

## **Why do Firms Repurchase Shares? Evidence from Actual Share Repurchases**

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### **Abstract**

In practice, the share repurchase announcement is not a commitment to managers. To this end, the large difference between the actual and announced share repurchases is often observed in markets. In this paper, we explore the implications from actual share repurchase activities, different from the existing methods which focus on the announcements of share repurchases and hence largely ignore the managers' actual repurchasing activities. By considering actual share repurchases and controlling variables, the new empirical evidence found in this paper clearly supports the agency and investor divergence of opinion hypotheses, but not for the information asymmetry hypothesis.

**JEL Classifications:** G14, G20, G30

**Keywords:** information signaling; agency problem; Divergence of opinion; investor heteroscedasticity; information asymmetry; share repurchase

### **1. Introduction**

Share repurchases, especially open market share repurchases, have been extensively examined in academic literature. Several explanations for managerial motivation to repurchase shares have been proposed by researchers, including the information asymmetry hypothesis based on signaling theory, the excess capital redistribution hypothesis based on agency theory, as well as other hypotheses focusing on capital structure optimization, acquisition deterrence, and dividends substitution.

Tests of these hypotheses focus primarily on the associated announcement effect. Comment and Jarrell (1991) document significant stock price reaction to the announcement of share repurchases. The information asymmetry hypothesis, developed by Bhattacharya (1979), Vermaelen (1984), Miller and Rock (1985), and Ofer and Thakor (1987), suggests that managers in better-performing firms believe their stocks are undervalued by the market and consequently they use repurchase announcements as a signal to differentiate themselves from low-performing firms. Managers in firms with high levels of information asymmetry therefore have an incentive first to announce share repurchases, and then follow through and repurchase shares to make their announcements creditable. Nohel and Tarhan (1998) argue that different firms may have different reasons for repurchasing shares, depending on their investment opportunity set.

However, Ikenberry, Lakonishok, and Vermaelen (1995 & 2000) and Peyer and Vermaelen (2009) find that share prices do not reach a new equilibrium immediately in response to these announcements, but tend to drift for at least three years. This long-term price drift and the related long-term abnormal returns both represent share repurchase anomalies, which serve to cast doubts on the explanatory power of traditional hypotheses. More recently, Huang and Thakor (2013), Conlon, Fuller, and Wang (2011) and Blau, Fuller, Walker, and Wang (2011) apply the investor heterogeneity hypothesis to open market share repurchases in an attempt to explain long-term share repurchase anomalies. This hypothesis emphasizes the importance of actual share repurchases, rather than focusing on the announcements of repurchase.

Academic researchers customarily assume that managers repurchase shares after their announcement. However, speculation in the press suggests actual repurchase rates of only 30-40 percent (For example, see Power, 1995). Jagannathan, Stephens, and Weisbach (2000) suggest an actual repurchase rate of 70-80 percent at most. Bamber (1987) find that, immediately after the market crash in 1987, many firms announced a repurchase program, but most of them did not actually repurchase shares. Lie (2005) document that the operating performance improvement and the positive earnings announcement returns are limited to firms who actually repurchase shares; they argue that it is the actual repurchases, not announcements, predict future firm's performance improvements. Similarly, Blau *et al.* (2011) find that there is no long-term abnormal return from firms who only announce open market repurchases but actually do not reacquire shares. Consistent evidences are also found in the Hong Kong and French markets.<sup>1</sup>

In this paper, we provide new evidence to explain managers' motivation of repurchasing shares by looking at the actual share repurchase activity. Existing literature, such as the information asymmetry hypothesis, focuses on the announcements of open market share repurchases (hereafter, repurchases) and largely ignores the managers' actual repurchasing activity. Both theoretical works and empirical tests often assume that managers repurchase shares after announcements. However, in practice, managers neither take their announcements as a commitment, nor do they always repurchase shares after announcements.<sup>2</sup> The degree of difference between the actual and announced share repurchases is indeed an idiosyncratic shock to investors. Apparently, this shock should be expected to impact on investors' expectations of the firm's future values. Thus, we hypothesize that in the absence of actual share repurchases, the explanatory power of previous studies may be compromised.

Of interest, we test the importance of the information based on actual share repurchases in explaining firms' repurchasing behaviors. Specifically, this paper tests the three hypotheses simultaneously: the information asymmetry hypothesis based on signaling theory, the excess capital distribution hypothesis based on agency theory, and the investor divergence of opinion hypothesis based on marginal-investor theory. Following the research of Dittmar (2000) and Grullon and Michaely (2004), and using different measures of actual share repurchases, we jointly test the predictions across these three hypotheses. Rather than focusing on repurchase announcements or assuming that managers actually repurchase share in the three years following an announcement, we examine the firm share repurchase behavior using actual share repurchases by the methodology proposed by Fama and French (2001), Skinner (2008), and Huang and Thakor (2013). This method allows us to observe directly whether managers repurchase shares and to estimate the amount of shares they repurchase in a year.

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<sup>1</sup> See e.g. Brockman and Chung (2001), Zhang (2005), Ginglinger and Hamon (2007), among others Bamber (1987), Stephens and Weisbach (1998), and Jagannathan *et al.* (2000) document that not all managers repurchase share right after their announcements.

<sup>2</sup> Bamber (1987), Stephens and Weisbach (1998), and Jagannathan *et al.* (2000) document that not all managers repurchase share right after their announcements.

In this paper, we find evidence in support of the investor heterogeneity hypothesis. Following Garfinkel and Sokobin (2006), Hong and Stein (2007), and Garfinkel (2009), we use estimates from trading volume to estimate the divergence of opinion amongst a firm's investors. Our results suggest that the investors of repurchasing firms have higher divergence of opinion on their holding firm's value than the investors of non-repurchasing firms. The difference in divergence of opinion between repurchasing and non-repurchasing firms persists after controlling for firm characteristics. When a firm has higher divergence of opinion among its investors, managers tend to repurchase more shares in the following year. Moreover, the divergence of opinion is significantly higher in the year prior to actual share repurchase than the year in which a consecutive repurchasing program concludes.

In addition, the empirical support has been found for an agency cost motivation for share repurchase programs – i.e. firms with large cash reserves that lack good investment opportunities. Our repurchasing sample firms have significantly higher levels of cash and free cash flow, and lower R&D expense than do non-repurchasing firms. We also find that firms with more cash and a higher level of free cash flow repurchase more shares. Our findings suggest that excess capital re-distribution could be a motivation for managers to repurchase shares, as after actual share repurchases, the cash reserve declines significantly, both in the form of cash and free cash flow.

We use a direct measure of information asymmetry and two indirect measures, the intangible asset ratio and fixed asset ratio, to estimate the level of information asymmetry in a firm. We find that the firms who repurchase shares have less information asymmetry compared to a sample of firms who do not repurchase shares. Nonetheless, there is no evidence for any significant decline in information asymmetry by using actual share repurchases. Although our findings are contrary to the predictions of the information asymmetry hypothesis, they are consistent with Miller and Rock (1985) who suggest that managers face adverse selection problem when they repurchase shares from market and they will therefore be reluctant to repurchase shares when information asymmetry is high.

The rest of our paper is organized as follows: Section 2 describes the methodologies and variables used in our empirical tests. Section 3 presents data and the properties of consecutive actual share repurchasing program. Section 4 reports the test results for the three hypotheses. Section 5 concludes the paper.

## 2. Method

### 2.1. 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.

## 2.2. The Measure of Actual Share Repurchase

Firms can use two techniques to repurchase shares: either the treasury stock method or the retiring stock method. Using the treasury stock method, firms repurchase shares from the market and hold them as treasury stock in the book. With the retirement stock method, firms repurchase and then retire shares from the market, which results in an immediate reduction in the number of shares outstanding.

For firms using the treasury stock method, we measure for each fiscal year the dollar value spent on share repurchases for year t as the change in common treasury stock from year t-1 to year t. We then estimate the number of shares actually repurchased by dividing the dollar amount with the share price at the end of fiscal year.

$$number\_repur_{i,t} = \frac{\$Treasury_{i,t} - \$Treasury_{i,t-1}}{Price_{i,t}}; \tag{1}$$

If a firm has zero treasury stock in the current and prior year, we infer that the firm uses the retirement method to repurchase shares. The actual number of shares repurchased in year t is calculated as

$$number\_repur_{i,t} = \frac{\$Purchase_{i,t} - \$Sales_{i,t}}{Price_{i,t}}; \tag{2}$$

We measure the actual change in shares outstanding, referred to as the actual share repurchases ratio, as the ratio of the actual shares repurchased during a year and the total shares outstanding at the beginning of that year.

$$Repur_{i,t} = \frac{number\_repur_{i,t}}{shares\_outstanding_{i,t-1}}; \tag{3}$$

## 2.3. The Measure of Divergence of Opinion

Following Hong and Stein (2007) and Garfinkel (2009), we use the abnormal market adjusted turnover,  $Abto_{i,t}$  to measure divergence of opinion among investors. To avoid the less-trading-frequency problem, we modify their methodology by using weekly cumulative trading volume rather than daily trading volume.

$$Abto_{i,t} = \frac{Vol_{i,t}}{Shrs_{i,t}} - \frac{Vol_{m,t}}{Shrs_{m,t}}, \text{ where} \tag{4}$$

$$Vol_{m,t} = \sum_{i=1}^m Vol_{i,t} \text{ and } Shrs_{m,t} = \sum_{i=1}^m Shrs_{i,t}$$

where  $Abto_{i,t}$  is firm  $i$ 's trading volume during week  $t$ ,  $Vol_{m,t}$  is the market's total weekly trading volume, and  $Shrs_{m,t}$  represents the market total shares outstanding. The measure the degree of divergence of opinion is determined by the mean and median value of the weekly market adjusted turnover for each firm year.

We also compute the standardized unexplained stock trading volume,  $SUV_{i,t}$  (Garfinkel and Sokobin (2006) and Garfinkel (2009)) as an alternative measure of divergence of opinion. This trading volume measures unexpected trading volume resulting from the impact of both liquidity demands and information.

$$Volume_{i,t} = \alpha_i + \beta_i |Ret_{i,t}|^+ + \gamma_i |Ret_{i,t}|^- + \varepsilon_{i,t}, \quad (5)$$

where  $\varepsilon_{i,t}$  is the error term. The plus and minus superscripts on the absolute returns indicate the sign of weekly returns. The standardized unexplained trading volume is defined as

$$SUV_{i,t} = \frac{\sum_1^{52} \varepsilon_{i,t}}{\sigma_{\varepsilon_{i,t}}} / 52 \quad (6)$$

#### 2.4. The Measure of Information Asymmetry

Information asymmetry could cause investors to hold different valuations of a stock. We use three measures to estimate the level information asymmetry. First, we include a direct measure suggested by Durnev, Morck and Yeung (2004) as the firm-specific variation,  $Psi_{i,t}$ , which is defined as a natural log transformation ( $Psi = \ln(\frac{1-R^2}{R^2})$ ) of R-squares obtained from the following regression:

$$Ret_{i,t} = \alpha_i + \beta_i Ret\_Industry_{i,t} + \gamma_i Ret\_market_{i,t} + \varepsilon_{i,t} \quad (7)$$

The industry- and market-wide weekly returns are value-weighted weekly stock return across industry and the market.  $Psi$  is an inverse measure of information asymmetry: a larger  $Psi$  reflects lower levels of information asymmetry.

Two other measures of information asymmetry are also used - the fixed asset ratio and the intangible asset ratio. Previous research suggest that firms with a higher proportion of fixed assets should be more transparent, since the uncertainty about the value of firm's assets is small and thus easy to value, while intangible assets typically are unrecognized and estimates of their fair values are not disclosed (Cañibano, Garcia-Ayuso, & Sánchez, 2000; Barth, Kasznik, & McNichols, 2001). We measure the fixed asset ratio as net fixed assets divided by total assets (Dittmar & Thakor, 2007) and intangible asset ratio as the intangible assets other than goodwill scaled by total assets other than goodwill (Barth & Kasznik, 1999).

#### 2.5. The Measure of Information Asymmetry

To evaluate the suppositions of the excess-capital-distribution hypothesis in relation to share repurchases, we capture each firm  $Cash$  and free cash flows,  $FCFs$ . Following Dittmar (2000),  $Cash$  is defined as cash and cash equivalents scaled by total assets, while  $FCFs$  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 costs, we include, operating expenditures, *OXD*, defined as operating costs divided by total sales.

## 2.6. Growth, Profitability, and Other Variables

We include the Fama and French (1993) book-to-market ratio, *bmratio* and the Research and Development expense, *R & D*, defined as the R&D spending divided by sales, to capture the firms' growth and new investment opportunity.<sup>3</sup> We control for other firm characteristics: to capture the firm size effect, we use *lnmk*, measured as the natural log of the firm's market value; to capture the contrarian trading effect, we include the past year's average monthly return, *Return*; and to capture the dividend substitution effect we include dividends paid per share, *Dividend*. Recent literature suggests that earnings are positively related to a firms' payout policy (Skinner, 2008), therefore we include profit margin, *PM*, defined as net income divided by sales, to measure the firms' profitability. Variables and their definitions are listed in Table 1.

**Table 1.** Definitions of variables

Variables	Definition
Ln(MV)	Nature log of the market capitalization
AT	Total asset
Bmratio	Fama and French (1993) book-to-market ratio
Debratio	A ratio of long-term debt to total asset
FixedAsset	A ratio of fixed asset to total asset
IntanAsset	A ratio of intangible asset to total asset
Psi	The residual of weekly return regressed on market and industry return
Cash	Cash and cash equivalent
FCF	Free cash flow
OXD	Operation cost divided by sales
R&D	Research & Development cost divided by sales
PM	Profit margin (net income divided by sales)
Return	Cumulative annual stock return
Dividend	Total dividends pay per share
Abto_mean	The mean of abnormal turnover
Abto_median	The median of abnormal turnover
SUV_mean	The mean of standardized unexplained volume
SUV_median	The median of standardized unexplained volume

<sup>3</sup> Refer to Fama and French (1993) for a detailed description of the *bmratio* measurement. The factors used to estimate the *bmratio* (Fama-French three-factor model) are from Kenneth R. French website, Data Library.

### 3. Data

For the actual share repurchase, we collect yearly treasury stock, and purchases and sales of common stock from the Compustat annual database as well as the fiscal-year-end and the fiscal-year highest and lowest stock price. For  $Abto$  and  $SUV$ , we collect stock daily trading volumes and returns from the Center for Research in Security Prices (CRSP) and aggregate them into calendar weeks to obtain the cumulative weekly trading volume and return. For the information asymmetry measure,  $Psi$ , we collect daily stock price and the weighted-average Standard & Poor's 500 index from CRSP. The industry average return is the cumulative return in each calendar week based on two-digit Standard Industry Classification (SIC) code. We collect each firm's other characteristics: total assets, book value of asset, long-term debt, fixed assets, intangible assets, cash and cash equivalent, sales, net income, operation costs, research & development expense, tax and other deferred items, dividends, and shares outstanding from Compustat annual data.

Our repurchase and non-repurchase pooled sample spans the period from 1991 to 2009. We require that each firm be U.S. firm listed on the NYSE, Amex or NASDAQ, have CRSP and Compustat data available, and have a fiscal-year-end stock price higher than \$5. We also exclude observations with negative total assets. We delete outlier observations, specifically, firms with a book-to-market ratio less than 1 percent or greater than 99 percent percentile of the total population and firms with negative profit margins (about 2% of total population).

The distribution of actual share repurchases is reported in Panel A, Table 2. There are about 40% of total observations having less than 1% actual share repurchase ratio. Only around 5% actual share repurchases are greater than 10% of total shares outstanding. In Panel B, we report the time-series trend of share repurchase from 1991 to 2009. Most firms repurchase 1% to 2% of their shares per year, with a median value of 1% and a mean value of 2.3%. In the later studies, we use the actual share repurchase ratio estimated from fiscal-year-end stock price only.

We also observe two significant peaks in the number of firms who has actively engaged in actual share repurchase during our sample period. The first peak is around 1998/1999, during the early stage of the Internet (Dot-Com) bubble. The second peak is in 2008, which marks the beginning of the recent financial crisis. Not only there are more firms repurchase shares during these two peak periods, but firms on average repurchase more shares. These findings are consistent with the result of A. Dittmar and R. Dittmar (2004) that the aggregate share repurchases are affected by the business cycle.

Indeed, the actual share repurchase could be much smaller, even though managers actively repurchase shares after announcement. For firms using treasury stock method, managers could re-issue the treasury stock at the same year or one year later when they repurchase shares. Firms could also issue new shares on the market. The actual number of shares repurchased is offset by the new issued shares.

**Table 2.** Statistics of firms' net share repurchases

This table reports the distribution of net share repurchases, which is defined as the number of shares a firm repurchased divided by the firm's shares outstanding in a given fiscal year. We following Fama and French (2001), Skinner (2008), and Huang and Thakor (2013) to compute the net share repurchases. The net shares repurchased is estimated in the increase in common treasury stock divided by stock price, if the firm uses the treasury stock method for repurchases; otherwise the net shares repurchased is the difference between stock purchases and stock issuances divided by stock price. Since firms often continuously repurchase shares from market at market price, we estimate the average repurchasing price by two proxies, the fiscal year closing price and the midpoint of year-high and -low price.<sup>4</sup> The net share repurchased ratio is the number of net shares repurchased divided by shares outstanding.

<sup>4</sup> As managers usually repurchase shares when price is relatively low, our estimations are downward biased. The real net shares repurchased would be slightly higher.

**Panel A.** The distribution of actual share repurchase by firm-year

Panel A reports distribution of the net repurchase ratio. Close and Midpoint are ratio estimated by fiscal year closing stock price and middle of year-high and –low stock price.

Percentile	1%	5%	10%	25%	50%	75%	90%	95%	99%
Close	.00157%	.0176%	.0517%	.297%	1.3%	3.6%	7.5%	10.9%	22.7%
Midpoint	.00162%	.0176%	.0505%	.282%	1.2%	3.4%	6.7%	9.4%	18.5%

**Panel B.** Actual share repurchase from 1991 to 2009

Panel B reports the trend of share repurchase from 1991 to 2009. N is the number of firms that repurchased shares in that year. We compute the repurchase ratio with average repurchasing price based on fiscal-year end price and the middle of fiscal-year high and low price. Since these two estimations are very close, in later tables we reports the results based on fiscal year closing price only.

Year	N	Estimated by fiscal-year closing price				Estimated by fiscal-year middle price			
		mean	median	max	min	mean	median	max	min
1991	635	2.12%	0.66%	71.01%	0.00%	2.07%	0.69%	67.40%	0.00%
1992	666	2.14%	0.83%	39.87%	0.00%	2.00%	0.77%	33.55%	0.00%
1993	768	1.78%	0.62%	42.91%	0.00%	1.70%	0.62%	39.78%	0.00%
1994	984	2.18%	0.91%	36.11%	0.00%	1.96%	0.81%	32.14%	0.00%
1995	1001	1.92%	0.89%	48.25%	0.00%	1.93%	0.91%	40.53%	0.00%
1996	1138	2.36%	1.07%	35.93%	0.00%	2.24%	1.01%	51.22%	0.00%
1997	1303	2.36%	1.07%	51.60%	0.00%	2.32%	1.12%	43.83%	0.00%
1998	1545	3.58%	1.85%	65.84%	0.00%	2.90%	1.55%	47.23%	0.00%
1999	1445	4.47%	2.29%	90.93%	0.00%	3.75%	1.99%	57.60%	0.00%
2000	1263	4.28%	2.18%	67.56%	0.00%	3.50%	1.87%	50.71%	0.00%
2001	1044	2.34%	0.98%	67.84%	0.00%	2.09%	0.92%	62.84%	0.00%
2002	1003	2.81%	1.26%	77.28%	0.00%	2.32%	1.08%	76.46%	0.00%
2003	918	1.92%	0.96%	33.18%	0.00%	2.13%	1.13%	29.30%	0.00%
2004	874	2.23%	1.14%	24.74%	0.00%	2.28%	1.18%	25.60%	0.00%
2005	976	2.85%	1.69%	37.83%	0.00%	2.84%	1.71%	29.39%	0.00%
2006	1038	2.79%	1.71%	38.82%	0.00%	2.77%	1.67%	36.86%	0.00%
2007	1093	3.86%	2.05%	86.13%	0.00%	3.33%	1.91%	75.38%	0.00%
2008	1195	5.55%	3.07%	91.98%	0.00%	3.64%	2.29%	51.87%	0.00%
2009	730	1.86%	0.66%	25.71%	0.00%	2.00%	0.81%	23.02%	0.00%



To examine how the actual share repurchases affect the firm's characteristics, we limit our repurchasing sample for firm-year observations with significant actual share repurchase (greater than 1 percent of shares outstanding), which covers about 60 percent of our full actual repurchasing sample. In Table 3, we report t statistics of the sample categorized by the year and the repurchasing program. In Panel A, we report how frequently a firm has significant share repurchase. About 27 percent of firms repurchase more than 1 percent of shares outstanding only once in our 19-year sample period, from 1991 to 2009. About 18 percent and 13 percent of firms repurchase significant amount of shares twice or three times in our sample period respectively. The low frequency of share repurchase suggests that firms repurchase shares discontinuously.

**Table 3.** Repurchase frequencies and consecutively repurchases

This table reports the behavior of firms share repurchases. Showup is the number a firm being observed in our net repurchasing sample. Firm often repurchase shares consecutively. We categorize the consecutively repurchase by the number of uninterrupted repurchasing years. The mean and median of repurchase per firm-year and the sum of total repurchase during the uninterrupted sequence are reported.

Panel A			Panel B					
Frequency			Percentage Shares Repurchased					
Occurrence	N (firms)	% of total	Consecutive Years	obs.	%	mean	median	
1	1399	27.60%	1	4147	48.91%	3.02%	3.02%	
2	939	18.53%	2	1893	22.33%	2.97%	2.97%	
3	675	13.32%	3	967	11.41%	3.03%	2.32%	
4	512	10.10%	4	543	6.40%	2.91%	2.29%	
5	368	7.26%	5	350	4.13%	3.09%	2.38%	
6	245	4.83%	6	161	1.90%	3.32%	2.50%	
7	250	4.93%	7	119	1.40%	3.58%	2.66%	
8	141	2.78%	8	88	1.04%	2.66%	1.94%	
9	136	2.68%	9	60	0.71%	2.58%	2.00%	
10	117	2.31%	10	45	0.53%	2.93%	2.11%	
11	93	1.84%	11	35	0.41%	2.65%	1.64%	
12	60	1.18%	12	18	0.21%	2.60%	1.76%	
13	44	0.87%	13	17	0.20%	2.43%	1.88%	
14	31	0.61%	14	10	0.12%	2.50%	1.95%	
15	20	0.39%	15	5	0.06%	2.15%	1.84%	
16	17	0.34%	16	9	0.11%	3.00%	2.18%	
17	13	0.26%	17	7	0.08%	2.56%	2.17%	
18	7	0.14%	18	3	0.04%	2.82%	2.26%	
19	1	0.02%	19	1	0.01%	3.16%	1.95%	

We categorize the discontinuous actual share repurchase activities into different repurchasing programs according to the consecutive repurchasing years. We define the number of consecutive repurchasing year as following: the number of years a firm continuously repurchases shares more than 1 percent per year without interruption. For example, if a firm repurchases 1 percent of shares from 2002 to 2004 each year and does not have significant share repurchase in 2005, the number of consecutive repurchasing years of this program is three. With this definition, a firm could have multiple repurchasing programs in our sample period, and each program could have different consecutive repurchasing years.

In our sample, 49 percent of consecutive repurchasing program observations continue for only one year, 22 percent of significant repurchasing years belong to a two-year program, and 11 percent are part of a three-year program. As the number of consecutive years increases, the number of observations drops quickly. Only few firms (less than .5 percent) continuously repurchase shares for more than 10 years. Although the repurchasing programs are different in their consecutive year, the average shares repurchased per year are very similar across different programs, with the mean of share repurchase per year at 3 percent with a median of 2.5 percent. Detailed results are reported in Table 3, Panel B.

## 4. Empirical Results

### 4.1. The Difference between Repurchasing and Non-Repurchasing Firms

Before we investigate how firms change after actual share repurchases, we examine how repurchasing firms differ from non-repurchasing firms. We first construct two comparable samples of repurchasing and non-repurchasing firms. For each year in our sample (1993 – 2007), firms are identified as a non-repurchasing firm if they do not repurchase at least 1 percent of outstanding shares in a five-year window (two-years prior to and following the current year). Firms are designated as repurchasing firms if they repurchases more than 1 percent of shares outstanding in the current year and have positive actual repurchase (with a sum of three-year actual share repurchase greater than zero) in a three-year window (one-year before and one-year after). This classification yields 6,911 non-repurchasing firm-years and 3,356 repurchasing firm-year. All variables are measured at the beginning of each fiscal year. We report the differences between repurchasing and non-repurchasing firms in Table 4.

Table 4 shows a significance difference between the repurchasing firms and non-repurchasing firms, in line with the findings in Dittmar and Thakor (2007). In addition, repurchasing firms appear to have higher divergence of opinion, measured by four proxies from trading volume. The abnormal turnover, after controlling for market-wide and industry-wide variance, is higher for repurchasing firms at both the mean and the median. The standardized unexplained trading volume after controlling for the effect of abnormal return is also higher for repurchasing firms at both mean and median.

However, the evidence does seem to support the information asymmetry hypothesis proposed by Vermaelen (1981). The higher intangible asset ratio but lower fixed asset ratio in share repurchasing sample, together with the higher value of  $Psi$ , seems to contradict the traditional argument of the signaling hypothesis. Repurchasing firms also pay, on average, more dividends per share than non-repurchasing firms, which do not support the dividends / share repurchase substitution hypothesis.

**Table 4.** Firm characteristics between repurchase firm and non-repurchase firm

This table reports the differences between repurchase and non-repurchase firms. For each year, if a firm does not repurchase any shares in a five years window (two-year before and two-year after) and have data available across the window, we identify the firm as a non-repurchasing firm. We identify a firm as repurchasing firm if it repurchases more

than 1% shares outstanding in that year and has total positive net repurchases in a three-year window (one-year before and one-year after). The sample covers from 1993 to 2007, including 6911 non-repurchasing firm-year and 3356 repurchasing firm-year. All variables are measured at the beginning of each fiscal year. \*\*\*, \*\*, \* represent 1%, 5% and 10% levels of significance, respectively.

Variable	Non-repurchase	Repurchase	Non-Repur -Repur
N	6911	3356	
Ln(MV)	12.1917	13.2010	-30.80***
AT	1128.9	2592.1	-16.95***
Bmratio	0.6240	0.5847	5.52***
Debratio	0.1710	0.1484	7.50***
FixedAsset	0.3026	0.2612	9.94***
IntanAsset	0.0994	0.1241	-8.26***
Psi	-2.5118	-2.0748	-19.60***
Cash	0.1441	0.1524	-3.08***
FCF	0.0746	0.1337	-25.31***
OXD	0.9328	0.8407	16.07***
R&D	0.1269	0.0574	10.14***
PM	0.0345	0.0507	-13.78***
Return	1.1963	1.1363	6.32***
Dividend	0.2096	0.2954	-8.68***
Abto_mean	0.3578	0.4055	-8.13***
Abto_median	0.3684	0.4082	-6.71***
SUV_mean	0.0009	0.0010	-1.75*
SUV_median	-0.2236	-0.2063	-9.59***

We then focus on the difference of divergence of opinion between these two samples after controlling for firms' characteristics. The results are reported in Table 5. The dependent variable is abnormal turnover, while Repurchase is a dummy variable, which equals one if an observation is a repurchasing firm-year. We run four regression models while controlling for book-to-market ratio effect, information asymmetry effect, and excess cash flow effect.<sup>5</sup>

<sup>5</sup> Note that Chen and Wang (2012) argue a possible association between financial constraint and share repurchase. A firm with ample excess cash and cash flow tends to be unconstrained, so the financial constraint story and agency cost story are related.

**Table 5.** Difference of Divergence of opinion after controlling other factors

This table uses the sample as in table 4. The dependent variable is the *Abto\_mean*, a proxy for divergence of opinion. *Repurchase* is a dummy variable which equals one if a firm repurchases shares during the fiscal year. All other independent variables are measured at the beginning of each fiscal year. \*\*, \* represent 1% and 5% levels of significance, respectively, after controlling for heteroscedasticity.

	Simple model		Info. model		Agency Model		Full-factor model	
	Co-eff	T-value	Co-eff	T-value	Co-eff	T-value	Co-eff	T-value
Repurchase	0.1179	4.10**	0.0281	3.80**	0.0258	4.14**	0.0337	3.24**
Ln(MV)	0.0198	4.39**	0.0136	4.83**	0.0212	9.32**	0.0097	2.52*
AT	0.0000	0.11	0.0000	1.14	0.0000	0.67	0.0000	2.30*
Bmratio	0.0072	0.85	0.0044	0.42	0.0150	1.71	0.0052	0.34
Debtratio	-0.0356	-1.93					-0.0577	-1.55
FixedAsset			-0.0269	-1.54			-0.0077	-0.23
IntanAsset			0.1843	7.32**			0.3184	7.86**
Psi			0.0025	0.71			0.0015	0.29
Cash					0.0408	2.30*	0.1275	3.81**
FCF					0.0334	1.12	0.1046	2.17*
OXD					0.0719	3.79**	0.1123	3.58**
PM					0.0641	3.49**	0.0621	2.20*
Dividend					-0.0116	-1.97*	-0.0157	-1.09
Return							-0.0361	-3.95**
Intercept	0.1179	4.10**	0.1847	4.48**	0.0183	0.50	0.1208	1.74

We find that the intangible asset ratio is significantly positively related with divergence of opinion, which suggests that the intangible assets could be a potential reason why investors hold different opinions on firm value. However, the information asymmetry variable, *Psi*, is uncorrelated with divergence of opinion. This result is consistent with Varian (1985)'s theory that the divergence of opinion measure, abnormal turnover, is unaffected with information asymmetry.

#### 4.2. The Actual Shares Repurchased and the Divergence of Opinion

In this section, we examine the relationship between the actual share repurchase and the level of divergence of opinion. The sample is same as the one used in Table 4, but exclude the non-repurchasing firms. The results are reported in Table 6. The dependent variable is the actual share repurchase ratio during a fiscal year and all independent variables are measured at the beginning of each year.

The results are consistent across four models. When the divergence of opinion is higher, the managers repurchase more shares during the year. Firms with higher book-to-market ratio, more cash and free cash flows, or larger negative returns, repurchase more shares. Firms that have lower profitability or already paid dividends in last year repurchase fewer amounts of shares. More strikingly, we find firms with less information asymmetry problem repurchase more shares, in both

the information asymmetry model and the full-factor model. The result is again contradict with the information asymmetry hypothesis, but is consistent with the Miller and Rock (1985) that, with high information asymmetry, managers face the adverse selection problem when they repurchase shares, and thus, will be less likely to repurchase shares.

**Table 6.** Actual share repurchase and Divergence of opinion

This table examines the relationship between the divergence of opinion and the amount of actual shares repurchased in a year. The sample is same as the one in table 4. The dependent variable is the actual net share repurchase during the fiscal year. All independent variables are measured at the beginning of repurchasing fiscal year. \*\*, \* represent 1% and 5% levels of significance, respectively.

	Simple model		Info. model		Agency Model		Overall	
	Co-eff	T-value	Co-eff	T-value	Co-eff	T-value	Co-eff	T-value
Abto_mean	0.0097	5.70**	0.0088	4.57**	0.0094	4.15**	0.0053	2.05*
Ln(MV)	0.0066	16.68**	0.0054	10.84**	0.0057	10.24**	0.0045	6.56**
AT	-0.0006	-4.86**	-0.0008	-5.27**	-0.0004	-2.29*	-0.0003	-1.46
Bmratio	0.0191	12.21**	0.0135	7.19**	0.0287	12.25**	0.0233	8.38**
Debtratio	-0.0298	-8.72**					-0.0068	-1.02
FixedAsset			-0.0296	-9.59**			-0.0093	-1.57
IntanAsset			-0.0051	-1.14			0.0050	0.68
Psi			0.0053	8.36**			0.0056	5.90**
Cash					0.0304	7.14**	0.0209	3.47**
CF					0.1064	15.96**	0.1146	13.48**
OXD					-0.0241	-5.05**	-0.0197	-3.50**
PM					-0.0281	-6.82**	-0.0176	-3.49**
Dividend					-0.0022	-0.97	-0.0075	-2.93**
Return							-0.0093	-5.68**
Intercept	-0.0763	-14.33	-0.0410	-5.54**	-0.0679	-7.40**	-0.0253	-2.04*

However, it has been observed that BM ratio in Table 6 is positive, which is to some extent in support of the signaling theory and the arguments in Ikenberry *et al.* (1995) and Chan, Ikenberry, and Lee (2004). In this regard, we might not be able to completely reject this hypothesis, but remain conservative for a mixed result about information asymmetry hypothesis.

### 4.3. The Change in Firms after Actual Share Repurchases

This section investigates changes experienced firms subsequent to actual share repurchasing programs. To quantify changes around a repurchasing program, we first identify each of the repurchasing programs for a given firm. A consecutive repurchasing program is defined in preceding section. We collect the repurchasing programs with one, two, and three consecutive repurchasing years, which are labeled as S1, S2, and S3 respectively. We then compare the firms'

characteristics at the beginning of a repurchasing program (pre-) and one year after the end of the repurchasing program (post-). The results are reported in Table 7.

**Table 7.** Changes of firms' characteristics pre- and post- a continuous share repurchase

This table reports the changes of firms' characteristics at the year before and the year after an uninterrupted repurchase program. S1, S2, and S3 represent a repurchase program continues for one, two, and three years without interruption. Post is one year following the repurchase program; while pre is one year pre to the repurchase program. \*\*, \* represent 1% and 5% levels of significance, respectively, after controlling for heteroscedasticity.

Variable	S1			S2			S3		
	Post-	Pre-	T-value	Post-	Pre-	T-value	Post-	Pre-	T-value
Abto	0.4473	0.4829	-2.82**	0.4397	0.5532	-5.48**	0.4153	0.4673	-2.33*
Abto_m	0.4819	0.5181	-2.52*	0.4724	0.5842	-4.78**	0.4095	0.5071	-2.92*
Ln(MV)	12.358	12.452	-2.01*	12.594	12.698	-1.50	12.882	12.876	0.06
AT	2365.4	1958.7	1.86	2289.8	1967.0	1.46	2598.8	1875.8	1.98*
Bmratio	0.6394	0.5916	4.47**	0.6809	0.5825	6.22**	0.6961	0.5796	5.18**
Debtratio	0.1716	0.1591	2.76**	0.1786	0.1469	4.95**	0.1611	0.1476	1.52
FixedAsset	0.2801	0.2687	1.80	0.2736	0.2570	1.82	0.2692	0.2514	1.38
IntanAsset	0.1224	0.1196	0.64	0.1361	0.1255	1.58	0.1320	0.1236	0.87
Psi	-2.5315	-2.5583	0.79	-2.4277	-2.2848	-2.94**	-2.296	-2.373	1.19
Cash	0.1544	0.1783	-4.77**	0.1395	0.1745	-5.08**	0.1448	0.1682	-2.39*
FCF	0.0575	0.0822	-5.96**	0.0621	0.1071	-7.81**	0.0757	0.1152	-5.91**
OXD	0.9205	0.9215	-0.08	0.8981	0.8743	1.94	0.8876	0.8581	2.07*
R&D	0.1133	0.1385	-1.73	0.0989	0.0888	0.77	0.0855	0.0802	0.32
PM	-0.0458	-0.0427	-0.25	-0.0204	0.0125	-2.19*	-.0026	.0272	-1.87
Return	1.2089	1.1424	4.19**	1.1972	1.1916	0.25	1.2138	1.2412	-0.87
Dividend	1.2089	1.1424	4.19**	0.2539	0.2362	0.73	0.2984	0.2474	1.73

Table 7 shows that the divergence of opinion shifts downward after an actual share repurchase program. Both the mean and the median of abnormal turnover (Abto and Abto\_m) decrease. The decreases in abnormal turnover are statistically significant and consistent across all three types of consecutive repurchasing programs. The cash and free cash flow also reduce dramatically in all three types of repurchasing programs. The decreasing in cash could be a direct result of share repurchases. Managers invest the excess cash into share repurchases as there are no other better investment opportunities (Brav *et al.*, 2005).

More interestingly, we find that the book-to-market ratio increases, rather than decrease, after the actual share repurchase programs. In all three types of repurchasing programs, the firms' book-to-market ratio increases significantly in the year after the repurchasing program comparing to its value at the beginning of the program. This result suggests that the high book-to-market ratio might not be the result rather than the force that driving managers to repurchase shares. We also

document a significant increase in debt ratio, which suggests that equity value decreases after significant amount of cash is paid out.

This change in information asymmetry of the firm is, again, failed to support the signaling hypothesis. In type S1 and S3 share repurchasing programs, the information asymmetry measures do not change significantly after share repurchases. The information asymmetry increases after the type 2 repurchasing program. The profit margin represents the same pattern as information asymmetry: insignificant changes in type 1 and 3 programs and decrease in type 2 programs, which cast doubt on the argument that share repurchase announcements signal better future performance. This result, however, is consistent with Grullon and Michaely (2004), who document no operating performance increase following open market repurchase announcement.

We then examine the changes in divergence of opinion after controlling for other firm characteristics. Particularly, we run the regression including the divergence of opinion (*Abto\_m*) as the dependent variable and a dummy variable, *Pre*, which equals one if the observation is from the year at the beginning of a repurchasing program.

**Table 8.** Changes in divergence of opinion before and after an uninterrupted repurchasing

This table reports the changes of divergence of opinion at one year before and one year after an uninterrupted repurchasing program after controlling for firm characteristics. The dependent variable is the divergence of opinion, *Abto\_mean*. S1, S2, and S3 represent a repurchase program continues for one, two, and three years without interruption. *Pre* is a dummy variable is the variable is observed one year before share repurchase, otherwise equals zero. Other variables are measured each year respectively. \*\*, \* represent 1% and 5% levels of significance, respectively, after controlling for heteroscedasticity.

	S1		S2		S3	
	Co-eff	T-value	Co-eff	T-value	Co-eff	T-value
<i>Pre</i>	0.0252	2.67**	0.0404	2.22*	0.0539	2.09*
<i>Ln(MV)</i>	0.0508	10.48	0.0620	11.67**	0.0208	2.44*
<i>Bmratio</i>	0.0462	2.31*	0.0647	3.07**	-0.0023	-0.7
<i>IntanAsset</i>	0.3798	7.39**	0.4036	7.75**	0.1949	2.42*
<i>Psi</i>	-0.0287	-3.77**	-0.0371	-4.78**	-0.0213	-1.66
<i>Cash</i>	0.1243	2.70**	0.2036	4.10**	0.0878	1.13
<i>FCF</i>	-0.0092	-1.5	0.0197	0.29	0.1467	1.17
<i>PM</i>	0.1138	3.78**	0.1361	3.96**	0.1029	1.25
<i>OXD</i>	0.0994	3.20**	0.1334	3.60**	0.1018	1.22
<i>Dividend</i>	0.0087	1.22	0.0380	2.54*	-0.0279	-0.93
<i>Return</i>	-0.0902	-6.95**	-0.1359	-9.07**	-0.0980	-4.27**
<i>Intercept</i>	-0.3292	-4.03**	-0.4527	-4.98**	0.1325	0.85

The result is reported in Table 8. Consistent with the heterogeneous expectation hypothesis, the divergence of opinion is larger for observations from the year at the beginning of repurchasing program. As the number of consecutive year increases, the changes in divergence of opinion decrease, suggesting that the effects of actual share repurchases on the divergence of opinion decrease. Such decreasing effect is consistent with the insignificant return increases after type 2 and

3 repurchasing program in Table 7, and therefore, support the heterogeneous expectation hypothesis that stock price increases as the divergence of opinion decreases.

## 5. Conclusion

We test three major share repurchase hypotheses by looking at the firms' actual share repurchase - our research differs from previous empirical works, which focuses on the announcement effect of share repurchase and assume managers will repurchase shares after their announcement. Consistent with the investor divergence of opinion hypothesis, repurchasing firms have a higher degree of divergence of opinion compared to non-repurchasing firms. The difference in and the explanatory power of divergence of opinion remain significant after controlling for firm characteristics. Divergence of opinion drops significantly after managers actually repurchase shares. The results are consistent in repurchasing programs with one-, two- and three-consecutive years. Our empirical results are also consistent with the agency cost hypothesis. Repurchasing firms have higher level of cash and free cash flow, profitability and intangible asset ratio, but lower stock returns, and fixed assets ratio.

However, we do not find evidence to support the information asymmetry hypothesis. Our results indicate instead that firms with higher information asymmetry actually repurchase fewer shares, and have no significant decrease in information asymmetry following actual share repurchase. These results are in contrast to the information hypothesis but in agreement with Miller and Rock (1985), who argue that managers are reluctant to repurchase shares when the information asymmetry is higher due to adverse selection.

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