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The Explanation Power of Investors' Opinion Divergence in Open Market Repurchases

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Abstract This paper proposes a new theory to explain the behavior of share repurchases by assuming heterogeneity in investors' beliefs. This new theory provides testable hypotheses that are examined empirically in this paper. Our empirical results show strong evidence for the explanation power of investors' opinion divergence in firms repurchasing shares, even after considering controlling variables such as the undervaluation-signaling hypothesis. The results are also robust to various measures of investors' divergent opinions in open market repurchases.

Keywords: *investor heterogeneity in beliefs, undervaluation signaling hypothesis, information asymmetry, divergence of opinion, firm valuation, asset pricing, anomalies*

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1. Introduction

Recently, firms' behavior in share repurchases has drawn tremendous attention and raises an important question: Why do firms repurchase shares? [1] Several hypotheses have developed in literature to explain the behavior of repurchasing shares. The undervaluation signaling hypothesis, one of the most popular theories, is built upon information asymmetry.[2] This theory suggests that repurchased stocks are undervalued by investors due to information asymmetry. Announcements of share repurchases are signals from managers to dissipate information asymmetrically. Extraordinary growth in share repurchases could be the evidence that repurchases are an efficient signaling tool to correct mispricing.[3]

However, recent empirical evidences have questioned on this theory. Ikenberry, Lakonishok and Vermaelen [41] find a buy-and-hold portfolio, built after announcements, earns significant positive abnormal returns and suggest markets under-react to announcements. Such abnormal returns have also been documented in Canada [42], U.K. [55], and Japan [64], etc. Peyer and Vermaelen [54] confirm the persistency of such abnormal returns, and conclude that 'Without under-reaction, such a strategy cannot be successful'.[4] The persistent market under-reaction is inconsistent with the hypothesis that repurchase announcements are an efficient signaling tool.

Another puzzling fact that cannot be explained by this undervaluation signaling theory is that the post-announcement abnormal returns are driven by high book-to-market ratio firms. Ikenberry, Lakonishok and Vermaelen [41] find that the abnormal returns are concentrated in 'value' stocks rather than 'glamour' stocks. Ikenberry, Lakonishok and Vermaelen [42], Zhang [64], and Von Eije and Megginson [62] confirm this pattern with data from Canada, Japan, and Europe.[5] High book-to-market ratio firms are usually value firms with less growth opportunity. Their values are determined mainly by assets in place, rather than uncertain growth in the future. One would expect that high book-to-market ratio firms should have less information asymmetry problem.[6] However, the less information-asymmetric firms appear to gain more from information signaling. Moreover, Barth and Kasznik [6] examine 3,661 open market repurchase announcements and find that general information asymmetry is negatively related to the likelihood of repurchase announcements.

Other theories, which explain the motivation of share repurchases, include the excess capital distribution hypothesis which is based on agency theory, leverage

1 Although U.S. corporations chose to pay out cash in the form of dividends rather than share repurchases in the past decades, Grullon and Michaely [35] report that the expenditure on share repurchases relative to earnings expanded almost 10 times through 1980 to 2000.

2 Theoretical works include Vermaelen [61], Ofer and Thakor [53], and Constantinides and Grundy [16], among others. Empirical evidence has been suggested by Vermaelen [60], Dann, Masulis and Mayers [18], Comment and Jarrell [13], D'Mello and Shroff [17], Grullon and Michaely [36], Louis and White [46], and Massa, Rehman and Vermaelen [47].

3Wansley, Lane and Sarkar [63] and Graham and Harvey [33] survey the CFOs for the reasons for share repurchases and managers response undervaluation is their first motivation among others.

4Peyer and Vermaelen [54], "The nature and persistence of buyback anomalies," Review of Financial Studies, 22-4, page 1745.

5Von Eije and Megginson [62], however, provide a different explanation and focus on the substitution effect between dividends and share repurchases.

6 This argument borrows the same idea as in Myers [52] that a firm's value is given by current assets and the value of real options from discretionary future investment opportunities.

hypothesis which is based on capital structure theory, anti-takeover hypothesis which is based on corporate governance literature, and etc. Dittmar [20] examines these hypotheses simultaneously from 1977 to 1996, and concludes that most hypotheses are only significant in a particular period, except for undervaluation-signaling and excess capital distribution hypotheses.[7]

The goal of our paper is to propose a new theory of share repurchase which builds on the idea that managers' share repurchase decision depends on investors' heterogeneity in beliefs. With different priors, investors could have separate expectations on the firm's future cash flows, although they share the common information about the firm's investment portfolio. Optimistic shareholders, who have higher expectation on future cash flows and believe that current stock price is undervalued, would rather pay a premium to pessimistic shareholders for their shares and acquire more rights on future cash flows. Pessimistic shareholders are willing to tender their shares, if the repurchasing price is higher than their valuations. With short sales constraints, those pessimistic shareholders will not be able to build up short positions after tendering. As suggested by Miller [49], stock price stays high when those pessimistic opinions are not reflected in the price.[8] The magnitude of the price increase is dependent upon both the degree of divergence of opinion and the quantity of shares actually repurchased. The larger the divergence of opinion, managers will repurchase more shares and the stock prices increase following those actual repurchases. From the optimistic investors' point of view, the stock was indeed undervalued. However, such undervaluation is not necessarily due to the information asymmetry, but simply the different opinions. It is the heterogeneous expectation that generates 'undervaluation'.

Managers could choose share repurchase regardless of the presence of agency problem, if the divergence of opinion is large. If managers work for the best interests of shareholders, they could repurchase shares as long as the expenditure on share repurchase does not affect the real investment decision. Share repurchases increase the utility for both pessimistic and optimistic shareholders. When agency problem emerge, managers might over-repurchase shares and push up stock price in short run. As in Jensen [43], they would have to skip good investment opportunities due to the lack of cash in the future. In both cases, however, managers benefit from the increases in stock price through options and stock compensation.[9]

With heterogeneous expectations and short sale constraints, idiosyncratic risks cannot be fully diversified, and thus should be priced.[10] Empirically, Babenko [3] finds that managers and employees are forced to bear more firm-specific risk after share repurchases. These two constraints predict that large, low growth firms, which usually have more excess cash and lower idiosyncratic risks, are more likely to repurchase shares. This prediction is consistent with the empirical evidence that abnormal returns are concentrated in 'value' rather than 'glamour' stocks.

In this paper, we find significant empirical evidence that supports the investor heterogeneous expectation in explaining share repurchases. The empirical results in this paper show that the higher the divergence of opinion among investors, the more likely a firm is to repurchase its shares, announce larger target shares, and actually repurchase more shares. These results hold, even after controlling other factors, such as the signaling and agency hypotheses. Finally, we find that firms earn long-term excess returns only when they actually repurchase shares. A portfolio that consists of no-actual-repurchasing firms earns no abnormal returns following repurchase announcements. Overall, our empirical evidence supports the divergence of opinion hypothesis as an alternative explanation for share repurchases, even after controlling for other hypotheses such as the undervaluation-signaling hypothesis. Our results are also consistent with Dittmar and Thakor [21], Bagwell [4] and Bagwell [5], who find evidence that shareholders have heterogeneous expectations about firm value.[11]

The rest of our paper is organized as follows: Section 2 proposes the heterogeneous expectation theory in the context of explaining share repurchases. In this section, we also provide testable hypotheses that are examined in the empirical section. Section 3 presents the proxies of investors' heteroscedastic beliefs. Section 4 describes data. Section 5 reports empirical results. Section 6 concludes this paper.

2. The Theory

In this section, we introduce our theoretical framework in which investors have divergence of opinion on a firm value and do not update their beliefs even though they observe the manager's repurchasing signal.[12] Reproducing Figure 1 of Wang and Liu [59], we first introduce the idea developed from Miller [49]. A firm has N shares and N shareholders, with each of them holds one share. Without divergence of opinion, all shareholders agree that the value of the firm is P_C per share, the respective demand curve of shares is OC in Figure 1. With divergence of opinion, optimistic shareholders hold higher reservation value of the firm and the demand curves shift upwards. According to the marginal-investor theory, the stock price is determined by the most pessimistic investor. From Figure 2, one can see that the higher the divergence of opinion (AO>BO>CO), the higher the stock price ($P_A > P_B > P_C$). This is the Miller [49]'s divergence of

7 See also Grullon and Ikenberry [34], Allen and Michaely [1] among others, for the review of motivation for share repurchase.

8 The evidence of Miller [49] theory has been documented by Diether, Malloy and Scherbina [19], Chen, Hong and Stein [12], Chang, Cheng and Yu [11], and Boehme, Danielsen and Sorescu [7].

9 See Vermaelen [61], Lambert, Lanen and Larcker [44] and Fenn and Liang [27] for more comprehensive discussion on the management incentive to share repurchases.

10 Theoretical works can be found in Mayshar [48], Constantinides and Duffie [15], and Fama and French [26]; while empirical evidence are documented by Goyal and Santa-Clara [32] and Storesletten, Telmer and Yaron [58].

11 Huang and Thakor [40] also propose an investor-management agreement explanation on share repurchases. However, their paper focuses on the changes of agreement parameter around repurchases, rather than the changes of stock prices following actual share repurchases.

12Conlon, Fuller and Wang [14] propose models of share repurchase with investor divergence of opinion. They show that in the equilibrium of this simple model is similar to a complex model where heterogeneous investors update their beliefs but do not have the full information about actual share repurchases.

opinion driven 'over-valuation' hypothesis, where supply of shares or shares outstanding is fixed.

Now, let us consider a situation where the manager can endogenously determine the supply of shares through share repurchases. As long as the manager is not the most pessimistic one among all shareholders, he observes the current stock price as undervalued, and thus has incentive to repurchase shares. After share repurchases, the number of shares outstanding drops to N'. The equilibrium stock prices are $P_A^{'}, P_B^{'}, P_C^{'}$, respectively.

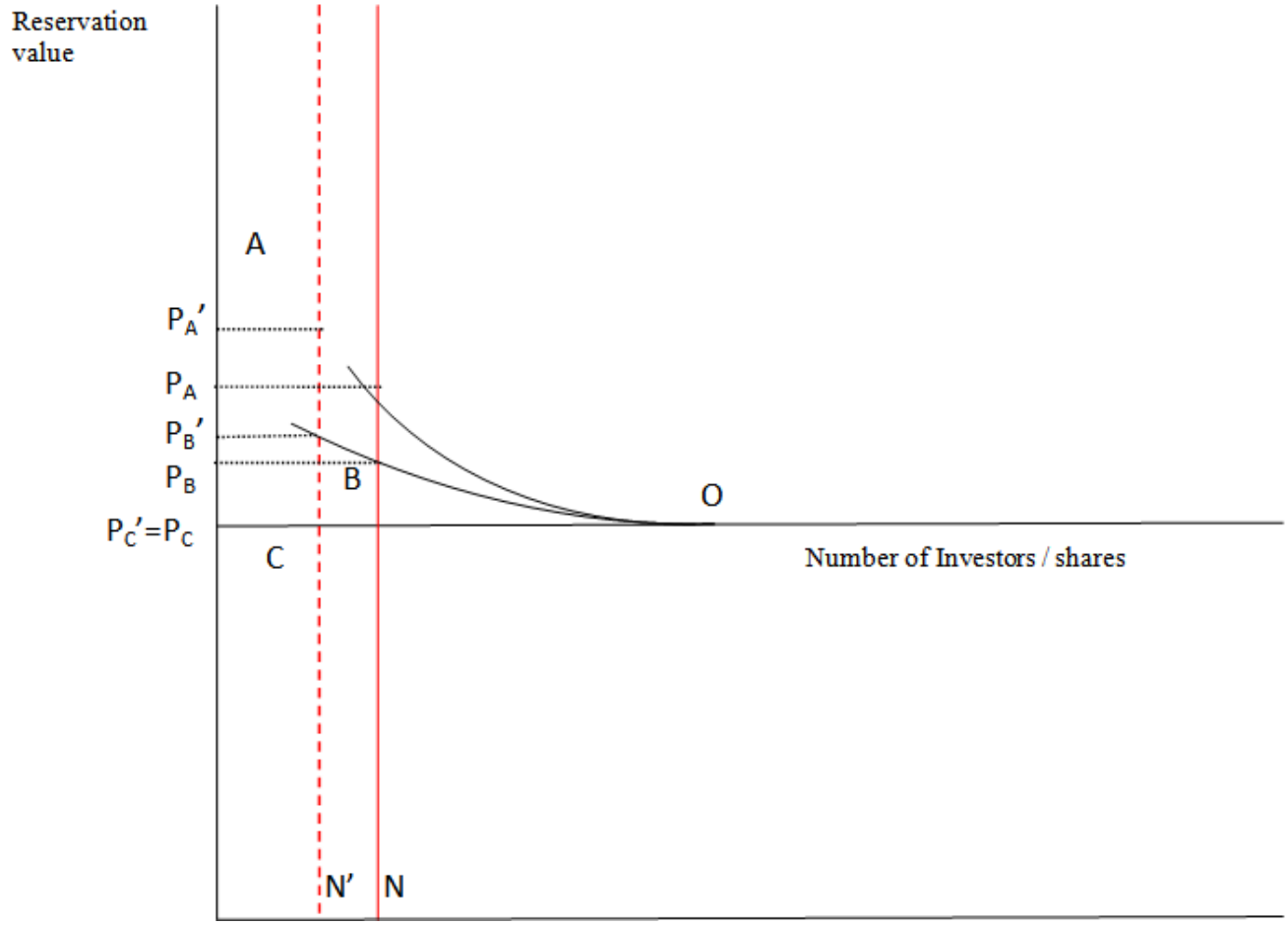

Figure 1. Divergence of opinion and share repurchase

Without the divergence of opinion, the stock price moves along the demand curve CO and does not change, $P_C^{'} = P_C$. With the divergence of opinion, stock prices go up along the demand curves AO and BO and $P_A^{'} > P_A, P_B^{'} > P_B$. Therefore, the manager can push up the stock price by repurchasing shares from pessimistic shareholders when the divergence of opinion exists. Furthermore, it is easy to show that $P_A^{'} - P_A > P_B^{'} - P_B$. The higher the divergence of opinion, the larger the price increases when the manager repurchases the same amount of shares.

2.1. The Theory of Share Repurchase with 'Un-Smart' Shareholders[13]

A firm has N shares and N shareholders, with each of them hold one share.[14] At the beginning, period 0, the firm has projects with future cash flow CF, which will be realized in the future, and 'free' cash C_0 in hand.[15]

Without the discount on time, the 'true' value of this firm is $V_0 = V_4 = CF + C_0$. With divergence of opinion, the shareholders hold different prior beliefs about the firm's project future payoff.[16] The most pessimistic shareholder believe the firm is worthy of $V^1 = CF^1 + C_0$. According to the marginal-investor theory, his opinion determines the asset price, such that $P_0 = V^1$. With the wealth constraints, other optimistic shareholders are not

13 We use the 'un-smart shareholders' to refer investors who update their expectations as the stock price goes up, but they do not try to infer the manager's repurchasing decision with the observed price information.

14 We look the manager as one of the shareholder and he also holds one share.

15 Since we do not restrict the sign of cash, one can always divide a firm's assets into a project portfolio, which includes all the investments and future investment opportunities, and cash. A positive C_0 means the firm has excess cash and no good investment opportunities; zero value of C_0 means the firm exhausts its cash and investment opportunity simultaneously; while a negative sign means the firm will have to borrow to finance some possible investments. In the later cases, managers will have to borrow to finance share repurchases.

16 We assume no information asymmetry between the manager and shareholders, neither among shareholder themselves. The different expectation on the project payoff is due to different prior beliefs.

able push up the stock price by buying his shares; with short sale constraints, the more pessimistic potential investors are not able to push down the price by short selling the stock. We outline the events of this four-period model in Figure 2.

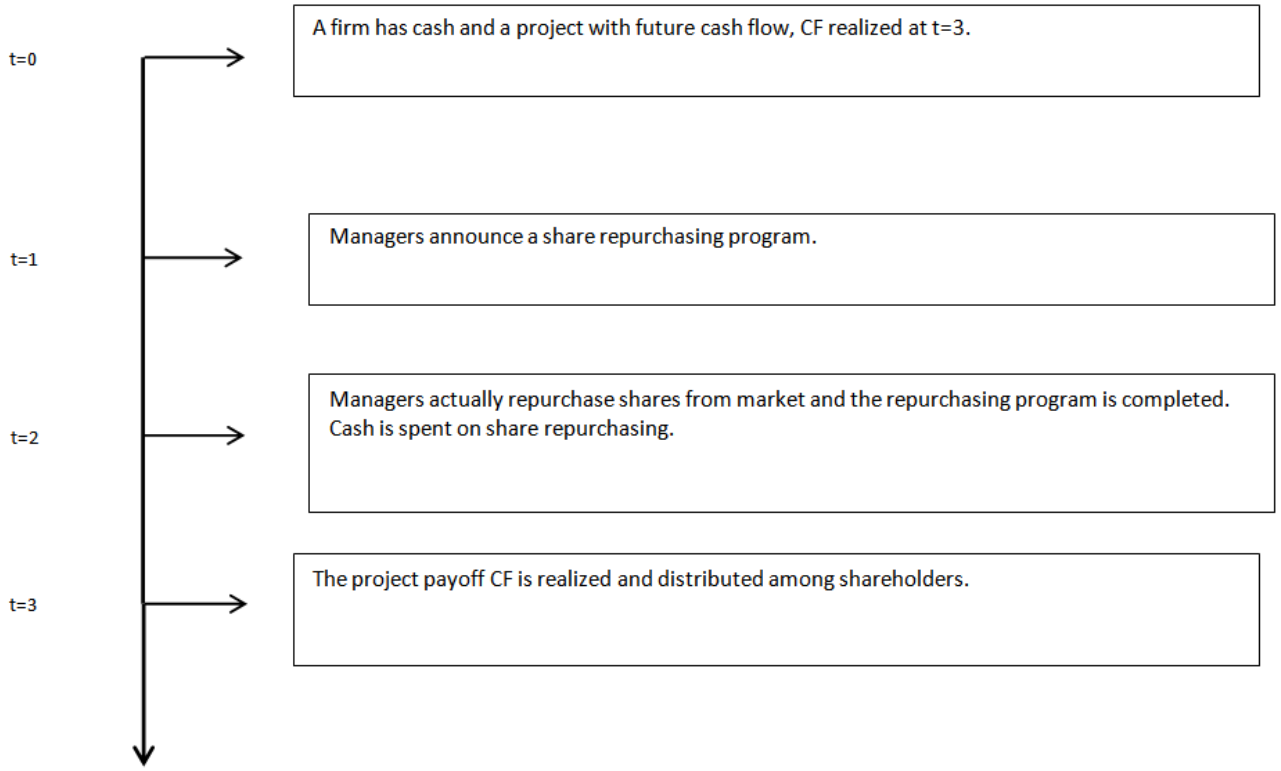

Figure 2. The time line of the model

In period 1, the manager announces an open market share repurchasing program. Shareholders keep their belief unchanged. [17] The equilibrium price is also unchanged, $P_1 = P_0$.

In period 2, the manager actually repurchases shares from the market, with an offering price $P_2 > P_1$. In response to this offer, shareholders tender their shares. However, with different evaluation on the firm, not every shareholder tenders his share, but only the ones whose reservation values are lower than P_2. The new marginal investor holds a reservation value equal to P_2 and has no difference between tendering and holding his share. Thus, P_2 is the new equilibrium stock price and is greater than $P_1 = P_0$. The stock prices keep increases as long as the manager repurchases shares from the market.

During the period 2, cash C_0 is spent on repurchasing shares. [18] The firm's project payoff *CF* is unaffected by repurchases. Each of remaining shareholders updates their beliefs about the firm value by a deduction of C_0, respectively.

In period 3, the project payoff *CF* is realized and distributed evenly among remaining shareholders.

2.2. A Numerical Example for Price Drift and Long-term Abnormal Returns

We use a simple numerical example to illustrate the increases in a stock price following share repurchases. We also decompose the increases in stock price to analyze the price upward drift and the long-term abnormal returns.

For simplicity, we assume there are three shareholders and one manager in the firm. Each of them holds one share. Let the 'true' value of the firm at liquidation be \$48. If all shareholders keep their shares to the last period, each of them will equally acquire one-fourth of the firm's wealth, \$12.

With the divergent opinions, each of investor (including shareholders and the manager) has his own expectation on the firm's future value. Shareholder 1 (SH1) believes each share will be worth \$10, \$11 for shareholder 2 (SH2), and \$13 for shareholder 3 (SH3). The manager, by chance, holds the belief of \$12 each share.

With short sale constraints, the stock price is traded at \$10 per share, which represents the most pessimistic shareholder's opinion as suggested by marginal-investor-theory. From the point of the manager's view, the stock is undervalued. Without share repurchase, the expected payoffs for each of the investors are: SH1: 10, SH2: 11, M: 12, and SH3: 13.

The manager first offers \$11 to repurchase shares. Only shareholder 1 is willing to tender his share. After tendering, the stock price goes up to \$11. The remaining

17 As we assume no information asymmetry between the manager and investors, there is no information released from repurchasing announcement. Shareholders, thus, do not update their beliefs in response to the announcement. However, as we assume investor heterogeneity, shareholders could have different opinion because they have different information process models, as suggested by Harris and Raviv [37] and Anderson, Ghysels and Juergens [2]. In this framework, shareholders react differently to the common repurchasing announcement and their reservation values may divergent further.

18 One should notice that C_0 is an arbitrage number. C_0 at the beginning status can be set as any number and equal to the amount spent on actual repurchases. Extra cash can be integrated as part of the project.

shareholders and the manager update their expected payoffs as: SH2: 11, M: 12.3, and SH3: 13.6.

As the stock price \$11 is still below the manager's belief, he offers to repurchase again at \$12. This time, only shareholder 2 tenders his share. After tendering, the stock price goes up to \$12. The manager and the shareholder 3 update their expected payoffs as: M: 12.5, and SH3: 14.5. As the stock price is close to the manager's belief, he stops to repurchase any more shares.

One can directly observe that the stock price goes up along the shareholders' reservation value schedule when the manager repurchases shares. This price rising is consistent with the stock price upward drift after the announcements of open market repurchase, as managers usually repurchase shares for a number of years after their announcements.

The manager, by chance, holds an expectation about the firm's value equal to \$15/share. Thus, the firm is undervalued from the managers' point of view (i.e. $P_0 < \$15$). The manager would be willing to offer \$12/share to repurchase the 20 shares hold by those pessimistic shareholders.

Furthermore, one can see that not only the stock price increase, but also the remaining shareholders' expected payoffs increase. As long as the manager is not over-optimistic, or the manager does not repurchase the shares at the price higher than the 'true' value of each share, the remaining shareholders always gains from the share repurchases. The gains come from the wealth transfer from tendering shareholders to non-tendering shareholders.

For example, at the first repurchase, the manager buys a piece of asset worth \$12 at the cost of \$11. There is \$1 wealth transferred from shareholder 1 to other shareholders. We argue that the long-term abnormal returns come from the wealth transfer effect from actual share repurchases.

There is no arbitrage opportunity for outside investors. An arbitrager, who observes the manager's announcement and wants to takes advantages of future price drift and abnormal returns, has to buy shares from existing pessimistic shareholders. The purchases from the arbitrager will simply push up the stock price. As the price goes up the level of the manager's belief, the manager will not repurchase any shares. The arbitrager thus become a shareholder and cannot load off his shares unless he sells at lower price.

There are limits of benefits from share repurchase too. First, the manager has to use free cash or low-cost debt to finance share repurchases. When considering the time value of the money, the cumulated interests could be too high between the time of repurchases and the time of future project payoff, the benefits from wealth transfer is limited. Second, the manager and remaining shareholders bear more idiosyncratic risk as some shareholders tender their shares. As suggested by Mayshar [48] and Fama and French [26] with divergence of opinion, the idiosyncratic risk is not fully diversifiable. Remaining shareholders ask for higher returns for bearing more idiosyncratic risk and push down the stock price.

2.3. Testable Hypotheses

A key aspect of our study is to differentiate between the investor's heterogeneous expectations and signaling hypothesis. Since the information asymmetry is not the main force generating different valuations in our model, including the information asymmetry variables should not affect the statistical significance of the coefficients on our proxy variables that measure the divergence-of-opinion among investors. Our tests examine whether including the divergence-of-opinion proxies affects the statistical significance of variables that control for information asymmetry. Thus:

H1: *Firms with a higher divergence of investors' opinion are more likely to repurchase shares.*

As the difference in valuations between optimistic investors and pessimistic investors gets larger (i.e. divergence of opinion increases), the more shares managers will be willing to repurchase. Thus:

H2: *The higher the divergence of opinion, the larger the targeted fraction of shares in repurchasing announcements*.

The model suggests stock price increases following actual share repurchases, as pessimistic shareholders leave the market after tendering their shares. Since a repurchase program is usually completed across years, a long-term abnormal return could be the result of long-term repurchase program. Thus, in long-run, stock price should not increase if managers only announce but do not actually repurchase shares.

H3: *A firm does not earn long-term abnormal return following repurchase announcements, if managers do not actually repurchase shares*.

Information asymmetry hypothesis argues that stock price will increase following repurchase announcements, because announcements signal a better future. Without the disclosure of actual share repurchases after announcements, investors have no reason to postpone their actions. Testing the prediction 3 would help to separate this model from signaling hypothesis. Rather than attributing to investors' under reaction, our model suggests that the 'long-term price drift' is because managers repurchase shares across a long period. 19

To examine the likelihood that a firm repurchases shares, we construct a sample of repurchasing and a matching sample of non-repurchasing firms. We then pool the repurchasing sample and non-repurchasing control sample as our full sample. The variable $REPUR_{i,t}$ is set to one if a firm announces at least once open market repurchase in that year, and is equal to zero otherwise. Logistic regressions are run to test the likelihood ratio after including proxies control for different hypotheses.

3. Measures of Divergence of Opinion

We choose four proxies to measure the divergence of opinion. The first proxy is the standard deviation of analyst earnings forecasts divided by the mean of the analysts' forecasts, $Disp1_{i,t}$, (see [19]). For each month, we compute the monthly divergence of opinion for a firm

19 An even more direct test is to examine whether price increases right after managers repurchase shares from the market. Such a test will give us a clear episode of how actual share repurchases move the price. We are not able to test this prediction due to the limits of U.S. data in this paper. With the detailed data from Hong Kong market, we will be able to examine the price behavior around actual repurchase directly.

by using the annual fiscal year earnings estimate for that month. We then estimate the average yearly divergence of opinion ($Disp1_{i,t}$) as the mean of the monthly divergence of opinion in any given year. Since the mean of analyst earnings forecast could be zero, and infinite analyst dispersion could be problematic, we choose an alternative measure $Disp3_{i,t}$, which we define as the standard deviation of analyst earnings forecasts scaled by stock price.[20] Our model suggests that it is the difference in valuations between optimistic and pessimistic investors that matter. Thus, our second proxy for the divergence of opinion is the difference between the highest earnings forecast and the lowest one, scaled by the absolute value of the mean earnings forecast.

$$\begin{aligned} Disp1_{i,t} &= Std(forecast)_{i,t} / Mean(forecast)_{i,t}; \\ Disp3_{i,t} &= Std(forecast)_{i,t} / Stock\_\Pr ice_{i,t}; \end{aligned} \quad (1)$$

We use the abnormal market adjusted turnover, $Abto_{i,t}$ [28,38] and standardized unexplained stock trading volume, $SUV_{i,t}$ [28,29] as our third and fourth proxies for divergence of opinion. To avoid the less-trading-frequency problem, we first compute the weekly trading volume and return for each stock. The weekly market adjusted turnover is the firm's weekly trading volume divided by its shares outstanding minus the ratio of market total trading volume scaled by market total shares outstanding. The market adjusted turnover is calculated as the yearly average of weekly turnover for each firm year. Standardized unexplained stock trading volume measures the unexpected trading volume from the effect of both liquidity and information. Unexpected trading volume is the residual volume ($\varepsilon_{i,t}$) from a regression of the firm's weekly trading volume on weekly signed absolutely returns:

$$Volume_{i,t} = \alpha_i + \beta_i \left|R_{i,t}\right|^{+} + \gamma_i \left|R_{i,t}\right|^{-} + \varepsilon_{i,t}, \quad (2)$$

The plus and minus superscripts on the absolute valued returns indicate the sign of weekly returns. The standardized unexplained trading volume is the yearly average of such residuals scaled by the standard deviation of residual.

Our study examines three measures of information asymmetry. First, we include a direct measure of information asymmetry by following Durnev, Morck and Yeung [23]. They suggest that greater firm-specific variation in stock price represents more information compounded into price and thus less information asymmetry. This measure is also employed by Morck, Yeung and Yu [51], Bushman, Piotroski and Smith [10], Dittmar and Thakor [21], and Duarte et al. [22]. The firm-specific variation, $Psi_{i,t}$, is defined as a natural log transformation ($Psi = \ln(\frac{1-R^2}{R^2})$) of R-squares from the following regression:

$$Ret_{i,t} = \alpha_i + \beta_i Ret\_Industry_{i,t} + \gamma_i Ret\_market_{i,t} + \varepsilon_{i,t}, \quad (3)$$

The dependent variable ($Ret_{i,t}$) is equal to the stock's weekly raw return, and the independent variables are industry- (defined as two-digital SIC code) and market-wide value-weighted weekly returns. Industry- and market-wide weekly return is calculated from the daily stock return collected from the Center for Research in Security Prices (CRSP). *Psi* is an inverse measure of information asymmetry: a larger *Psi* reflects lower information asymmetry.

Second, researchers generally believe that analysts' forecasts improve a firm's information environment. For example, Diether, Malloy and Scherbina [19] suggest a measure for potential information asymmetry, $R\cov$, the residual of analyst coverage. $R\cov$ is equal to the residual, $\eta_{i,t}$, from yearly regressions of ln(1+ analyst coverage) on ln(MK) and ln(B/M) as equation (4.4). A large residual implies a potential lack of analyst forecasts, and thus, the firm may suffer from information asymmetry.

$$\begin{aligned} &\log(1+number\_analysts)_{i,t} \\ &= \lambda_{0i} + \lambda_{1i} \ln(MK)_{i,t} + \lambda_{0i} \ln(BK/MK)_{i,t} + \eta_{i,t} \end{aligned} \quad (4)$$

Similar to high book-to-market ratio firms, firms with a higher proportion of fixed assets should be more transparent, since the uncertainty about the value of intangible assets and growth opportunities is small. As our third measure of information asymmetry, we compute the ratio of fixed assets to total assets [21]. The book-to-market ratio and the percentage of fixed assets also can be explained as proxies for growth opportunities.

To test the agency theory based excess-capital-distribution hypothesis, we include *Cash* and *FCFs* following Dittmar [20]. *Cash* is defined as cash and equivalents scaled by total assets, while *FCFs* , free cash flows, is the ratio of net income before taxes plus depreciation and changes in deferred taxes and other deferred charges divided by total assets. As our third proxy for agency problems, we include *OXD* , the operating expenditure, defined as operating costs divided by total assets.

Although our model suggests that managers are more willing to repurchase shares when they can finance a share repurchase with excess cash flows, they will not do so if the cash flows can be used to finance good investment opportunities. Thus, managers in a firm with growth opportunity are less likely to repurchase, however, they will be forced to do so if investors worry the cash flows will not be spent on investment but consumed by managers. Following Barth and Kasznik [6], we construct an index to capture excess cash and limited investment opportunities, *CASHIND* . *CASHIND* is equal to cash from operations plus cash from investing activities minus cash from financing activities other than that related to repurchases and cash dividends, divided by sales. As suggested by Barth and Kasznik [6], using this proxy presumes firms do not issue debt to finance share repurchases other than to finance needs from operations or positive net present value projects.[21]

20 Since the result for $Disp1_{i,t}$ are essentially the same as for $Disp3_{i,t}$, we report the result only for $Disp1_{i,t}$.

21 Due to the lack of data, the variable *CASHIND* , as well as *InTrading* and *InOwner* , have not been applied to this version of the paper yet.

Recent literature suggests managers use share repurchases as an earnings management tool [31,39,56]. We include profit margin, PM, to capture the managers' earnings management incentive in share repurchases. Profit margin is defined as net income divided by sales.

We control other firm characteristics which have been suggested to affect the decision to repurchase shares. We choose firm size, $\ln mk$, measured as natural log of the firm's market value, which is equal to the average monthly stock price times shares outstanding; and the firm's book-to-market ratio, $bmratio$ (see [25]);[22] and the past year average monthly return to capture the momentum effect.

We use a horse racing logistic regression (see [20]) to test the likelihood of share repurchases:

$$\begin{aligned} Repur_{i,t} &= \beta_0 + \beta_1 \ln mk_{i,t-1} + \beta_2 bmratio_{i,t-1} \\ &+ \beta_3 return_{i,t-1} + \beta_4 InfAsy_{i,t-1} + \beta_5 Agency_{i,t-1} \\ &+ \beta_6 DO_{i,t-1} + \beta_7 Earnings_{i,t-1} + \xi_{i,t} \end{aligned} \quad (5)$$

where, $InfAsy$, $Agency$, DO, and $Earnings$ represent a group of proxies for information asymmetry, agency problem, divergence of opinion, and earnings management as discussed above. All independent variables are measured one year prior to the announcements of open market share repurchases.

To test hypotheses H1 and H2, we use only the share repurchase sample. We use both portfolio approach and regression approach to examine the relationship between the fraction of target shares and the determinants of share repurchases. We first sort the repurchasing sample by book-to-market ratio into quartiles, and then sort each quartile by proxies of share repurchase determinants into sub-quartiles. A positive difference in the fraction of target shares between the highest and the lowest repurchase determinant sub-quartile would suggest a positive effect of such determinant on share repurchases.

We then again run the horse race regression to examine the explanatory power of each repurchase determinant. We finally test the relative explanation power of each repurchase determinant by a pooled multi-factor regression. We describe the tests on hypothesis H3 in section 6 which require different data and methodology.

4. Data

Open market share repurchase data is taken from the Securities Data Company (SDC) platinum. Due to the data availability and access limit, the sample period is obtained from 1994 to 2003. The selection criteria follows Peyer and Vermaelen [54].[23] Specifically, we exclude repurchases driven by anti-takeover or going to private considerations. The shares repurchased must be common stock. We also require that sample firms are U.S. firms listed on the NYSE, Amex or NASDAQ, have available CRSP and Compustat data, and one week prior to announcement a stock price greater than $3/share. In addition, we require the announced repurchase programs have the 'Completed' or 'Intended to Completed' status in SDC till the end of 2009. Stephens and Weisbach [57] find that not all firms finish their announced repurchasing programs. The managers' motivation for a repurchase may be unclear if they do not intend to finish the repurchasing program.

We collect our matching sample from the population of non-repurchasing firms. In a given year, we build non-repurchasing population including firms that do not announce any type of share repurchases in three years around that year.[24] We select matching sample following Grullon and Michaely [36]. We match the non-repurchasing firm with share repurchase sample by two-digital standard industry Classifications code first, and then matched by the market value and the book-to-market ratio of the firm.[25] The matching score is given by:

$$\begin{aligned} MC = &\left(\frac{market\_value_s - market\_value_m}{market\_value_s + market\_value_m}\right)^2 \\ &+ \left(\frac{Book/Market_s - Book/Market_m}{Book/Market_s + Book/Market_m}\right)^2 \end{aligned} \quad (6)$$

The matching sample is built up year by year and selected from firms with lowest matching score without duplication.

Analyst earnings forecasts data is collected from the First Call Historical Database (FCHD). FCHD contains consensus estimates of analyst earnings forecasts from 1990. Diether, Malloy and Scherbina [19] examine the differential between the Detail History file and the Summary History file in I/B/E/S database and find that the results are very similar. We collect the estimate consensus, including mean, standard deviation, and number of analyst forecast, from FCHD directly. Ljungqvist, Malloy and Marston [45] find a potential sampling problem due to the widespread ex post changes to the historical contents of the I/B/E/S database. As they suggest, we avoid such sampling problem by downloading the data after 2006.

We collect firm characteristics: total assets, book value of asset, fixed assets, cash and cash equivalent, sales, net income, operation costs, research & development expense, and tax and other deferred items from Compustat quarterly and annual data. The stock price, return, trading volume, and shares outstanding data are from the Center for Research in Securities Prices (CRSP) daily database. The firm's SIC code, and share code and listing information are from Compustat and CRSP, respectively.

Table 1. Summary statistics of control variables for subsamples

	Non-repurchase	Repurchase	p-Value of median	p-Value of spreads
Panel A: Full Sample				
Ln(mk)	13.47	13.54	0.49	0.37
bmratio	0.5283	0.5197**	0.00	0.00
Ln(AT)	6.85	7.11**	0.00	0.00
Cash	0.0424	0.0492**	0.00	0.00
CF	0.0351	0.0413**	0.00	0.00
PM	0.0522	0.073**	0.00	0.00

[22] Please see Fama and French [25] for the details for this measurement.

23 From 2004, the Securities and Exchange Commission (SEC) changes the disclosure policy and requires the firms to report their actual share repurchase activities at monthly basis.

24Stephens and Weisbach [57], Brockman and Chung [9], Zhang [65], and Ginglinger and Hamon [30] report that open market share repurchases usually take years for execution. One year lag after announcement limits the side effect from actual share repurchases.

25 If matching firm with two digital SIC code is not available, WE use firms matched with one digital SIC code instead.

XRD	0.0578	0.0616	0.77	0.51
OXD	0.8557	0.8278**	0.00	0.00
price	24.41	26.38**	0.00	0.00
stdprc	2.97	2.84	0.29	0.49
returns	0.0132	0.0148**	0.01	0.00
# of obs.	271126	1388		
Panel B: high&low Book-to-Market ratio				
High Book-to-Market ratio				
Ln(mk)	12.96	12.55**	0.00	0.01
bmratio	0.9589	0.9454	0.14	0.56
Ln(AT)	7.02	7.05	0.95	0.92
Cash	0.0242	0.0329**	0.00	0.00
CF	0.0226	0.0301**	0.00	0.02
PM	0.033	0.0607**	0.00	0.00
XRD	0.0249	0.0357	0.65	0.32
OXD	0.8736	0.8254**	0.00	0.00
price	18.43	19.56	0.28	0.74
stdprc	2.05	2.01	0.35	0.48
returns	0.0083	0.0171**	0.00	0.00
# of obs.	741	284		
Low Book-to-Market ratio				
Ln(mk)	14.42	14.53	0.68	0.39
bmratio	0.2146	0.2495**	0.00	0.00
Ln(AT)	6.76	6.84	0.07	0.10
Cash	0.0866	0.0891*	0.04	0.15
CF	0.0514	0.0532	0.62	0.69
PM	0.0794	0.0793	0.16	0.06
XRD	0.0823	0.0733	0.19	0.06
OXD	0.8263	0.8228	0.53	0.57
price	34.08	33.44	0.18	0.08
stdprc	4.67	4.19	0.09	0.07
returns	0.0186	0.0192*	0.04	0.00
# of obs.	707	318		
Panel C: high&low agreement by Dispersion1_mean				
High Disagreement				
Ln(mk)	13.03	12.84	0.18	0.36
bmratio	0.5896	0.5738	0.47	0.12
Ln(AT)	6.35	6.26	0.36	0.38
Cash	0.0492	0.0776**	0.00	0.00
CF	0.0256	0.0289	0.67	0.86
PM	0.0274	0.0393**	0.00	0.02
XRD	0.0726	0.0836	0.21	0.08
OXD	0.8883	0.8775	0.07	0.33
price	18.03	18.59	0.42	0.47
stdprc	2.84	2.46*	0.03	0.02
returns	0.0089	0.0096	0.41	0.18
# of obs.	744	381		
Low Disagreement				
Ln(mk)	13.94	13.96	0.59	0.29
bmratio	0.4468	0.4915**	0.01	0.00
Ln(AT)	7.32	7.87**	0.00	0.00
Cash	0.0394	0.04393	0.33	0.44
CF	0.04368	0.0466	0.27	0.21
PM	0.0891	0.1085**	0.00	0.00
XRD	0.0481	0.0428	0.93	0.90
OXD	0.8021	0.7555**	0.00	0.00
price	30.87	31.18	0.72	0.36
stdprc	3.27	3.12	0.68	0.86
returns	0.0166	0.0159	0.96	0.86
# of obs.	620	407		

26 The number of matching firms is different with the number of repurchasing sample is because some firms announce repurchases more than once in our full sample period. The matching firm could be different for the same repurchasing firm in the different announcement years.

Panel D: high&low agreement by Dispersion1_median				
High Disagreement				
Ln(mk)	13.38	13.39	0.73	0.81
bmratio	0.5576	0.5328**	0.00	0.00
Ln(AT)	6.72	6.84	0.11	0.38
Cash	0.0445	0.0507*	0.05	0.06
CF	0.0328	0.0396**	0.00	0.00
PM	0.0451	0.0642**	0.00	0.00
XRD	0.0594	0.0642	0.52	0.21
OXD	0.8669	0.8436**	0.00	0.00
price	22.52	24.32**	0.01	0.04
stdprc	2.95	2.73*	0.05	0.11
returns	0.0122	0.0142	0.06	0.00
# of obs.	2078	995		
Low Disagreement				
Ln(mk)	13.65	13.66	0.72	0.37
bmratio	0.5162	0.5068**	0.00	0.00
Ln(AT)	6.99	7.25**	0.00	0.00
Cash	0.0393	0.045*	0.02	0.03
CF	0.0389	0.0441**	0.00	0.00
PM	0.0629	0.0794**	0.00	0.00
XRD	0.0514	0.054	0.77	0.98
OXD	0.842	0.8157**	0.00	0.00
price	26.33	28.21**	0.01	0.02
stdprc	3.01	2.91	0.78	0.94
returns	0.0148	0.0159	0.20	0.04
# of obs.	1596	1118		

This table provides medians for control variables for the full sample and several sub-samples. The variables details are: ln(mk), the natural log of market value; bmratio, the Fama and French [25] Book-to-Market ratio; ln(AT), the natural log of total assets; Cash, the ratio of cash and cash equivalents to total assets, as in Dittmar [20] CF, cash flow, the sum of net income before taxes plus depreciation and changes in deferred taxes and other deferred charges divided by total assets, as in Dittmar [20]; PM, profit margin, net income divided by sales; XRD, the expenditure on R&D divided by sales; OXD, the operating costs, the total operation costs divided by sales; price, average stock price; stdprc, the standard deviation of monthly stock price; returns, the average monthly returns over 12-month period before repurchase announcement. All variables are observed at one fiscal year prior to the announcement of share repurchase. Non-repurchase sample is constructed as matching sample following Grullon and Michaely [36]. For each firm who announces open market repurchase in a year, we select the matching firm following rules: first, we require the matching population firms do not announce any type of repurchases in three years, one year before and one year after; second, we require the matching firm has the same two-digit SIC code as the announcing firm. If firm with same two-digit SIC code is not available, we use one digit SIC instead; third, we select the matching firm by picking up the smallest matching score without duplication. The matching score is computed as

$$MC = \left(\frac{market\_value_s - market\_value_m}{market\_value_s + market\_value_m}\right)^2 + \left(\frac{Book/Market_s - Book/Market_m}{Book/Market_s + Book/Market_m}\right)^2$$

. The subscripts s and m refer to sample and matching firms, respectively. All variables are measured in the fiscal year prior to the repurchase announcement. Panel A details the full sample. Panel B details firms in the higher and lower Book-to-market ratio quartile. Panel C details firms in the upper (high disagreement) and lower (low disagreement) quartile of the disagreement parameter, Disp1, the mean of the analyst forecast dispersion, which equals the mean of the standard deviation of analyst EPS forecasts divided by the mean of forecasts, as in Diether, Malloy, and Scherbina [19] in the year prior to the repurchase announcement. Panel D details firms in the upper and lower quartile of the disagreement parameter, Disp1m, the median of the analyst forecast dispersion. P-values indicate if the Non-repurchase and repurchase samples are significantly different from each other with respect to the sample median and spreads, using a nonparametric Kolmogorov-Smirnov test. ** and * represent statistical significance at 1% and 5% level, respectively.

Table 1 reports sample summary statistics. Panel A summarizes the full sample and suggests that the market

values of the repurchasing and matching sample are similar. However, when compared to the matching firms, the repurchasing firms have a higher book-to-market ratio. This result casts first doubt on the argument that the book-to-market ratio solely drives the share repurchases. Repurchase firms also have more cash and free cash flows than controlling sample, consistent with agency hypothesis and our model.

In panel B, we compare the repurchase sample with matching sample in the highest and lowest book-to-market ratio quartiles. The difference between the repurchasing firms and the matching sample changes as the book-to-market ratio changes. Significant differences exist in high book-to-market ratio firms, but, not in the low book-to-market ratio pairs. This result is consistent with the literature that book-to-market ratio is a key factor that affects share repurchases.

Panel C shows the results sorted by our key divergence of opinion variable, the dispersion of analyst earnings forecasts. Since the model predicts that it is the high divergence of opinion drives share repurchases, we expect the effect of book-to-market ratio and other variables are absorbed by the variable of divergence of opinion, especially in the highest divergence of opinion quartile. The results in panel C and D are exactly what we expect: the differences in book-to-market ratios, firm sizes, and free cash flows between the two samples become insignificant in the highest divergence of opinion quartile. In the lowest divergence of opinion quartile, the repurchase sample has a higher book-to-market ratio.

5. Empirical Results

5.1 The Likelihood of Share Repurchases

To examine the explanatory power of the book-to-market ratio, divergence of opinion, and other proxies suggested by the signaling and agency hypotheses, we run a horse racing regression. First, we run logistic regressions on variables from existing hypotheses. The results are presented in Table 2, Panel A.

We find that firms with a high book-to-market ratio are more likely to repurchase shares. The sign of the coefficient for the book-to-market ratio is positive and statistically significant for most of the regression models. Consistent with the undervaluation signaling hypothesis, we find that firms with high information asymmetry are more likely to repurchase shares, as *Psi* is negative and significant. We also find that repurchase firms have a lower profit margin after controlling for other characteristics. The coefficient for PM is significant at the 1% level across all regressions. The fixed asset is positive and significant. Recall that the fixed assets could be proxy for both information asymmetry and growth opportunity. As a proxy for information asymmetry, the positive sign on fixed assets is inconsistent with the direct measure of information asymmetry, *Psi*. The positive coefficient on fixed assets may also suggest the repurchase firms have less growth opportunity. This result, combined with the negative sign on profit margin, implies that managers tend to repurchase share when the firm has lower income and less growth opportunities. This implication is consistent with the argument that repurchases are an earnings management tool.[27] However, we do not find evidence to support the agency problem hypothesis. The coefficient for *Cash*, *FCFs*, and *OXD* are not statistically significant.

Panel B shows the regressions results when we add our proxies for the divergence of opinion. Consistent with the prediction of the model, all proxies of divergence of opinion are positive and significant at the 1% level. Firms with higher divergence of opinion are more likely to repurchase shares. More strikingly, we find that after including the divergence of opinion variables, the effect of book-to-market ratio becomes insignificant. Profit margin is negative and significant.

Finally, as in Dittmar [20] we put all proxies for different hypotheses into one regression and examine which one has the most explanatory power. As the model predicts, proxies of divergence of opinion are positive and significant. The profit margin is positive and significant, and the information asymmetry proxies lost their explanatory power. The positive signs on both fixed assets and divergence of opinion proxies, together with the negative sign on profit margin, indicate that when investors have different opinions about the firm's future and the firm has no better investment opportunity, the managers often repurchase shares from pessimistic shareholders.

Overall, the results in Table 2 are consistent with our theoretical prediction 1 that the divergence of opinion affects the decision to repurchase share. We confirm the results of existing literature that the book-to-market ratio and information asymmetry are positively related to the likelihood of a share repurchase. However, we also show that divergence of opinion has incremental explanatory power than the book-to-market ratio and information asymmetry.

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27 For the literature on this argument, see Roychowdhury [56], Hribar, Jenkins and Johnson [39], Gong, Louis and Sun [31], among others.
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Table 2. Horse races of logistic regression on share repurchase determinants

Panel A: logistic regression on information asymmetry and agency proxies

Wald-score	50.57	50.38	21.71	52.68	46.58	45.80	67.59
	logitO1	**logitA1**	**logitA2**	**logitA3**	**logitI1**	**logitI2**	**logitI3**
intercept	0.317	0.288	0.714	-0.031	0.106	0.399	0.352
	0.31	0.37	0.06	0.94	0.76	0.21	0.27
bmratio	**0.192**	**0.204**	**0.367**	**0.206**	**0.212**	0.174	0.146
	0.04	0.04	0.00	0.03	0.03	0.07	0.12
Ln(mk)	0.028	0.029	-0.001	0.032	0.034	0.023	0.014
	0.18	0.17	0.97	0.13	0.13	0.28	0.55
PM	**-2.294**	**-2.303**	**-0.889**	**-1.987**	**-2.060**	**-2.126**	**-1.936**
	0.00	0.00	0.02	0.00	0.00	0.00	0.00
return	-0.010	-0.026	-0.601	-0.029	-0.459	-0.418	-0.213
	0.97	0.97	0.61	0.97	0.66	0.68	0.83
Cash		0.100					
		0.71					
CF			-0.331				
			0.74				
OXD				0.326			
				0.16			
Psi					**-0.063**		
					0.07		
Rcov						-0.235	
						0.23	
Fix Assets							**0.694**
							0.00

Penal B: logistic regression on divergence of opinion proxies and pooled multi-factor regression

Wald-score	61.63	59.50	214.31	64.60	56.01	53.79	77.65	74.02
	logitD1	**logitD2**	**logitD3**	**logitD4**	**logitP1**	**logitP2**	**logitP3**	**logitP4**
intercept	0.152	0.243	1.237	0.923	0.057	0.109	-0.088	-0.003
	0.64	0.44	0.00	0.01	0.87	0.76	0.83	0.99
bmratio	0.186	0.173	0.101	**0.196**	0.189	0.184	0.154	0.146
	0.05	0.07	0.29	0.04	0.06	0.07	0.11	0.13
Ln(mk)	0.034	0.028	0.013	0.004	0.035	0.031	0.022	0.017
	0.11	0.18	0.56	0.85	0.11	0.17	0.31	0.42
PM	**-1.994**	**-2.097**	**-2.122**	**-2.289**	**-1.776**	**-1.889**	**-1.425**	**-1.538**
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
return	0.212	0.206	0.349	-0.031	-0.185	-0.029	-0.029	-0.059
	0.83	0.84	0.74	0.97	0.86	0.84	0.97	0.95
Cash					-0.113	-0.029		
					0.68	0.91		
CF								
OXD							0.271	-0.268
							0.24	0.25
Psi					-0.042	-0.044		
					0.23	0.21		
Rcov								
Fix Assets							**0.649**	**0.629**
							0.00	0.00
Disp1	**0.566**				**0.521**		**0.497**	
	0.01				0.00		0.00	
Disp3		**7.007**				**6.502**		**5.483**
		0.00				0.00		0.01
Abto_median			**-2.069**					
			0.00					
SUV_median				**1.381**				
				0.00				

This table reports the horse race logistic regression among several hypothesized motivations. The dependent variable equals one if a firm announces at least once open market share repurchase in that year, or else equals zero. Psi, another measure of information asymmetry, is defined as $Psi = \ln\left[(1-R_i^2)/R_i^2\right]$ as in Dittmar and Thakor [21], where R_i^2 is industry i's average R^2 from a regression of firm-specific weekly returns on value-weighted market and value-weighted industry indices. The industry is defined at the two-digital SIC code. Rcov, the residual of analyst coverage, is another measure of information asymmetry, defined as the residual from yearly regressions of ln(1 + analyst coverage) on ln(MV) and ln(B/M), as in Diether, Malloy and Scherbina [19]. We select, FA, the ratio of fixed assets to total assets as the third measure of information asymmetry, computed as in Dittmar and Thakor [21]. Disp1, the standard deviation of analyst annual EPS forecasts divided by the mean of forecasts as in Diether, Malloy and Scherbina [19]; Disp3, the standard deviation of analyst annual EPS forecasts divided by the stock price as in Garfinkel [28]; AbTO, the abnormal market adjusted turnover as in Hong and Stein [38] and Garfinkel [28], SUV, the standardized unexplained trading volume as in Garfinkel [28], into quartiles. Other independent variables are defined as in Table 1. We run general linear regression for every proxy for each hypothesis. We then select the best proxy for each hypothesis and run the pooled the multi-factor regression. The p-values are reported and the bold font represents significant at or less than 5% level.

Panel B shows the regressions results when we add our proxies for the divergence of opinion. Consistent with the prediction of the model, all proxies of divergence of opinion are positive and significant at the 1% level. Firms with higher divergence of opinion are more likely to repurchase shares. More strikingly, we find that after including the divergence of opinion variables, the effect of book-to-market ratio becomes insignificant. Profit margin is negative and significant.

Finally, as in Dittmar [20], we put all proxies for different hypotheses into one regression and examine which one has the most explanatory power. As the model predicts, proxies of divergence of opinion are positive and significant. The profit margin is positive and significant, and the information asymmetry proxies lost their explanatory power. The positive signs on both fixed assets and divergence of opinion proxies, together with the negative sign on profit margin, indicate that when investors have different opinions about the firm's future and the firm has no better investment opportunity, the managers often repurchase shares from pessimistic shareholders.

Overall, the results in Table 2 are consistent with our theoretical prediction 1 that the divergence of opinion affects the decision to repurchase share. We confirm the results of existing literature that the book-to-market ratio and information asymmetry are positively related to the likelihood of a share repurchase. However, we also show that divergence of opinion has incremental explanatory power than the book-to-market ratio and information asymmetry.

5.2 The Fraction of Target Shares in Announcements of Open Market Repurchases

From the point of classical signaling theory, the announcements of open market share repurchases are not a convincing signal. First, open market repurchase announcements are not a commitment. There is no penalty for non-execution, and firms can stop or withdrawn from a repurchasing program at any time. Stephens and Weisbach [57] report that approximately one-half of firms announcing a share repurchase bought their target number. More than 10 percent of repurchasing firms bought less than 5% of target shares during the three-year period following the announcement. Second, such repurchase announcements do not contain much solid information. The only numbers in the announcements are what percent of the firm's shares the managers intend to buy. An open market repurchasing program usually does not have a fixed ending date. Third, until 2004, managers did not have to disclose the actual shares repurchased in their financial statements. To examine the strength of the motivation behind a repurchase announcement, we use the targeted fraction of shares to be repurchased.

We test our hypothesis H2 by examing the relationship between the fraction of target shares in announcements and the suggested proxies. We then run a general linear regression while controlling for various firm characteristics. As in Fama and French [25], we double sort the share repurchasing sample by the book-to-market ratio and other hypothesized motivation proxies. The results are reported in Table 3.

Table 3. percentage of shares sought and the percentage of announced program completed

***Panel A**: Double sort by B/M ratio and firm specific risk (Psi), high Psi, low Inf. Asy.*

bmq	*Psi*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*110*	*8.45*	*6.15*	*11%*
	2	*80*	*8.28*	*6.10*	*20%*
	3	*89*	*7.49*	*5.60*	*9%*
	largest	*68*	*8.00*	*6.45*	*25%*
2	*lowest*	*104*	*7.65*	*6.40*	*20%*
	2	*88*	*6.46*	*6.05*	*10%*
	3	*67*	*6.05*	*5.00*	*16%*
	largest	*88*	*9.81*	*6.50*	*13%*
3	*lowest*	*86*	*5.88*	*5.00*	*17%*
	2	*88*	*6.71*	*5.20*	*13%*
	3	*94*	*7.32*	*5.45*	*14%*
	largest	*79*	*8.36*	*5.80*	*24%*
largest	*lowest*	*75*	*7.54*	*5.60*	*12%*
	2	*82*	*6.74*	*5.00*	*13%*
	3	*88*	*8.89*	*8.05*	*16%*
	largest	*103*	*9.15*	*7.90*	*20%*

***Panel B**: Double sort by B/M ratio and residual of analyst coverage*

bmq	*Rcov*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*101*	*8.42*	*6.20*	*10%*
	2	*71*	*8.19*	*6.10*	*18%*
	3	*80*	*7.54*	*5.60*	*15%*
	largest	*95*	*8.08*	*6.20*	*19%*
2	*lowest*	*95*	*7.07*	*6.20*	*14%*
	2	*79*	*7.08*	*5.70*	*19%*
	3	*90*	*7.94*	*6.00*	*12%*
	largest	*83*	*8.27*	*6.00*	*16%*
3	*lowest*	*88*	*7.82*	*5.15*	*17%*
	2	*93*	*7.02*	*5.40*	*15%*
	3	*83*	*6.06*	*5.00*	*22%*
	largest	*83*	*7.25*	*5.30*	*13%*
largest	*lowest*	*91*	*9.42*	*7.40*	*13%*
	2	*94*	*7.38*	*5.50*	*10%*

	3	86	7.74	6.60	21%
	largest	77	8.12	6.90	21%

Panel C: Double sort by B/M ratio and Fixed Assets

bmq	FAq	obs.	%sought_mean	%sought_median	%completed
lowest	lowest	22	5.79	4.90	14%
	2	126	7.29	6.10	13%
	3	124	9.30	6.80	20%
	largest	75	8.04	5.60	12%
2	lowest	81	6.07	5.00	9%
	2	89	7.52	6.50	19%
	3	95	7.75	6.50	19%
	largest	82	8.96	5.90	12%
3	lowest	122	6.19	5.00	14%
	2	67	7.61	6.30	16%
	3	77	7.78	5.60	21%
	largest	81	7.18	5.20	17%
largest	lowest	153	6.92	5.10	19%
	2	55	9.04	7.00	9%
	3	41	8.76	7.50	27%
	largest	99	9.36	8.30	10%

Panel D: Double sort by B/M ratio and Cash

bmq	Cash	obs.	%sought_mean	%sought_median	%completed
lowest	lowest	71	9.86	6.20	18%
	2	63	7.56	5.60	17%
	3	76	8.19	6.60	12%
	largest	137	7.32	5.70	15%
2	lowest	82	8.37	6.00	13%
	2	89	6.22	5.00	12%
	3	77	6.75	6.00	14%
	largest	99	8.80	7.80	19%
3	lowest	88	7.66	5.80	19%
	2	81	6.39	5.00	12%
	3	108	6.28	5.00	16%
	largest	70	8.23	5.70	20%
largest	lowest	109	8.87	7.90	17%
	2	113	7.72	6.40	20%
	3	85	7.82	5.60	12%
	largest	41	8.27	6.30	10%

Panel E: Double sort by B/M ratio and Cash Flows

bmq	CF	obs.	%sought_mean	%sought_median	%completed
lowest	lowest	125	7.38	6.00	15%
	2	43	7.38	6.30	16%
	3	71	8.19	5.90	15%
	largest	108	9.09	5.90	15%
2	lowest	152	6.84	5.15	14%
	2	68	8.47	6.40	25%
	3	73	8.80	7.00	11%
	largest	54	6.91	6.00	11%
3	lowest	207	6.82	5.10	14%
	2	46	6.82	5.80	28%
	3	51	8.76	5.50	20%
	largest	43	6.35	5.00	12%
largest	lowest	230	7.77	6.25	16%
	2	68	8.17	7.05	19%
	3	30	10.62	6.80	10%
	largest	20	9.09	9.20	15%

This table provides mean (%sought_mean) and median of percentage (%sought_median) of shares sought for a repurchasing program and the percentage of completed open market repurchase program (%completed) across subsamples sorted by measures of information asymmetry and agency problems. The full sample covers all open market repurchase programs with 'Completed' and 'Intended to Completed' status in the SDC platinum through 1994 to 2003. The sample are first sorted by Fama and French [25] Book-to-Market ratio and then proxies: Psi, another measure of information asymmetry, is defined as $Psi = \ln\left[(1-R_i^2)/R_i^2\right]$ as in Dittmar and Thakor [21], where R_i^2 is industry i's average R^2 from a regression of firm-specific weekly returns on value-weighted market and value-weighted industry indices. The industry is defined at the two-digital SIC code. Rcov, the residual of analyst coverage, is another measure of information asymmetry, defined as the residual from yearly regressions of ln(1 + analyst coverage) on ln(MV) and ln(B/M), as in Diether, Malloy and Scherbina [19]. We select, FA, the ratio of fixed assets to total assets as the third measure of information asymmetry, computed as in Dittmar and Thakor [21]. The higher Rcov, lower Psi, and lower FA represent the higher information asymmetry. Cash and free cash flows are measures of potential agency problem motivated repurchase, as in Dittmar [20]. Cash is the sum of cash and cash equivalent divided by total assets, while CF is the cash flow, the net income before taxes plus depreciation and changes in deferred taxes and other deferred charges divided by total assets. Results are represented in panel A, B, C, D, and E, respectively. All variables are measured one year prior to the announcement of share repurchase.

To test the information asymmetry hypothesis, we double sort the repurchasing sample by book-to-market ratio and information asymmetry proxies, *Psi*, and $R\cov$. The results are presented in Table 3, panels A and B, respectively. The fraction of target shares, measured as mean and median of percentage shares sought increases with *Psi*, and increases only in high book-to-market ratio quartiles (quartile 3 and 4). Recall that *Psi* is an inverse measure of information asymmetry. The larger the *Psi*, the smaller is the information asymmetry. Thus, the increasing in the fraction of target shares along with *Psi* suggests that firms actually intend to repurchase less when information asymmetry is higher. This result implies that, if different opinion component caused by information asymmetry can be absorbed by divergence of opinion, information asymmetry may actually keep managers from repurchasing shares. We argue that the reason is because with high information asymmetry, managers face server adverse selection costs. Similar to the idea in Miller and Rock [50], managers bear high adverse selection costs and lose to informed traders in the markets. In the high book-to-market ratio quartiles, we also find that the less the information asymmetry, the more likely the firm will finish the repurchasing program.

The results from double-sorting on the book-to-market ratio and fixed assets are reported in panel C. Consistent with the results from direct measure of information asymmetry, the indirect measure of information asymmetry, fixed assets, also has a positive relationship with the fraction of target shares. The mean and median of percentage shares sought increase with the value of fixed assets and this pattern is consistent across all book-to-market ratio quartiles, except for the lowest one. Overall, the results suggest that if the fraction of target shares in repurchasing announcements is a signaling tool used by managers, information asymmetry actually reduces the motivation for managers to use such a tool and adds additional costs to accomplish their commitments.

We then examine the excess capital distribution hypothesis by double-sorting the sample on book-to-market ratio and Cash and Cash Flows. We do not find a significant pattern across quartile portfolios sorted by Cash, as presented in Table 3, panel D. However, the fraction of target shares increases with the amount of free cash flows in the highest book-to-market ratio quartile, which is consistent with the excess capital distribution hypothesis.

We have re-examined the existing literature and the results support the undervaluation hypothesis as the significance is driven by high book-to-market ratio firms. However, rather than supporting the information asymmetry explanation, the evidence suggests that the potential adverse selection problem caused by information asymmetry might reduce the motivation for managers to repurchase shares. Our results weakly support the excess-capital-distribution hypothesis.

We then double sort the repurchasing sample by book-to-market ratio and four divergence of opinion proxies, *Disp*1, *Disp*2, *Abto*, and *SUV*. Results are reported in Table 4.

Table 4. percentage of shares sought and the announced program completed – divergence of opinion

***Panel A**: Double sort by B/M ratio and Dispersion of Analyst Earnings Forecasts/Mean*

bmq	*Disp1q*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*94*	*7.50*	*5.65*	*14%*
	2	*88*	*7.34*	*5.45*	*18%*
	3	*84*	*10.01*	*7.70*	*15%*
	largest	*81*	*7.53*	*5.80*	*14%*
2	*lowest*	*100*	*6.66*	*5.00*	*14%*
	2	*80*	*7.60*	*6.40*	*10%*
	3	*95*	*8.67*	*6.10*	*11%*
	largest	*72*	*7.41*	*6.40*	*29%*
3	*lowest*	*96*	*6.34*	*5.00*	*23%*
	2	*84*	*6.80*	*5.00*	*17%*
	3	*77*	*8.32*	*5.40*	*17%*
	largest	*90*	*6.85*	*5.95*	*9%*
largest	*lowest*	*57*	*6.14*	*5.00*	*19%*
	2	*94*	*8.29*	*6.50*	*11%*
	3	*92*	*8.40*	*7.05*	*22%*
	largest	*104*	*9.00*	*7.95*	*13%*

***Panel B**: Double sort by B/M ratio and Dispersion of Analyst Earnings Forecasts/Price*

bmq	*Disp3q*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*64*	*8.32*	*5.40*	*14%*
	2	*70*	*8.22*	*6.00*	*16%*
	3	*58*	*8.02*	*6.15*	*17%*
	largest	*46*	*8.10*	*6.20*	*20%*
2	*lowest*	*78*	*6.29*	*5.00*	*12%*
	2	*82*	*7.43*	*5.75*	*15%*
	3	*96*	*7.18*	*6.15*	*13%*
	largest	*64*	*9.03*	*6.77*	*23%*
3	*lowest*	*56*	*6.73*	*5.00*	*20%*
	2	*106*	*7.26*	*5.05*	*24%*
	3	*85*	*6.85*	*5.20*	*14%*
	largest	*69*	*6.94*	*5.20*	*10%*

largest	*lowest*	*54*	*7.74*	*5.10*	*24%*
	2	*58*	*7.69*	*6.70*	*19%*
	3	*79*	*7.73*	*5.60*	*14%*
	largest	*67*	*8.24*	*7.40*	*12%*

***Panel C**: Double sort by B/M ratio and Abnormal Market Adjusted Turnover*

bmq	*AbTOq*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*102*	*7.98*	*5.85*	*8%*
	2	*78*	*6.98*	*5.75*	*26%*
	3	*83*	*6.72*	*5.00*	*17%*
	largest	*84*	*10.54*	*7.55*	*13%*
2	*lowest*	*103*	*7.92*	*6.00*	*10%*
	2	*75*	*6.99*	*5.80*	*23%*
	3	*71*	*7.26*	*6.00*	*23%*
	largest	*98*	*7.91*	*6.40*	*9%*
3	*lowest*	*100*	*7.51*	*5.10*	*16%*
	2	*88*	*6.49*	*5.00*	*17%*
	3	*95*	*6.43*	*5.40*	*22%*
	largest	*64*	*8.02*	*5.55*	*9%*
largest	*lowest*	*115*	*7.86*	*6.50*	*15%*
	2	*82*	*7.55*	*6.70*	*20%*
	3	*74*	*8.56*	*5.30*	*11%*
	largest	*77*	*8.91*	*8.20*	*18%*

***Panel D**: Double sort by B/M ratio and Standardized Unexplained Trading Volume*

bmq	*SUVq*	*obs.*	*%sought_mean*	*%sought_median*	*%completed*
lowest	*lowest*	*72*	*9.49*	*6.50*	*15%*
	2	*78*	*8.20*	*6.65*	*14%*
	3	*84*	*6.97*	*5.55*	*19%*
	largest	*113*	*7.91*	*5.60*	*13%*
2	*lowest*	*88*	*8.47*	*6.75*	*18%*
	2	*90*	*7.20*	*6.00*	*9%*
	3	*84*	*6.67*	*5.10*	*18%*
	largest	*85*	*7.98*	*6.30*	*15%*
3	*lowest*	*89*	*6.63*	*5.20*	*11%*
	2	*78*	*6.29*	*5.00*	*18%*
	3	*102*	*7.85*	*5.85*	*17%*
	largest	*78*	*7.23*	*5.20*	*22%*
largest	*lowest*	*117*	*8.66*	*6.90*	*20%*
	2	*95*	*8.14*	*6.60*	*17%*
	3	*71*	*7.56*	*6.20*	*10%*
	largest	*65*	*7.98*	*6.60*	*14%*

This table provides mean (%sought_mean) and median of percentage (%sought_median) of shares sought for a repurchasing program and the percentage of completed open market repurchase program (%completed) across subsamples sorted by measures of divergence of opinion. The full sample covers all open market repurchase programs with 'Completed' and 'Intended to Completed' status in the SDC platinum through 1994 to 2003. The sample are double sorted by Fama and French [25] Book-to-Market ratio and disagreement measures: Disp1, the standard deviation of analyst annual EPS forecasts divided by the mean of forecasts as in Diether, Malloy and Scherbina [19]; Disp3, the standard deviation of analyst annual EPS forecasts divided by the stock price as in Garfinkel [28]; AbTO, the abnormal market adjusted turnover as in Hong and Stein [38] and Garfinkel [28], SUV, the standardized unexplained trading volume as in Garfinkel [28] into quartiles. Results are represented in panel A, B, C, and D, respectively. Panel E reports the correlation coefficient among share repurchase determinants and the percentage of shares sought. All variables are measured one year prior to the announcement of share repurchase.

Panel A and B report mean and median of the fraction of target shares in announcements across quartiles sorted by book-to-market ratio and divergence of opinion measured from dispersion of analyst earnings forecasts. The value of the fraction of target shares increases with the estimate of divergence of opinion in both panels A and B. Especially, in panel B, the median increases monotonically with the dispersion of analyst earnings forecasts scaled by stock price across all four book-to-market quartiles. It's the first time in this paper we observe the repurchasing motivation proxy dominates the book-to-market ratio. This result is consistent with our hypothesis H2 that firms will announce more target shares when the divergence of opinion is higher. The incremental explain power of divergence of opinion over book-to-market ratio also suggests that the divergence of opinion is a key determinant in the decision of share repurchases. Additionally, we find an interesting pattern from the repurchasing program completion rate across quartiles. The completion rate increases as the divergence of opinion increases in the low book-to-market ratio quartiles. This is evidence that supports prediction 3 firms with higher divergence of opinion will not only announce more target shares, but also indeed repurchase more shares. However, a puzzle appears in the high book-to-market ratio quartiles: the completion rate decreases as the divergence of opinion increases. This result implies that although managers intend to announce large amount of target shares, constraint by high book-to-market ratios, they have no ability to repurchase such amount.

The portfolios built on divergence of opinion proxy, *Abto* , also suggest the fraction of target shares increases with the divergence of opinion. Although the trends through quartile 1 to quartile 4 in each book-to-market

ratio subsample are not as consistent as the ones in *Disp*1 and *Disp*2 quartiles, the fraction of target shares in quartile 4 is still significantly greater than the fraction in quartile 1. The results from our forth proxy of divergence of opinion, *SUV* , are however, mixed and insignificant. The in-significant results from *Abto* and *SUV* are expected. Remember that both abnormal turnover and standardized unexplained trading volume are computed from stock trading volume, shares outstanding, and returns. As long as firms actually repurchase shares after repurchase announcement, shares outstanding must change. Therefore, the value of *Abto* and *SUV* are affected by share repurchase itself and are no longer exogenous variables. Later on, we will show that their coefficients in regression analysis are also in-significant as expected.

Overall, the results are consistent with hypothesis H2 that firms with higher divergence of opinion announce more target shares in announcements. The larger repurchasing completion rates in the high *Disp*1 quartiles, especially in low book-to-market ratio subsample, suggest that those firms not only intend to repurchase more shares, but also actually repurchase those shares.

Before we jump into regression analysis, we examine the correlation coefficients among those variables. Since we have multiple proxies for each hypothesis, correlation coefficient will tell us where the potential multiple collinear problems could come from. We choose only one proxy for each hypothesis in the regression analysis. The correlation coefficients are reported in Table 5.

Table 5. Correlation coefficients for repurchase sample

	bmratio	*Ln(mk)*	*PM*	*Ret*	*Cash*	*CF*	*OEFF*	*Psi*	*Rcov*	*fixasset*	*Disp1*	*Disp3*	*Abto*
bmratio	*1.00*												
Ln(mk)	***-0.31***	*1.00*											
	0.00												
PM	*-0.06*	***0.13***	*1.00*										
	0.02	*0.00*											
Returns	*0.00*	*-0.01*	***0.09***	*1.00*									
	0.99	*0.68*	*0.00*										
Cash	*-0.16*	*-0.06*	*0.06*	*0.06*	*1.00*								
	0.00	*0.02*	*0.02*	*0.02*									
CF	*-0.11*	*0.07*	*0.50*	*0.15*	***0.09***	*1.00*							
	0.00	*0.04*	*0.00*	*0.00*	*0.01*								
OXD	*-0.05*	*-0.12*	*-0.55*	*-0.05*	*0.01*	***-0.13***	*1.00*						
	0.05	*0.00*	*0.00*	*0.07*	*0.72*	*0.00*							
Psi	*0.09*	*0.21*	*0.07*	*-0.16*	*-0.23*	*0.04*	*-0.09*	*1.00*					
	0.00	*0.00*	*0.01*	*0.00*	*0.00*	*0.18*	*0.00*						
Rcov	*0.02*	*0.01*	*-0.01*	*-0.14*	*-0.02*	*-0.03*	*-0.02*	*0.05*	*1.00*				
	0.55	*0.77*	*0.67*	*0.00*	*0.45*	*0.35*	*0.39*	*0.08*					
fixasset	*0.00*	*0.07*	*-0.21*	*-0.06*	*-0.16*	*0.07*	*0.11*	***0.10***	*-0.01*	*1.00*			
	0.91	*0.01*	*0.00*	*0.04*	*0.00*	*0.03*	*0.00*	*0.00*	*0.79*				
Disp1	*0.05*	*-0.12*	***-0.23***	*-0.12*	*0.07*	*-0.19*	*0.10*	*-0.13*	*0.00*	*0.07*	*1.00*		
	0.04	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.94*	*0.01*			
Disp3	*0.10*	*-0.13*	***-0.25***	*-0.11*	*0.05*	*-0.16*	*0.13*	*-0.13*	*0.06*	*0.16*	***0.64***	*1.00*	
	0.00	*0.00*	*0.00*	*0.00*	*0.07*	*0.00*	*0.00*	*0.00*	*0.02*	*0.00*	*0.00*		
Abto_median	*0.03*	*0.01*	*0.04*	*-0.12*	*-0.06*	*0.04*	*-0.01*	*0.21*	*0.04*	*-0.02*	*-0.02*	*0.05*	*1.00*
	0.33	*0.58*	*0.19*	*0.00*	*0.03*	*0.29*	*0.64*	*0.00*	*0.18*	*0.58*	*0.38*	*0.07*	
SUV_median	*-0.15*	***0.28***	*0.06*	*-0.01*	*-0.01*	*0.06*	*-0.03*	*0.03*	*0.00*	*0.06*	*-0.04*	*-0.03*	*0.00*
	0.00	*0.00*	*0.02*	*0.76*	*0.78*	*0.07*	*0.33*	*0.20*	*0.86*	*0.04*	*0.14*	*0.25*	*0.94*

We adopt three variables to proxy for agency problem: Cash, Free Cash Flows, and Operation Expenditure. Among them, Cash and Free Cash Flows are significant correlated, but the correlation coefficient is less than 0.1. Free Cash Flows and Operation Expenditure are also negatively significantly correlated with -0.13 coefficient estimates. Among three proxies for information asymmetry, *Psi* ,and Fixed Assets are significantly correlated with coefficient 0.1. As expected, two proxies for divergence of opinion estimated from analyst earnings forecast data, *Disp*1 and *Disp*3 are positively significantly correlated with a coefficient value 0.64. We drop one of them in our regression analysis. The result form general linear regression analysis is reported in Table 6.

The horse racing regression analysis is similar to the one in testing prediction 1 and 2. We first run a regression without controlling for any other hypothesized motivations to test the effect of firm's size, book-to-market ratio, and stock return momentum on share repurchase. We find that large firms tend to announce small fraction of target shares in repurchase announcement. This result is expected. Small firms usually have fewer shares outstanding; therefore, with same amount of shares sought in announcement, small firms have a larger fraction of target shares. The book-to-market ratio and past year returns are not significant. Interestingly, the firm's profit margin is significantly

negatively related with the fraction of target shares. The negative coefficient implies that firms with trouble in increasing or keeping earnings tend to announce large number of target shares. By reducing more shares outstanding, managers can artificially increase earnings per share.

We then test the excess capital distribution hypothesis by adding proxy for agency problem. Although Cash and

Free Cash Flows are not significant as predicted by agency problem based cash distribution hypothesis, we do find that firms announce larger fraction of target shares have higher operation costs, which implies potential agency problem. Together with the negative coefficient on Profit margin, the result suggests that managers spend too much in operation, however, cannot improve the earnings.

Table 6. Regression analysis on determinants of the fraction of target shares in announcements

Fit-value	3.73	3.29	5.95	3.46	5.78	5.06	5.55	6.42	7.31	5.75	5.4	6.38
	O	**A**	**A**	**A**	**IA**	**IA**	**IA**	**DO**	**DO**	**DO**	**DO**	**Pool**
Inter.	11.89	12.36	8.814	11.14	11.84	10.012	10.618	10.155	10.015	10.918	10.59	9.472
	0	0	0	0	0	0	0	0	0	0	0	0
bmratio	-0.325	-0.353	-0.242	-0.226	-0.385	-0.008	-0.332	-0.37	-0.444	-0.324	-0.350	-0.418
	0.43	0.47	0.56	0.64	0.36	0.98	0.43	0.37	0.28	0.43	0.39	0.32
lnmk	**-0.277**	**-0.338**	**-0.269**	**-0.350**	**-0.330**	**-0.264**	**-0.306**	**-0.261**	**-0.261**	**-0.288**	**-0.281**	**-0.296**
	0	0	0	0	0	0	0	0	0	0	0	0
pm	**-3.657**	0.660	-2.098	0.683	**-3.805**	**-3.256**	**-3.268**	**-3.117**	-2.745	**-4.048**	**-4.142**	-0.358
	0.02	0.78	0.27	0.8	0.02	0.04	0.04	0.05	0.09	0.01	0.01	0.85
return	-6.981	-11.87	-5.657	-10.74	-4.176	-4.370	-5.516	-4.105	-3.988	-6.667	-5.695	-2.206
	0.14	0.03	0.22	0.05	0.38	0.35	0.24	0.37	0.39	0.15	0.22	0.64
cash	1.642											
	0.14											
Cash Flow		-1.755										
		0.66										
OXD			**1.833**									**1.871**
			0.05									0.04
RE				0.404								
				0.75								
Psi					0.293							**0.362**
					0.04							0.01
Rcov						0.569						
						0.49						
Fix Assets							1.173					
							0.08					
Disp1								1.593				
								0.05				
Disp3									35.167			**35.28**
									0			0
Abto										-0.926		
										0.11		
SUV											-0.34	
											0.81	

This table reports the horse races on general linear regression among several hypothesized motivations after controlling for heterogeneous error and year-trend. The dependent variable is the fraction of target shares (parentage of shares sought). The independent variables are defined as in Table 4. We run general linear regression for every proxy for each hypothesis. We then select the best proxy for each hypothesis and run the pooled the multi-factor regression. The p-values are reported and the bold font represents significant at or less than 5% level.

Consistent with the results from portfolio approach analysis, the information asymmetric proxy *Psi* has a significant and positive sign. Firms with less information asymmetry problem announce more target shares, although the likelihood test in Table 2 suggests information asymmetry is a reason why firms announce share repurchases. This seemly contradict result is consistent with the fact that although repurchases are not a commitment, as Stephens and Weisbach [57] argue, firms a large proportion of announcing firms still repurchases their target shares and finish the program. We, again, tend to conclude that the potential adverse selection costs due to information asymmetry actually are resistant for managers actual share repurchases.

As the model predicted, two proxies for divergence of opinion, *Disp*1 and *Disp*3 , are both positive and significant. Consistent with the results in portfolio approach, other two proxies, *Abto* and *SUV* , are neither significant. We therefore will drop these two proxies. Since *Disp*3 has a higher significance level than *Disp*1 , we choose *Disp*3 as our best proxy for divergence of opinion in pool horse race regression.

Before we run the horse race, the changes on the coefficient of Profit margin draw us attentions. This coefficient keeps negative and significant at 5% level through all above regressions. This seems strongly support the Roychowdhury [56] earnings management tool hypothesis. However, after including *Disp*3 , the significant level of Profit margin reduces to 10% level. We argue that the decreases in the explanation power of Profit margin are because investors have different opinions on the share repurchasing firm's profit ability, although share repurchasing firms generally have low level of profit ability. The one who accept the firm's profit ability will hold her shares, while the other who is not satisfied will tender shares.

The pooled horse race regression confirms our model prediction 3 and 4, as well as our conjectures on adverse

selection costs and firms' profitability. Divergence of opinion significantly affects the fraction of targeted shares in announcements. The large the divergence of opinion, the larger is the number of targeted shares. Rather than information asymmetry driving the share repurchases, the adverse selection costs due to information asymmetry are resistant for managers to repurchase shares. Profitability becomes insignificant as expected.

5.3. Long-term Price Drift and Actual Share Repurchases

Long-term abnormal returns following announcement of open market share repurchases were early documented by Ikenberry, Lakonishok and Vermaelen [41], followed by Ikenberry, Lakonishok and Vermaelen [42], Rau and Vermaelen [55], Zhang [64] and Peyer and Vermaelen [54]. The abnormal returns due to long-term price upward drift have been attributed to investors' under-reaction [36] or mistakes [54]. However, those explanations bring out further questions: why investors keep under reacting or making mistakes in share repurchases. Our model suggests that investors neither under-react to announcements of share repurchase, nor do they continuously make mistakes. Investors choose to tender or hold their shares based on their own opinions. The long-term price drift is due to the property of the long-term open market repurchasing program.

Table 7. Actual share repurchase sample statistics

***Panel A**: Firms with 'Completed' or 'Intend to completed' repurchasing program*				
year	*# of firms*	*%sought*	*Book/market*	*Size*
2004	*7102*	*7.68*	*0.9327*	*6.5767*
2005	*6828*	*8.07*	*0.8927*	*6.6509*
2006	*6514*	*8.15*	*0.8747*	*6.7424*
2007	*6015*	*7.80*	*0.9504*	*6.8361*
2008	*5303*	*7.94*	*1.2595*	*7.0084*
***Panel B**: Firms with 'Completed' repurchasing program only*				
year	*# of firms*	*%sought*	*Book/Market*	*size*
2004	*2430*	*10.40*	*1.0235*	*6.7754*
2005	*2307*	*6.98*	*0.9595*	*6.8269*
2006	*2170*	*8.58*	*0.9431*	*6.9479*
2007	*1982*	*6.48*	*1.0201*	*7.0399*
2008	*1773*	*8.12*	*1.3418*	*7.1871*
***Panel C**: Three-day cumulated market excess return around announcements by firms with 'Completed'or 'Intend to completed' repurchasing program*				
year	*CAR*	*%sought*		
2004	*1.64%*	*7.91*		
2005	*1.28%*	*8.35*		
2006	*1.55%*	*8.08*		
2007	*1.07%*	*8.04*		
2008	*1.46%*	*8.12*		

This table reports the sample statistics for firms announce open market share repurchase from 2004 to 2008. %sought is the percentage of shares sought (the fraction of target shares) in a repurchase announcement. Book-to-market ratio is calculated as Fama and French [25] and Size is measured as the market value of the repurchasing firm at the end of year prior to announcement of share repurchase. CAR is the three-day cumulative market excess return around the announcement of share repurchase, as in Peyer and Vermaelen [54]. Panel A reports the statistics for firms whose repurchasing programs are labeled as 'Completed' or 'Intend to Completed' in SDC database, while panel B reports statistics for 'Completed' firm only. Panel C represents the three days cumulative market excess returns around announcements.

We test hypothesis H3 by looking at actual share repurchase data. We first select firms who announce open market share repurchases from SDC platinum. We screen the sample firms with same conditions as early. Starting from 2004, the SEC requires firms to report actual share repurchase information. We collect the actual share repurchase information in firm's quarterly reports from Compustat Quarterly data. The final sample covers from 2004 to 2008 and the sample statistics are reported in Table 7.

We first separate the full sample into two sub-samples according to their repurchasing program status. Although two sub-samples are similar in firm size, firms who have completed their program averagely have higher book-to-market ratio. This result is consistent with existing literature that book-to-market ratio is a driving force of share repurchases. The differences in the fraction of target shares are insignificant. The abnormal announcement returns are also similar to previous findings, suggesting that the property of share repurchases after the SEC disclosure rule does not change too much.

Table 8. Long-term price drift for firms do NOT actually

Months	Prior	# of obs.	Post	# of obs.	Post-prior	T-value
12	-0.22%	6441	0.205%	10289	0.428%**	-2.67
24	0.10%	10975	0.167%	17584	0.059%	-0.47
36	0.24%	14057	0.129%	21462	-0.111%	0.96
48	0.248%	15777	0.153%	23511	-0.095%	0.84

This table reports the long-term price drift for firms who announced share repurchase from 2004 to 2008, but did not repurchase any shares after the announcements. The long-term price drift is measured by market excess return. We use Fama [24] time calendar approach to compute market excess return by subtracting market return (CRSP weighted monthly average) from stock monthly raw return.1 Months are the number of month prior to or after a repurchasing announcement.

The model predicts that the long-term price drifts are due to actual share repurchases, rather than an under-reaction to share repurchase announcements. Therefore, one should not observe the long-term abnormal returns following an announcement where no share is actually repurchased. We test this prediction by examining the abnormal return from a selected sample where firms only announce repurchases but do not actually repurchase shares. We use the calendar approach proposed by Fama [24] to estimate the abnormal returns for one to four years around announcements of share repurchases. The results are reported in Table 8. Different from existing literature, but consistent with the model prediction, there is no positive abnormal return following announcements. The returns on a long-term buy and hold portfolio are no different between the periods before announcements and the periods after.

The result in Table 8 provides indirect support for the hypothesis H3. We test the H3 directly by examining the abnormal returns and the timing of actual share repurchases. The model predicts that price stays high right after actual share repurchases, as if no information were released from actual share repurchases and investors do not update their reservation values. We estimate the monthly abnormal return with Fama [24] approach and compute the average monthly return for the months with actual repurchases and without actual repurchases. Due to the limitation of the SEC filing requirement and the structure of Compustat data, we can only observe the frequency of actual share repurchases at quarterly level. The average monthly abnormal returns for repurchasing

quarters and non-repurchasing quarters are reported in Table 9, in the window from one to four years.

The result looks striking at first glance. The abnormal returns in non-repurchasing quarters are significantly higher than ones in repurchasing quarters, directly opposite with the model prediction. This result, however, is consistent with the price support hypothesis that managers repurchase shares when the stock price is low. The negative market excess returns reflect managers' ability in timing the market. The quarterly actual repurchase data is not suitable to test the immediate price reaction to share repurchases. With the trading level data from Hong Kong market, Brockman and Chung [9] are able to examine the price behavior following actual share repurchases. Although they focus on managerial timing and the liquidity effects, they document that returns in repurchase periods are significantly higher than the ones in non-repurchase periods. [29] Their results lend direct support for this heterogeneous expectation share repurchase model.

Table 9. Abnormal return and actual share repurchase

Months	No_repur	Repur	No-repur - Repur	T-value
12	0.36%	-0.10%	0.46%**	2.27
24	0.39%	-0.12%	0.51%**	3.16
36	0.34%	-0.17%	0.51%**	3.55
48	0.24%	-0.15%	0.49%**	3.68

This table reports the differences in abnormal returns between firms who announced but did not repurchase any shares and firms who announced and actually repurchased shares from 2004 to 2008. The abnormal returns are Alfas from regressing firms' monthly raw return on market return, firm size, and book-to-market ratio (Fama-French three factor model) in each period. Month is the number of months after a repurchasing announcement.

6. Conclusion

In this paper, considering the investors' opinion divergence, we investigate why firms repurchase shares. Although the undervaluation-signaling hypothesis has been popular for years, the empirical evidence often is not consistent with the signaling hypothesis. Many researchers borrow the ideas from behavioral finance, and accept the irrational explanation that investors persistently under-react to repurchase announcements and make mistakes. This explanation, however, challenges the principle of market efficiency. It is not clear why rational investors do not arbitrage on long-term abnormal returns.

In our model, investors are fully rational, but different from each other in that they hold different expectations about the firm's cash flows. That is, investors can hold different opinions about firm's future cash flows even though they observe the same market information. Thus, they react differently to the same information conveyed in repurchase announcements. Each investor chooses the optimal trading strategy based on their reservation values, and the offered repurchasing prices. The managers' share repurchase decision maximizes each shareholder's utility in different ways. Pessimistic shareholders are able to tender their shares and gain a tender premium, while optimistic shareholders acquire more shares of future cash flows and a higher liquidation value of their share holdings. Any long-term price drift, following a share repurchase announcement, reflects the movement of the price along the investors' demand curve. Share repurchases are indeed 'best choices' when the firm has excess capital and few investment opportunities. Our model is consistent with the top two reasons that managers responded to in a real world survey by Brav et al [8]. [30]

In addition to providing a theory that is consistent with documented anomalies about share repurchases, this paper also presents supportive empirical evidence. We find the likelihood that a firm will repurchase shares increases, as the divergence of investor opinion increases. This pattern holds consistent, even after controlling for the book-to-market ratio, firm size, past returns, and information asymmetry. We also document a positive relationship between the divergence of opinion and the announced target shares. There is no long-term abnormal return, if a firm only announces a repurchasing program but does not repurchase any stock. Overall, our evidence suggests that the heterogeneous expectation theory has incremental explanation power over existing hypotheses.

The model and the evidence presented in this paper mainly focus on a firm's share repurchase decision. However, like Dittmar and Thakor [21], this paper provides an alternative explanation that can affect corporation decisions. The classic homogeneous assumption might not hold in a real managers' decision-making environment, so the heterogeneity assumption is required to understand manager and investor behavior.

29 Brockman and Chung [9], "Managerial timing and corporate liquidity: evidence from actual share repurchases," *the Journal of Financial Economics*, 61, page 434, Table 5.

30 In responding the question 'What factors might get your company to seriously consider repurchasing shares in the future?', managers rank (1) Market undervaluation of our stock and (2) Our company having extra cash/marketable securities the top two factors that affect the repurchasing decision. Managers also state that 'We make repurchase decisions after our investment plans are Determined'. See Brav *et al.* [8] for details.

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