \cdot \$30$. For many shareholders, however, this difference in price was of little consequence because they did not keep shares for long. 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, and therefore shareholders who did not sell 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).

Appendix C. Proposition Proofs

Proof of Proposition 1.

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

$$E(P_2|v) = \overline{P} + \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2}\left(v - \overline{P}\right), \tag{45}$$

$$Var\left(P_2|v\right) = \frac{\sigma_p^2 \sigma_\varepsilon^2}{\sigma_p^2 + \sigma_\varepsilon^2}. \tag{46}$$

We conjecture that the equilibrium price is as

$$P_1 = \overline{P} + \beta F, \tag{47}$$

and solve for parameter β in the equilibrium. Substituting the conjecture for P_1 into the manager's problem (12), and taking the first-order condition with respect to F, yields

$$F^* = \frac{E(P_2|v) - \overline{P}}{2\beta} = \gamma\left(v - \overline{P}\right), \tag{48}$$

where

$$\gamma = \frac{\sigma_p^2}{\sigma_p^2 + \sigma_\varepsilon^2}\frac{1}{2\beta}. \tag{49}$$

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

$$E(P_2|F) = \lambda E(P_2|F, \text{info}) + (1 - \lambda)\, E(P_2|F, \text{no info}) = \overline{P} + 2\lambda\beta F. \tag{50}$$

The equilibrium price is set by the market clearing condition. Using $\sum_{i=1}^{n+m} Q_i = 0$ and the individual demand functions (14), we can write this condition as

$$F + \sum_{i=1}^{n+m} X_i^* = F + (n+m)\frac{E\left(P_2|F\right) - P_1}{\theta} = 0. \tag{51}$$

Substituting (50) into condition (51), we obtain the market clearing price

$$P_1 = \overline{P} + \left(\frac{\theta}{n+m} + 2\lambda\beta\right) F. \tag{52}$$

Comparing this expression to conjecture (47), we can solve for parameter β

$$\beta = \frac{\theta}{(n+m)\,(1 - 2\lambda)}. \tag{53}$$

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 parameter 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

$$\begin{aligned} Var(F^*|\sigma_u^2) &= \sigma_u^2, \\ E(F^*|\sigma_u^2) &= 0. \end{aligned} \tag{54}$$

Using (48), we obtain

$$\sigma_u^2 = \frac{(n+m)^2 (1-2\lambda)^2 \sigma_p^4}{4\theta^2 \left(\sigma_p^2 + \sigma_\varepsilon^2\right)^2}. \tag{55}$$

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

$$\Pr(F^* > 0) - \Pr(F^* < 0) = \int_0^\infty f(x)\,dx - \int_{-\infty}^0 f(x)\,dx = 0. \tag{56}$$

where $x = v - \overline{P}$ denotes mispricing 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

$$\begin{aligned} \text{Volume(Rep)} - \text{Volume(Iss)} &= E[F|F^* > 0]\Pr(F^* > 0) - E[-F|F^* < 0]\Pr(F^* < 0) \\ &= \int_0^\infty \gamma x f(x)\,dx - \left(-\int_{-\infty}^0 \gamma x f(x)\,dx\right) = 0. \end{aligned} \tag{57}$$

(ii) Using (45)-(48), we can write the manager's trading profit conditional on signal as

$$\Pi(x) = \beta\gamma^2 x^2. \tag{58}$$

Profit from repurchases minus profit from equity sales is then

$$\frac{\int_0^\infty \Pi(x) f(x)\,dx}{\int_0^\infty f(x)\,dx} - \frac{\int_{-\infty}^0 \Pi(x) f(x)\,dx}{\int_{-\infty}^0 f(x)\,dx} = 2\beta\gamma^2 \left(\int_0^\infty x^2 f(x)\,dx - \int_{-\infty}^0 x^2 f(x)\,dx\right). \tag{59}$$

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

$$R(x) = E(P_2|v) - P_1 = \beta\gamma x. \tag{60}$$

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

$$\left|\frac{\int_0^\infty R(x) f(x)\,dx}{\int_0^\infty f(x)\,dx}\right| - \left|\frac{\int_{-\infty}^0 R(x) f(x)\,dx}{\int_{-\infty}^0 f(x)\,dx}\right| = 2\beta\gamma(\int_0^\infty x f(x)\,dx + \int_{-\infty}^0 x f(x)\,dx) = 0. \tag{61}$$

Proof of Proposition 3.

(i) To see that market timing increases current shareholder value in expectation, it is sufficient to note that the first term in (8) averages out to zero

$$E[Q^+ \left(P_1 - \overline{P}\right)] = Q^+\beta\gamma E(x) = 0, \tag{62}$$

while the expectation of the second term is positive for the informed manager because $P_2' > P_2$ and $Q^+ < \overline{Q}$.

(ii) For the share repurchase of undervalued equity ($F > 0$ and $x > 0$), the price effect is positive, i.e., $P_1 > \overline{P}$. Because both terms in (8) are positive, it follows that the current shareholder value always increases with repurchases of undervalued equity.

(iii) Recall that the manager issues shares ($F < 0$) during the overpricing ($x < 0$). Substituting the expression for the long-term price (1), the equilibrium price P_1, and the optimal demand for shares by the firm F in (8), we obtain

$$E[\Delta W|x] = E\left[Q^+\beta\gamma x + \frac{\gamma x\left(P_2 - \overline{P} - \beta\gamma x\right)}{N - \gamma x}\left(\overline{Q} - Q^+\right)|x\right]. \tag{63}$$

Using the fact that conditional expectation $E[P_2|x] = \overline{P} + 2\beta\gamma x$, we can rewrite the change in current shareholder wealth caused by the firm's action as

$$E[\Delta W|x] = \frac{\beta\gamma x}{N - \gamma x}\left(Q^+ N + \gamma x\left(\overline{Q} - 2Q^+\right)\right). \tag{64}$$

Because $x < 0$ it follows from (64) that shareholders are worse off with issuance when

$$Q^+ N > \gamma x \left(2Q^+ - \overline{Q}\right). \tag{65}$$

This condition is always satisfied when the share turnover is relatively large, $Q^+ \geq \overline{Q}/2$. When the turnover is small, $Q^+ < \overline{Q}/2$, the condition is also satisfied, except for the case when the overpricing is large, i.e.

$$x < -\frac{Q^+ N}{\gamma \left(\overline{Q} - 2Q^+\right)}. \tag{66}$$

Proof of Proposition 4.

(i) In (8), the first term averages out to zero, while the expectation of the second term is negative for the informed manager because $P_2' > P_2$ and $Q^+ > \overline{Q}$. Therefore, it must be that current shareholder value is lower with market timing.

(ii) For the issuance of overvalued equity ($F < 0$ and $x < 0$), the price effect is negative, i.e., $P_1 < \overline{P}$. Because both terms in (8) are negative, current shareholder wealth decreases with the timing of equity issuance for any $x < 0$.

(iii) For share repurchases of undervalued stock, we have $x > 0$. From (64), the current shareholder value decreases with repurchase timing if

$$Q^+ N < \gamma x \left(2Q^+ - \overline{Q}\right). \tag{67}$$

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

$$x > \frac{Q^+ N}{\gamma \left(2Q^+ - \overline{Q}\right)}. \tag{68}$$

Proof of Proposition 5.

Suppose there is one firm that maximizes current shareholder value, while other firms continue to follow symmetric strategies, so that the equilibrium price is given by (15). The proof for the equilibrium where all managers are shareholder value maximizers is available upon request. The problem of maximizing current shareholder value with respect to F can be written as

$$\max_F E\left[Q^+\left(P_1-\overline{P}\right)+\left(P_2'-P_2\right)\left(\overline{Q}-Q^+\right)|v\right], \tag{69}$$

which using expression for P_2' and the equilibrium price schedule (15) simplifies to

$$\max_F Q^+\beta F+\frac{F\beta\left(2\gamma x-F\right)}{N-F}\left(\overline{Q}-Q^+\right). \tag{70}$$

Taking the first order condition, we obtain

$$F^*=N-\sqrt{\frac{\left(\overline{Q}-Q^+\right)N}{\overline{Q}}\left(N-2\gamma x\right)}. \tag{71}$$

The second order condition is satisfied everywhere in the region where F^* exists, i.e.,

$$-\left(\overline{Q}-Q^+\right)\left(N-2\gamma x\right)<0. \tag{72}$$

Using Taylor's expansion of (71) around $x=0$ and keeping the first two terms, we obtain the optimal demand by the manager

$$F^* = \overline{F}+\Gamma x,\text{ where} \tag{73}$$

$$\overline{F} = N\left(1-A\right)>0, \tag{74}$$

$$\Gamma = 2\gamma A>0, \tag{75}$$

$$\text{and } A = \sqrt{\left(\overline{Q}-Q^+\right)/\overline{Q}}. \tag{76}$$

Proof of Proposition 6.

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

$$\Pr\left(F^*>0\right)-\Pr\left(F^*<0\right)=\int_{-\frac{\overline{F}}{\Gamma}}^{\infty}f\left(x\right)dx-\int_{-\infty}^{-\frac{\overline{F}}{\Gamma}}f\left(x\right)dx=1-2\Phi\left(-\frac{\overline{F}}{\Gamma\sigma}\right)>0, \tag{77}$$

where $f\left(x\right)$ 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

$$\begin{aligned}
\text{Volume(Rep)} - \text{Volume(Iss)} &= E\left[F|F^* > 0\right]\Pr\left(F^* > 0\right) - E\left[-F|F^* < 0\right]\Pr\left(F^* < 0\right) \\
&= \int_{-\frac{\overline{F}}{\Gamma}}^{\infty}\left(\overline{F} + \Gamma x\right) f\left(x\right) dx + \int_{-\infty}^{-\frac{\overline{F}}{\Gamma}}\left(\overline{F} + \Gamma x\right) f\left(x\right) dx \\
&= \overline{F} > 0. \qquad (78)
\end{aligned}$$

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

$$\Pi\left(v\right) = E\left[\left(P_2 - P_1\right) F|v\right]. \qquad (79)$$

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

$$\Pi\left(x\right) = \beta\left(4\gamma^2 A\left(1-A\right)x^2 + 2\gamma x N\left(1-A\right)\left(1-2A\right) - N^2\left(1-A\right)^2\right), \qquad (80)$$

where A is given by (76). 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 $x > -\frac{\overline{F}}{\Gamma}$. Therefore, repurchases are less profitable than issuances when

$$\frac{\int_{-\frac{\overline{F}}{\Gamma}}^{\infty}\Pi\left(x\right) f\left(x\right) dx}{\int_{-\frac{\overline{F}}{\Gamma}}^{\infty} f\left(x\right) dx} - \frac{\int_{-\infty}^{-\frac{\overline{F}}{\Gamma}}\Pi\left(x\right) f\left(x\right) dx}{\int_{-\infty}^{-\frac{\overline{F}}{\Gamma}} f\left(x\right) dx} < 0. \qquad (81)$$

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

$$\begin{aligned}
\int_A^B x^2 f\left(x\right) dx &= \frac{\sigma^2}{\sqrt{2\pi\sigma^2}}\left(-Be^{-\frac{B^2}{2\sigma^2}} + Ae^{-\frac{A^2}{2\sigma^2}}\right) + \sigma^2\left(\Phi\left(B/\sigma\right) - \Phi(A/\sigma)\right), \qquad (82) \\
\int_A^B x f\left(x\right) dx &= -\frac{\sigma^2}{\sqrt{2\pi\sigma^2}}\left(e^{-\frac{B^2}{2\sigma^2}} - e^{-\frac{A^2}{2\sigma^2}}\right), \\
\int_A^B f\left(x\right) dx &= \Phi\left(B/\sigma\right) - \Phi(A/\sigma).
\end{aligned}$$

By substituting $\Pi\left(x\right)$ and using (82), it is possible to show that (81) is satisfied for $\overline{Q} < Q^+$.

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

$$R\left(x\right) = E\left(P_2|x\right) - P_1 = \beta\left(2\gamma x - \overline{F} - \Gamma x\right). \qquad (83)$$

Recall that the manager repurchases when $x > -\frac{\overline{F}}{\Gamma}$. Therefore, we can show using (82) that the expected stock returns conditional on issuance and repurchase are, respectively,

$$\frac{\int_{-\infty}^{-\frac{\overline{F}}{\Gamma}} R(x) f(x) dx}{\int_{-\infty}^{-\frac{\overline{F}}{\Gamma}} f(x) dx} = -\frac{2\gamma\beta(1-A)\sigma^2}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(\frac{\overline{F}}{\Gamma}\right)^2}{2\sigma^2}} / \Phi\left(-\frac{\overline{F}}{\Gamma\sigma}\right) - \beta(1-A)N, \text{ and} \tag{84}$$

$$\frac{\int_{-\frac{\overline{F}}{\Gamma}}^{\infty} R(x) f(x) dx}{\int_{-\frac{\overline{F}}{\Gamma}}^{\infty} f(x) dx} = \frac{2\gamma\beta(1-A)\sigma^2}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(\frac{\overline{F}}{\Gamma}\right)^2}{2\sigma^2}} / \left(1 - \Phi\left(-\frac{\overline{F}}{\Gamma\sigma}\right)\right) - \beta(1-A)N. \tag{85}$$

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

$$1 - \Phi(-\frac{\overline{F}}{\Gamma\sigma}) > \Phi(-\frac{\overline{F}}{\Gamma\sigma}). \tag{86}$$

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 C. Construction of Timing Measure

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).

Consider a manager who repurchases a fraction b 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

$$(1-b)P_2' = P_2 - bP_1. \tag{87}$$

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 (87) and obtain the additional return from repurchase as

$$\text{Repurchase timing} = \frac{P_2' - P_2}{P_1} = b\left(\frac{P_2' - P_1}{P_1}\right). \tag{88}$$

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. This 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)). 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.

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

	Full sample			Firms with institutional ownership$>5\%$		
Variable	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 Δownership, normalized by average ownership	1,200,178	-0.220	0.570	-0.867	-0.024	0.072	-423.67***
Quarterly Δownership, normalized by last quarter ownership	1,200,178	-0.118	0.331	-0.606	-0.023	0.075	-391.01***
Annual Δownership, normalized by average ownership	296,062	-0.595	0.839	-2.000	-0.222	0.122	-385.79***
Annual Δownership, normalized by last year ownership	296,062	-0.303	0.525	-1.000	-0.203	0.133	-314.29***
Institutional holdings/outstanding 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 for diff. in means	Wilcoxon z-statistic for diff. in medians
Timing SEOs minus repurchases (1-year)	0.331	0.648	5.97***	17.94***
Timing SEOs minus repurchases (3-year)	2.665	2.785	23.33***	31.44***
Timing sales minus repurchases (1-year)	0.620	0.290	12.61***	43.21***
Timing sales minus repurchases (3-year)	1.744	0.805	17.74***	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
$\lvert BHAR_{SEOs}\rvert - \lvert BHAR_{repurchases}\rvert$ (1-year)	0.965	9.913	1.56	15.67***
$\lvert BHAR_{SEOs}\rvert - \lvert BHAR_{repurchases}\rvert$ (3-year)	9.582	38.629	6.31***	25.74***
$\lvert BHAR_{sales}\rvert - \lvert BHAR_{repurchases}\rvert$ (1-year)	0.417	11.679	1.36	37.31***
$\lvert BHAR_{sales}\rvert - \lvert BHAR_{repurchases}\rvert$ (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

Table 7. Market Timing Events and Net Selling.

The table presents summary statistics for stock repurchases and equity sales in subsamples of data sorted by measures of net selling. We calculate net selling 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 to obtain Δownership. *NETSELL* (*NETSELL RATE*) is defined as Δownership, normalized by the average of the beginning-of-year and end-of-year institutional ownership (the beginning-of-year institutional ownership). 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. The BHARs in % are calculated over a period of one year after the timing event. To make the adjustment for risk, we match firms in our sample to 100 Fama-French portfolios formed on size and book-to-market. *Timing SEOs* is equal to the one-year post-SEO BHAR in %, multiplied by the proportion of newly issued equity (as identified in the SDC New Issues database). *Timing sales* is equal to the one-year BHAR in % after an increase in shares outstanding (as identified in the CRSP monthly database), 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 one-year post-repurchase BHAR in % after a decrease in shares outstanding (as identified in the CRSP monthly database), multiplied by the fraction of equity repurchased. The last column in the table gives t-test statistics for the difference of means.

	NETSELL (below median)		*NETSELL* (above median)		
	Obs	Mean	Obs	Mean	T-test
Timing SEOs	2,374	-0.758	1,987	1.660	-6.88***
Timing sales	18,140	-0.284	17,164	1.654	-16.42***
Timing repurchases	20,633	0.007	16,909	-0.001	4.04***
Risk-adjusted returns after SEO	2,374	3.462	1,987	-8.554	8.58***
Risk-adjusted returns after sale	18,140	3.239	17,164	-6.824	17.73***
Risk-adjusted returns after repurchase	20,633	2.830	16,909	-0.953	8.09***
Fraction of firm-years with SEO (%)	58,190	4.079	58,191	3.415	5.97***
Fraction of firm-years with sale (%)	58,190	31.174	58,191	29.496	6.23***
Fraction of firm-years with repurchase (%)	58,190	35.457	58,191	29.058	23.41***

	NETSELL RATE (below median)		*NETSELL RATE* (above median)		
	Obs	Mean	Obs	Mean	T-test
Timing SEOs	2,366	-0.674	1,995	1.552	-6.33***
Timing sales	18,101	-0.232	17,203	1.594	-15.47***
Timing repurchases	20,623	0.006	16,919	0.000	2.66***
Risk-adjusted returns after SEO	2,366	3.046	1,995	-8.012	7.89***
Risk-adjusted returns after sale	18,101	2.710	17,203	-6.245	15.77***
Risk-adjusted returns after repurchase	20,623	2.441	16,919	-0.476	6.23***
Fraction of firm-years with SEO (%)	58,190	4.065	58,191	3.428	5.73***
Fraction of firm-years with sale (%)	58,190	31.107	58,191	29.563	5.73***
Fraction of firm-years with repurchase (%)	58,190	35.441	58,191	29.075	23.28***

	NETSELL (bottom quartile)		*NETSELL* (top quartile)		
	Obs	Mean	Obs	Mean	T-test
Timing SEOs	1,134	-1.078	745	3.968	-8.61***
Timing sales	8,970	-0.625	7,743	2.809	-17.39***
Timing repurchase	8,571	0.100	6,909	-0.039	4.10***
Risk-adjusted returns after SEO	1,134	4.900	745	-17.988	10.40***
Risk-adjusted returns after sale	8,970	5.002	7,743	-11.508	18.57***
Risk-adjusted returns after repurchase	8,571	4.091	6,909	-3.080	8.72***
Fraction of firm-years with SEO (%)	29,095	3.897	29,095	2.561	9.13***
Fraction of firm-years with sale (%)	29,095	30.830	29,095	26.613	11.25***
Fraction of firm-years with repurchase (%)	29,095	29.458	29,095	22.382	19.54***
	NETSELL RATE (bottom quartile)		*NETSELL RATE* (top quartile)		
	Obs	Mean	Obs	Mean	T-test
Timing SEOs	1,132	-1.058	749	3.828	-8.33***
Timing sales	8,960	-0.608	7,764	2.715	-16.75***
Timing repurchases	8,572	0.100	6,514	-0.031	3.78***
Risk-adjusted returns after SEO	1,132	4.672	749	-16.999	9.78***
Risk-adjusted returns after sale	8,960	4.837	7,764	-10.748	17.39***
Risk-adjusted returns after repurchase	8,572	3.926	6,514	-2.463	7.73***
Fraction of firm-years with SEO (%)	29,095	3.890	29,095	2.574	8.98***
Fraction of firm-years with sale (%)	29,095	30.796	29,095	26.685	10.97***
Fraction of firm-years with repurchase (%)	29,095	29.462	29,095	22.389	19.53***