The effects of ownership and stock liquidity on the timing of repurchase transactions

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Abstract

We analyze detailed monthly data on U.S. open market stock repurchases (OMRs) that recently became available following stricter disclosure requirements. We find evidence that OMRs are timed to benefit non-selling shareholders. We present evidence that the profits to companies from timing repurchases are significantly related to ownership structure. Institutional ownership reduces companies' opportunities to repurchase stock at bargain prices. At low levels, insider ownership increases timing profits and at high levels it reduces them. Stock liquidity increases profits from timing OMRs.

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1. Introduction

In this study, we investigate the timing of open market repurchase (OMR) transactions. We use novel data from SEC quarterly filings on the repurchase transactions of U.S. listed companies. The data recently became available following changes in mandatory disclosure in 2004. Past research suggests that companies seek to repurchase stock at low prices.[1] Companies can time repurchases to buy back stock at favorable prices when corporate decision makers have better information than outside shareholders. Repurchases can redistribute wealth among existing shareholders depending on shareholders' decisions to sell or retain their shares. Because wealth is transferred from selling to non-selling shareholders, repurchases that are timed using private information resemble insider trading.[2]

In the first part of this article, we analyze whether repurchasing companies time repurchases by executing OMRs at relatively low prices. Previous research on the timing of repurchase transactions by U.S. listed companies is limited given the historical lack of reliable data. Before 2004, U.S. companies were not required to disclose detailed price and volume data on repurchase transactions. Hence, most previous studies use data on the *announcements* of repurchase programs rather than data on completed repurchase *transactions*. Effective 17 December 2003, the SEC requires U.S. listed companies to report monthly volume and price data on their repurchase activity in their quarterly

[1] According to Brav et al. (2005), U.S. executives often state that the market price of their stock is an important or a very important factor influencing their repurchase decisions and that "their firm tracks repurchase timing". The belief that companies attempt to repurchase stock when it is cheap is so widespread that the SEC has encouraged companies to announce repurchases during times of crisis to reassure the market (SEC, 2001).

[2] Rule 10b-5 under the Securities and Exchange Act of 1934 requires insiders to refrain from trading in the firm's shares while in possession of "material" non-public information regarding share value. This prohibition theoretically applies to share repurchases (Securities Exchange Act Release No. 19244, November 17, 1982, 47 FR 53333, 53334, November 26, 1982). However, the bar for materiality is high, repurchase programs are widespread, and we are not aware of any case in which repurchases under a board-approved repurchase program have led to regulatory sanctions for insider trading. In fact, the SEC actively encourages stock repurchases by providing safe harbors to anti-manipulation rules through Rule 10b-18.

filings (10-Ks and 10-Qs).[3] We take advantage of this recent regulatory change and hand-collect unique data on the monthly OMR activity from quarterly filings of a sample of U.S. companies listed on the NYSE, NASDAQ or AMEX over the period between February 2004 and July 2006. Specifically, we collect monthly data on the volume of OMR transactions for 265 U.S. companies and 5,035 firm-months, and monthly OMR price data for 214 companies and 4,066 firm-months.

We use these data to test whether companies time OMRs by repurchasing stock at comparatively low prices. We find that stock repurchases follow abnormal price declines and precede abnormal price increases. Moreover, average repurchase prices are lower than comparable average market prices, and the total cost of a company's repurchases is lower than a benchmark based on naïve trading strategies. Our findings suggest that companies make economically significant cost savings by timing OMRs. Estimated average cost savings over a trading period of 19 months amount to around 0.25 percent of the market capitalization of a company's equity, and 0.54 percent of the book value of a company's total assets. The maximum values of the 19-month cost savings are staggering at 7.76 percent of market capitalization and 28.21 percent of total assets. We show that most of these cost savings derive from companies selecting the most favourable months in which to make repurchases. Based on this evidence and after considering alternative explanations (such as price support and signaling), we conclude that companies time repurchases on the open market.

Next, we examine the determinants of repurchase timing. We argue that insider and institutional ownership are crucial determinants of the profits realized by companies that time OMRs (through price advantages and cost savings). A company should have fewer opportunities to time repurchases when a higher proportion of its outstanding shares are held by informed investors. More informed ownership is likely to result in more informed trading that renders the stock price more informative offering less scope for temporary undervaluation. Both insiders and institutions are normally considered well-informed investors (e.g., Seyhun, 1986; Sias et al., 2006). In sum, we expect an

[3] Purchases of Certain Equity Securities by Issuers and Others (Exchange Act Release No. 33-8335); available at http://www.sec.gov/rules/final/33-8335.htm.

"information effect" of both insider and institutional ownership; either type of ownership may have a negative impact on the price advantages and cost savings realized by repurchasing companies.

For insider ownership, we may also expect an opposite effect. Fried (2005) highlights the wealth transfers from selling to non-selling shareholders through repurchases of undervalued shares. He argues that by repurchasing shares at less than fair value, informed insiders (who are unlikely to sell at such prices) extract wealth from selling shareholders (who tend to be less informed). Fried argues that non-selling shareholders benefit from this wealth transfer *pro rata* in relation to their pre-repurchase shareholdings. The higher the insiders' shareholdings the more they stand to benefit and the greater their incentive to time repurchases. This "wealth transfer effect" predicts a positive relation between profits from repurchase timing and insider ownership.

It is reasonable to expect that both effects, the wealth transfer and the information effect, exist at the same time but the relative strengths of the two effects may vary with ownership levels. It is possible that the relation between insider ownership and repurchase timing is non-linear. For instance, at low levels of informed ownership the positive wealth transfer effect of inside information may offset its negative information effect; while the information effect may prevail at high levels of inside information. We have no *ex ante* expectations regarding the relative strengths of the two effects over various ranges of inside ownership; instead we expect our empirical analysis to shed light on the matter.

We also expect a positive relation between market liquidity and companies' opportunity to time repurchases. In less liquid markets, transactions have larger price impacts and are subject to higher transaction costs (i.e. wider bid-ask spreads). As higher price impact and transaction costs increase the price at which stock can be bought back, less liquid stocks will provide less opportunity for cost savings from OMR timing than more liquid stocks.

We estimate the impact of ownership structure (insider and institutional ownership) and market liquidity (Amihud illiquidity ratio (Amihud, 2002) and bid-ask spread) on several novel "timing measures" designed to capture the price and cost advantages from OMR timing. These timing measures are computed as differences between the actual repurchase price or cost and several benchmarks based on market price and volume data. We find results that support our expectations. We

report an inverse u-shaped relation between repurchase timing and insider ownership: at low levels of insider ownership there is a positive association between insider ownership and our timing measures, while at high levels there is a negative association. This suggests that at low levels of insider ownership, the wealth transfer effect dominates the information effect and insider ownership encourages timing, while at high levels the negative information effect offsets the positive wealth-transfer effect as more informed ownership and trading provides companies less opportunity to time repurchases. We also find evidence for an information effect of institutional ownership: we document a monotonic, negative relation between our timing measures and institutional ownership. Finally, we find that greater stock liquidity (measured by a lower Amihud illiquidity ratio or a lower bid-ask spread) facilitates repurchase timing supporting our prediction that companies benefit more from timing OMRs when their stock is more liquid.

This study contributes to the existing literature in several ways. The existing literature on the timing of repurchases is limited, and the literature on repurchase transactions (as opposed to announcements of repurchase programs) is scarce in the U.S.A. due to the lack of disclosure of detailed repurchase-transaction data. Prior to 2004, U.S. researchers had to rely on either Compustat-based or CRSP-based repurchase measures. These measures are known to be biased (e.g., Banyi et al., 2008) and they cannot be used to precisely obtain repurchase prices.[4] Thanks to disclosure changes introduced in December 2003, we are able to construct a novel dataset of monthly repurchase volume and price data. Based on these data, we investigate if companies time repurchases and evaluate the economic significance of the benefits accruing to companies from timing their repurchases. To the best of our knowledge, Bozanic (2010) is the only published paper that uses the recently available actual monthly repurchase data to investigate repurchase timing.[5] However, there are important

[4] Compustat-based measures are the change in treasury stock, the decrease in shares outstanding, and the cash spent to repurchase common stock. The only CRSP-based measure is the decrease in shares outstanding. Please, refer to Banyi et al. (2008) for information on the biases that undermine these measures.

[5] To the best of our knowledge, the first empirical study to use monthly repurchase data from SEC filings is Simkovic (2009), a law and economics article. Simkovic analyzes the impact of the new repurchase disclosure regime introduced at the end of 2003 on the completion rates of repurchase programs. The repurchase dataset

differences between Bozanic's article and our paper. Bozanic (2010) tests the market timing hypothesis by studying the relations between repurchase volume and both lagged stock returns and the differences between leading stock prices and current repurchase prices. We not only run similar tests using lagged and leading market-adjusted returns as explanatory variables but we also investigate whether, after controlling for standard risk factors, dummies based on the timing of repurchase transactions are significant determinants of stock returns. Further, Bozanic (2010) does not study the total cost of a company's repurchases whereas we provide direct evidence that companies make OMRs at comparatively low prices.[6] In this paper we also investigate the determinants of repurchase timing. To the best of our knowledge, there are no published papers on U.S. repurchases that pursue a similar line of investigation. Moreover, the relations between repurchase timing and both ownership structure and liquidity that we report in this paper are completely novel. Finally, we hope our paper, in particular the parts on the technical aspects of the data collection process in Section 2, will represent a point of reference for the growing number of researchers using the repurchase-transaction data that are now available.

The paper is structured as follows. Section 2 describes our data with particular focus on the data on repurchase transactions. Section 3 motivates our examination of repurchase transactions, and presents empirical evidence consistent with repurchase timing. In Section 4, we examine the determinants of repurchase timing focusing on ownership structure and stock liquidity. Section 5 concludes with a discussion of our findings.

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used by Simkovic is similar to the dataset we use. Banyi et al. (2008) and Bozanic (2010) are the only other two published papers that use monthly data from SEC filings.

[6] A further difference between Bozanic (2010) and our paper is that we identify and exclude repurchase transactions not executed on the open market using accurate information from SEC filings. In contrast, Bozanic (2010) attempts to eliminate these transactions by simply discarding repurchases of 100 or less shares, and for under a $1 or over $1,000.

2. U.S. disclosure environment and data

2.1. Disclosure of monthly repurchase volume data and monthly repurchase price data

On 17 December 2003, a new SEC disclosure requirement took effect.[7] Under the new rule, companies must include a table in their quarterly filings (10-Ks and 10-Qs) providing, for the quarter, the following information on a monthly basis: total number of shares repurchased (monthly repurchase volume), the average price paid per share (monthly repurchase price), the total number of shares repurchased as part of publicly announced repurchase programs, and the maximum number (or approximate dollar value) of shares that may still be purchased under existing repurchase programs. Moreover, in the footnotes to the table companies must provide information on repurchase programs that expire or are suspended over the period the table refers to. Finally, if there are repurchases that are not carried out as part of publicly announced repurchase programs, additional footnotes should be included disclosing the amount of shares repurchased outside publicly announced programs and the nature of the repurchase transactions. For example, the footnotes should specify the number of shares that are repurchased on the open market, through privately negotiated transactions (PNTs), or through self-tender offers (fixed-price or Dutch-auction self-tender offers).

We hand-collect data on OMRs from SEC filings 10-Ks and 10-Qs, which are freely available from Edgar. Specifically, we collect monthly volume and price data on OMRs carried out by a sample of U.S. listed companies in the period between February 2004 and July 2006. Data are gathered from quarterly SEC filings (10-Ks and 10-Qs). We construct two datasets: one with monthly repurchase volume data and a smaller one with monthly repurchase price data. These datasets are described in the following two sections.

2.2. Repurchase volume dataset

We first identify U.S. listed companies that potentially executed OMRs of their common stock in the sample period ranging from January 2004 to December 2004. We use the SDC Platinum Database

[7] Purchases of Certain Equity Securities by Issuers and Others, Exchange Act Release No. 33-8335, available at http://www.sec.gov/rules/final/33-8335.htm.

of Mergers and Acquisitions to search for announcements of OMR programs of U.S. listed companies (listed on NYSE, NASDAQ or AMEX) in the period between 1 January 2004 and 31 December 2004. We find 442 companies with announced repurchase programs.

We study the timing of repurchases by focusing on companies that (i) have the right to purchase own stock throughout the sample period and (ii) do repurchase in the sample period. We analyze a company's repurchase timing in the 19 months following the month of the announcement of the company's repurchase program (post-announcement period).[8]

For each of the 442 companies that announced repurchase programs, we collect monthly volume (total number of shares repurchased) data for the overall OMR activity in the 19-month post-announcement period from 10-Ks and 10-Qs.[9] We purge the monthly repurchase volume data by eliminating repurchase transactions that are not carried out on the open market. In particular, we eliminate repurchases executed through self-tender offers, off-market privately negotiated transactions (PNTs), accelerated share repurchases (ASR), and structured share repurchases (SSR).[10] Most of the PNTs are repurchases from directors and employees to cover tax withholding obligations on exercises of stock options and vesting of restricted shares.[11] We take particular care to identify the volume of

[8] In several cases, we use the terms "firm-month", "monthly period", "calendar month", and similar terms even when we refer to periods that do not exactly correspond to calendar months. For example, a company's reporting period stretching from March 28, 2004 to April 28, 2004 is referred to as the calendar month April 2004.

[9] "Overall OMR activity", includes both OMRs that are part of the announced repurchase programs that we find on SDC Platinum, and OMRs related to other programs and/or executed outside publicly announced programs.

[10] We exclude ASR and SSR transactions as the company delegates the timing of open market transactions to the investment bank. In an ASR contract, the repurchasing company purchases own shares from an investment bank. The investment bank sells the shares short to the company and subsequently closes its short position through open market purchases. In a SSR contract, the company enters into an agreement with the investment bank which requires the company to make upfront cash payment in exchange for the right to receive its own shares or cash at the time of expiry.

[11] Directors and employees may be liable to pay taxes when they exercise stock options on their companies' stock. Also, they may be required to pay taxes when their restricted shares vest. In both cases, taxes are paid on

non-OMRs searching through 10-Ks and 10-Qs. The new SEC rule on repurchase disclosure requires companies to specify in their filings the nature of repurchases that are not carried out under publicly announced repurchase programs.

The rule does not explicitly require companies to disclose the nature of the repurchase transactions that are part of publicly announced programs. While we cannot rule out that some transactions we classify as OMRs are, in reality, other types of stock repurchase, we are confident that the vast majority of the transactions included in our dataset are OMRs for the following reasons. First, Regulation FD, introduced by the SEC on 23 October 2000,[12] requires companies to disclose material non-public information to investors when the information has already been disclosed to a selected group of investors. By not disclosing the terms of executed ASRs, SSRs, and PNTs, companies would violate this rule given that these terms are arguably material (e.g., the price at which the company is willing to repurchase its own stock conveys information to the market) and are known to the counterparties in the repurchase transactions. Second, it is very unlikely that the exact nature of large repurchase transactions is not disclosed in quarterly filings that are designed to inform investors. Self-tender offers, ASRs, and SSRs are normally very large and, for this reason, we are quite confident that information on these repurchase programs is normally provided in 10-Ks and 10-Qs. Likewise, it is likely that large PNTs are disclosed.

In collecting repurchase volume data, we exclude observations from the initial dataset of 442 companies for the following reasons. We exclude 60 companies because their filings cannot be found and/or do not provide sufficiently detailed information on OMRs. We exclude 6 companies with 13 sub-periods in their fiscal years instead of the standard 12 monthly periods. We also exclude 25 observations without any OMRs in the post-announcement period, and 82 companies whose repurchase authorization expires or whose repurchase activity is completed, discontinued, or

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their behalf by their companies to the taxation authorities. In return for these payments, the companies may receive shares of their own stock from their directors and employees.

[12] Selective Disclosure and Insider Trading, Exchange Act Release No. 33-7881, available at http://www.sec.gov/rules/final/33-7881.htm.

suspended during the post-announcement period. Finally, we exclude 3 companies because the information presented in their 10-Ks and 10-Qs does not allow us to purge data from non-OMRs transactions. The final dataset of "clean" monthly volume data includes 265 companies and 5,035 firm-months.

2.3. Repurchase price dataset

For each of the 265 companies with "clean" repurchase volume data, we collect monthly price (average price paid to repurchase shares) data for the 19-month post-announcement period from 10-Ks and 10-Qs. We exclude all the companies for which we cannot purge price data and eliminate the contaminating effects of non-OMRs owing to the lack of information in quarterly filings.[13] As a result, we exclude a total of 51 companies. The final sample with "clean" monthly repurchase price data comprises 214 companies and 4,066 firm-months.

2.4. Other data

We hand-collect data on insider ownership from companies' proxy statements. These statements report a figure for the fraction of a company's outstanding shares owned by all of its officers and directors that comprise "contingent shares". These are company's shares that officers and directors can acquire within 60 days of the proxy statement date through the exercise of stock options, warrants, and other similar rights. We take great care in identifying the number of contingent shares searching through the footnotes to the tables in the proxy statements. We subtract contingent shares from the reported figures on the aggregate ownership stake of officers and directors. As a result, the insider ownership data used in this study includes only shares that insiders actually own as of the date of the

[13] Lack of information in the filings makes it generally harder to clean repurchase *price* data than repurchase *volume* data. Non-OMRs are very often executed outside publicly announced programs. Following the introduction of the new SEC disclosure rule in December 2003, companies are obliged to disclose the exact nature of repurchases that are not part of publicly announced programs in the footnotes to the "repurchase table" in 10-Ks and 10-Qs. For repurchases made outside publicly announced programs, companies must disclose repurchase volume data but are not required to provide price data.

proxy, not shares that they have the right to purchase in the near future.[14] We collect institutional ownership data from Thomson Financial 13F institutional database. This database contains information from 13F filings and, therefore, does not report equity holdings of institutions that are not required to file 13F forms. We download daily data on stock return, stock price, ask and bid prices, trading volume, number of shares outstanding, return on the S&P's Composite Index, return on the value-weighted market index (comprising NYSE, NASDAQ, and AMEX companies), and return on the equally-weighted market index (comprising NYSE, NASDAQ, and AMEX companies) from the Center for Research in Security Prices (CRSP). We use CRSP also to collect information on the market where a company is listed and on the company's SIC code. From the same database, we collect daily data on Fama and French's (1993) three factors and Carhart's (1997) momentum factor. In some empirical analyses, we use repurchase price and volume data from 10-Ks and 10-Qs that are adjusted for stock splits, reverse splits, stock dividends, spin-offs, and similar events. To carry out the adjustments, we retrieve the information needed from 10-Ks, 10-Qs, and CRSP. Similarly, wherever necessary, we use daily price and trading volume data from CRSP that are adjusted for stock splits, stock dividends, and similar transactions. Finally, we collect data on companies' total assets, total liabilities, cash and short term investments, and operating income from Compustat.

2.5. Descriptive statistics for the repurchase volume dataset

In this section, we provide descriptive statistics for the larger repurchase dataset with "clean" volume data. As reported in Panel A of Table 1, our dataset comprises 265 companies and 5,035 monthly observations. 2,939 of these monthly observations are repurchase firm-months, i.e. firm-months in which the volume of repurchased shares is larger than zero. The remaining 2,096 observations are non-repurchase firm-months.

[Insert Table 1]

[14] We exclude contingent shares because they may or may not be purchased in the near future and, therefore are a less reliable measure of ownership than shares that are currently owned. In any case, the empirical findings are qualitatively similar if we include contingent shares when constructing the insider ownership measure.

Panel B of Table 1 contains descriptive statistics of the relative frequencies of firm-months with and without repurchases. The p-value of the Kolmogorov-Smirnov test on the equality of the distributions is very small. This finding indicates that the distribution across calendar months of firm-months with repurchases is statistically different from the distribution of firm-months without repurchases. The structure of Panel C of Table 1 is similar to that of Panel B, but in Panel C we report descriptive statistics on the distributions by event month. The large p-value of the Komogorov-Smirnov test suggests that we cannot reject the null hypothesis that the frequency distributions for the two sub-samples of repurchase and non-repurchase firm-months are the same. Panels B and C of Table 1 are based on Tables A1 and A2 in Appendix 1. These tables provide more details on the distributions of the relative frequencies both by calendar month and by event month. Finally, Panel D of Table 1 reports some descriptive statistics on the number of months in which a company repurchases stock within the 19-month post-announcement period. The mean (median) number of months is 11.09 (11). Some companies make repurchases in each of the 19 months of the sample period whereas others execute repurchases in only one of them.

Since our sample comprises only 265 companies, we want to verify how representative of the whole universe of U.S. listed companies this sample is. We compare some characteristics of the companies in our sample with the same characteristics of the overall set of U.S. companies with listed common stock (listed on NYSE, NASDAQ, and AMEX) that can be found in CRSP. At the end of April 2005 (the mid-point of the sample period), we find 4,795 U.S. companies in CRSP. The mean and the median market values (price times the number of outstanding shares) for the universe of CRSP companies are $2,823,578,000 and $275,933,100 respectively at the end of April 2005. On the same date, the mean and the median market values of the companies in our sample are $10,736,415,100 and $1,296,104,800 respectively. This shows that the companies in our sample are relatively large. At the end of April 2005, 59% of the companies in CRSP are listed on NASDAQ, 31% on NYSE, and 10% on AMEX. In our sample, 49% of the companies are listed on NASDAQ, 48% on NYSE, and 3% on

AMEX.[15] Hence, NYSE is over-represented and NASDAQ and AMEX are under-represented in our dataset. In terms of industries where CRSP companies operate, 39% of the companies are in the manufacturing industry (sic codes 2011-3999), 20% in the financial sector (sic codes 6011-6799), and 19% in the services sector (sic codes 7011-8999). The remaining industries account for 22%. In our sample, 37% of the companies operate in the manufacturing industry, 28% in the financial sector, and 18% in the services sector. Hence, financial companies are over-represented in our dataset.

3. Do companies time open market repurchases?

3.1. Motivation and research questions

Past survey evidence suggests that companies time their OMRs so as to buy back shares when they are undervalued. Brav et al. (2005) find that 86.4% of U.S. companies surveyed state that the current market price of their stock is an important or a very important factor to their repurchase decisions, in that their repurchase decision is based on whether their "stock is a good investment, relative to its true value." Brav et al. (2005) also conduct some follow-up interviews with executives. Around one half of the interviewed executives state that "their firm tracks repurchase timing and that their firm can beat the market." Moreover, in the same interviews executives often say that repurchases are accelerated or initiated when the market price of their stock is low in comparison with recent historical prices.

The quantitative empirical evidence on repurchase timing in the U.S. stock market is limited. Some previous literature focuses on repurchase announcements and presents indirect evidence on the timing of repurchases. It shows that OMR announcements are greeted by abnormal increases in stock prices (e.g., Vermaelen, 1981; Comment and Jarrell, 1991), and that companies announcing OMR programs experience long-term abnormal increases in stock prices in the post-announcement period (Ikenberry et al., 1995; Chan et al., 2007). These findings may indicate that companies tend to start repurchase programs when their stock is undervalued in the market; investors see repurchase

[15] In computing these percentages, we discard 3 companies from the sample of 265 companies because they switched their listing from one exchange to another during the sample period.

announcements as signals of undervaluation, and push stock prices up through their trading on the announcement day and in the following months. This evidence is rather indirect given that actual purchases of own stock do not necessarily follow repurchase announcements (Simkovic, 2009; Stephens and Weisbach, 1998).

There is also some limited U.S. research on actual open market purchases of own stock offering more direct evidence on repurchase timing. Stephens and Weisbach (1998) find an inverse relation between the number of repurchased shares in a quarter and the abnormal return in the previous quarter. Chan et al. (2007) show that companies experiencing large positive abnormal returns in the one-year period following a repurchase announcement repurchase less in the same period than companies with small or zero post-announcement abnormal returns; this finding is consistent with the notion that a company repurchases less when investors, as a result of a repurchase announcement signaling undervaluation, react more quickly and reduce or eliminate the undervaluation of the company's stock. Cook et al. (2003) analyze a set of voluntarily disclosed daily repurchase transactions for a sample of 54 companies (NYSE and NASDAQ companies). They find that companies repurchase more after price declines. Cook et al. (2004) use a similar dataset of voluntarily disclosed daily repurchases for 64 companies (NYSE and NASDAQ companies) and compare the effective cost of a repurchase program with benchmark costs based on naïve repurchase strategies. They show that the repurchase cost is lower than the benchmark costs for NYSE companies. Finally, Bozanic (2010) uses a dataset of monthly repurchase data and finds that the repurchase volume in one month is negatively related to lagged stock returns and positively associated with the difference between the leading average market price and the repurchase price in the current month.

There is also evidence of repurchase timing outside the U.S.A. Brockman and Chung (2001) analyze a sample of daily repurchase transactions from Hong Kong and show that the actual total cost of a repurchase program is on average lower than the bootstrapped benchmark cost of the same program; in other words, the effective cost of repurchases is lower than a benchmark cost based on a random repurchase strategy. Further evidence consistent with repurchase timing is provided for Canada (Ikenberry et al., 2000; McNally et al., 2006; McNally and Smith, 2007), Hong Kong (Zhang, 2005), and France (Ginglinger and Hamon, 2007).

Below, we re-examine and extend the results of these studies using our novel dataset of U.S. repurchase transactions. Specifically, we test whether (i) companies make OMRs after abnormal price declines and before abnormal price increases; (ii) companies tend to repurchase stock on the open market at comparatively low prices; and (iii) the actual costs of repurchases are below a benchmark estimate of expected costs.

3.2. Association between repurchase volume and prior and subsequent abnormal stock returns

Companies that time repurchase transactions will typically execute repurchases after abnormal stock price falls and before abnormal price increases. Therefore, if companies time repurchase transactions, we expect that, all else equal, repurchase volume in a given month is negatively associated with abnormal returns in previous months, and positively associated with abnormal returns in subsequent months. In this section, abnormal return is defined as the difference between the stock return of a repurchasing company minus the return on a market index. We use three alternative stock indices to proxy the market: the S&P Composite Index, the CRSP value-weighted market index (comprising NYSE, NASDAQ, and AMEX companies), and the CRSP equally-weighted market index (comprising NYSE, NASDAQ, and AMEX companies).

We use the dataset of "clean" repurchase volume data comprising 265 companies and 5,035 firm-months. The dependent variable is *REP*: for each-firm month, this variable is the number of shares repurchased in that month divided by the number of shares outstanding at the beginning of the month. Since *REP* is censored at zero, we estimate Tobit models. As shown in Panel D of Table 1, in the overall sample of 5,035 firm-months the mean of *REP* is 0.38%, its median is 0.08%, its maximum value is 15.95% (3.4% is the value of the 99th percentile), and its minimum value is 0.[16]

[16] Although some of the values of *REP* may appear to be large, they are consistent with trading volume data and regulations. Companies that repurchase their own shares can protect themselves from the risk of liability for price manipulation by complying with the safe harbor of Rule 10b-18. To qualify for the safe harbor, a firm must limit its daily repurchases to 25% of the average daily trading volume in the previous four calendar weeks. For example, in the four weeks preceding the maximum of REP (15.59%) in May 2005, average daily turnover (the number of shares traded over the number of outstanding shares) was 5.93%. In May 2005 the firm could have

Three of our Tobit models examine abnormal returns within one month around the repurchase month using the explanatory variables *MAR 0*, *MAR -1*, and *MAR +1*. *MAR 0* is the market-adjusted return for the current repurchase month, and *MAR +1* (*MAR -1*) is the market-adjusted return for the month following (before) the current month. The remaining three models allow a wider window of abnormal stock performance using windows of two months before and after the repurchase month: the independent variables *MAR -1 TO -2* and *MAR +1 TO +2* are the market-adjusted returns for the two months before and the two months after the current month. We posit that a company holds unbiased estimates of the abnormal performance of its stock in future months that it uses when choosing its repurchasing strategy. Hence, we include *MAR +1* and *MAR +1 TO +2* as measures of the future abnormal returns expected by the company.

As a result of including lags and leads of market-adjusted returns among our explanatory variables, some observations of the original sample of 5,035 firm-months are dropped in the Tobit models (reducing the numbers of observations to 4,505 and 3,975, respectively).

Table 2 reports the estimates of six Tobit models. In particular, there are two different specifications for each of the three market indices used. Results are not qualitatively different across the three market indices. The coefficients on both *MAR -1* and *MAR -1 TO -2* are negative and statistically significant at a 1% level. This indicates that there is a negative relation between the market-adjusted returns in past months and the magnitude of repurchase activity in the current month. The coefficients on *MAR +1* are negative but statistically insignificant. Hence, no conclusions can be drawn. By contrast, those on *MAR +1 TO +2* are positive and significant at a 10% level. These findings show that there is a positive relation between the market-adjusted returns in future months and the magnitude of repurchase activity in current months. On the whole, the evidence on the variables *MAR -1*, *MAR -1 TO -2*, and *MAR +1 TO +2* indicates that repurchasing companies time their stock repurchases. Companies tend to repurchase more after abnormal price declines than after

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complied with the volume condition of the safe harbor with a *REP* of up to 31.13% (i.e. 5.93% x 25% x 21 days). Moreover, compliance with the safe harbor is not mandatory.

abnormal price increases. Also, a company's repurchase activity is likely to be followed by abnormal increases in stock price.

[Insert Table 2]

The coefficient on *MAR 0* is negative and statistically significant at a 1% level. This finding indicates that there is a negative relation between the market-adjusted returns in the current month and the magnitude of repurchase activity in the same month. Companies seem to choose months with abnormal price declines to buy back stock.

3.3. Abnormal returns around repurchases

To further test whether companies are able to time their OMR transaction, we analyze the abnormal returns of a company's stock in months in which the company repurchases shares, and in months that either precede or follow share repurchases. If companies time their repurchases so that they buy back their stock when it is under-valued in the market, we expect months before repurchase transactions to have negative abnormal returns and months that follow repurchases to have positive abnormal returns.

Based on the repurchase volume dataset containing 5,035 firm-months, we estimate OLS regressions using as a dependent variable the risk premium of a stock (*R-Rf*), i.e. the stock return in excess of the risk-free rate of return. For stock *i* and month *t*, the dependent variable is computed as the average daily return on stock *i* in month *t* minus the average daily risk-free return in the same month.

As explanatory variables in the regressions, we include Fama and French's (1993) three factors and Carhart's (1997) momentum factor. In particular, we use average daily values of the factors.[17] In the estimated models, the Fama-French factors are represented by the variables *Rm-Rf*, *SMB*, and *HML*.

[17] In 10-Ks and 10-Qs, the starting and ending dates of the three reporting periods in a quarterly reporting period do not always correspond to the starting and ending dates of calendar months. Hence, we cannot use monthly data provided by CRSP for stock returns, risk-free return, Fama and French factors, and momentum factor. Instead of monthly data, we use averages of daily data for days between actual starting and ending dates of reporting periods.

Rm-Rf is the average daily return on the market portfolio (average daily value-weighted market return) minus the average daily risk-free return. *SMB* is the average daily difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks. *HML* is the average daily difference between the return on a portfolio of stocks with high book-to-market ratios and the return on a portfolio of stocks with low book-to-market ratios. Carhart's momentum factor, *UMD*, is the average daily difference between the return on a portfolio of stocks with high past returns and the return on a portfolio of stocks with low past returns.

The main explanatory variables of interest are a series of intercept dummy variables that reflect the incidence of repurchase transactions in the previous, current, and subsequent months, and are designed to capture shifts in the constant, interpreted here as a measure of abnormal return. *MONTH 0* is a dummy that equals one for firm-months with a positive volume of share repurchases. *MONTH -1* (*MONTH +1*) is a dummy that is set to one if in the next (previous) monthly period some repurchase transactions take place. *MONTHS -1 TO -2* (*MONTHS +1 TO +2*) is a dummy that is equal to one if in at least one of the next (previous) two monthly periods some repurchases are carried out. As a result of the inclusion of these dummies in four of our six OLS regressions, some observations drop out from the original sample of 5,035 firm-months reducing the numbers of observations to 4,505 and 3,975, respectively.

The firm-month observations in our dataset are highly clustered over time since the sample period (February 2004 – July 2006) is quite short. Time-clustering can potentially induce cross-correlation in the observations which, in turn, can result in biases in the standard errors and *t*-statistics on the OLS estimates. In our OLS regressions, we adjust the *t*-statistics on the OLS estimates by taking into account the cross-correlation across errors of observations from the same calendar month (using *Stata* option *cluster*).

Table 3 presents the estimates of six specifications of the OLS regression. All six include the Fama-French (1993) factors and three also the Carhart (1997) momentum factor among the explanatory variables. Also, four of the six regressions comprise *MONTH* intercept dummies, either the dummies *MONTH 0*, *MONTH -1*, and *MONTH +1* reflecting a three-month window around the

repurchase month, or the dummies associated with the wider five-month window: *MONTH 0*, *MONTHS -1 TO -2*, and *MONTHS +1 TO +2*.

[Insert Table 3]

Across the four regressions in columns (iii) to (vi), the coefficients on the variables *MONTH -1* and *MONTHS -1 TO -2* are negative and statistically significant at the 1 percent level. This finding indicates that periods preceding repurchases tend to be characterized by negative abnormal returns. The coefficients on the variables *MONTH +1* and *MONTHS +1 TO +2* are positive and statistically significant at least at the 5 percent level, demonstrating that months following repurchase transactions have positive abnormal returns. In sum, our results suggest that companies appear to time their repurchases by purchasing own stock after abnormal price declines and before abnormal price increases.

Since the coefficient on the dummy *MONTH 0* is negative and statistically significant at the 1 percent level, we conclude that repurchases are carried out in periods characterized by negative abnormal returns.

The coefficients on *Rm-Rf* and *SMB* are positive and statistically significant at standard levels, whereas that on *HML* is not significant. The coefficient on *UMD* is negative and either marginally statistically significant or insignificant at the 10 percent level. An interesting finding is that the coefficient on the constant is always positive and statistically significant at least at the 5 percent level in four of the six regressions. Hence, there is some evidence of a residual positive abnormal return that cannot be explained by risk factors and repurchase activity. Since our sample comprises firm-months for periods following announcements of repurchase programs, the positive coefficient on the constant confirms previous evidence on the existence of long-term post announcement positive abnormal returns (e.g., Ikenberry et al., 1995; Ikenberry et al., 2000).

3.4. Comparisons of actual versus benchmark repurchase prices and costs

We expect that companies that successfully time their repurchases execute them at prices and costs that are lower than the corresponding benchmark based on a naïve trading strategy. The naïve benchmarks are designed to reflect the prices and costs faced by a company that does not time its

repurchases. We expect such a company to repurchase stock at prices that are not systematically different from those at which the average investor would trade, i.e. the average market prices. In the first part of this section, we compare the price at which a company executes repurchases on the market in a particular month with a benchmark based on the average price of the company's stock in the same month. A repurchasing company can time repurchases by taking advantage of private information that is not possessed by the average investor. If companies time their repurchases, we expect the repurchase price to be lower than the benchmark price. In the second part, we analyze whether the total cost of a company's repurchases over a 19-month period is on average lower or higher than the benchmark cost of the same amount of repurchases based on the average price of the company's stock in that period.[18] If companies time their repurchases, we expect the effective total cost of repurchases to be lower than the benchmark.

The empirical analyses of this section are carried out on data that are adjusted to eliminate the contaminating effects of stock splits, reverse splits, stock dividends, spin-offs, and similar transactions that artificially alter price and trading volume. Both repurchase data (volume and price) from 10-Ks and 10-Qs and market data (stock price and volume) are adjusted.[19]

3.4.1. "Within-month" timing only: monthly average repurchase price vs. monthly average daily market closing price

We consider the sample of 4,066 firm-month observations with "clean" repurchase price. On a monthly basis, we compare the average price at which a company repurchases stock with a benchmark given by the average closing price of the stock in the market. We analyze whether in months with repurchases companies buy back stock at low prices. Hence, we investigate what we define as "within-month" timing, which is the price advantage of buying back at relatively low prices within a particular

[18] For a given month, the cost of repurchases is given by the repurchase volume times the average repurchase price.

[19] In order to adjust repurchase price and volume data, we use information on stock splits, reverse splits, stock dividends, spin-offs, and similar transactions from 10-Ks, 10-Qs, and CRSP. Market data are adjusted based on information from CRSP.

month.[20] For each of the 2,316 firm-months with repurchase activity, we compute the monthly average of the daily closing prices of the stock of the company. This average is computed both as simple un-weighted average and as volume-weighted average. In this second case, the price in each trading day is weighted by the corresponding daily trading volume over the total monthly trading volume. For each firm-month, we calculate the variable *%PRICE*, as the ratio of the average repurchase price divided by the average daily closing price minus one (expressed as a percentage). The variable *%PRICE* is an inverse measure of repurchase timing: the greater the price advantage of repurchases relative to the naïve benchmark the smaller, i.e. the more negative, the variable. There are two versions of the variable: one based on the simple average closing price (*%PRICES*) and one based on the volume-weighted average closing price (*%PRICEW*).

For the variables *%PRICES* and *%PRICEW*, Panel A of Table 4 presents descriptive statistics and univariate tests on mean and median values. The maximum value of *%PRICES* (*%PRICEW*) is 21.543% (18.875%) and the minimum value of the variable is -21.624% (-23.199%). Both the mean (–0.619%) and the median (-0.207%) of the variable *%PRICES* are negative and statistically significant at a 1% level. This result indicates that, on average, repurchasing companies carry out repurchases on the market at a price that is 0.619% lower than the average closing price. Findings for the variable *%PRICEW* are very similar. Both its mean (-0.513%) and its median (-0.147%) are negative and statistically significant at a 1% level. Based on this evidence, we conclude that consistent with repurchase timing, companies buy back own stock on the open market at prices that are significantly below average market prices.

[Insert Table 4]

3.4.2. "Within-month" and "between-month" timing combined: effective versus benchmark cost of repurchases in 19-month post-announcement period

The analysis of the previous sub-section compares actual and benchmark repurchase prices rather than costs (based on both prices and repurchase volume). Also, the benchmark used in the last sub-section omits market price data from firm-months without repurchase activity. The analysis in this

[20] See Appendix 2 for examples that illustrate the calculation of the ''within-month'' timing measure.

sub-section uses the additional data on volume and non-repurchase firm-months. For each of the 214 companies with "clean" repurchase price data we calculate the total cost of the repurchases executed over the 19-month period following a repurchase announcement by summing up the repurchase costs (repurchase price times repurchase volume) over all the months with repurchase activity. For example, if a company repurchases 100,000 shares at an average price of $35 in one month and 150,000 shares at an average price of $37 in another month, the total cost of repurchases is $9,050,000. We compare the effective total cost of repurchases with a benchmark that is the total number of shares repurchased over the post-announcement period times the average daily closing price over the same period. In the previous example, the total number of repurchased shares is 250,000; if the average closing price is $38, the benchmark total cost of repurchases is $9,500,000. Since our benchmark in this sub-section depends on average market prices both from months with and without repurchases, we jointly investigate the presence of "within-month" timing and "between-month" timing. The latter involves companies choosing months with relatively low prices to execute repurchases.[21] For each company, we create the variable *%COST1*, the percentage difference between the effective and benchmark total cost of repurchases, defined as the ratio of the effective total cost divided by the benchmark total cost of repurchases minus one (expressed as a percentage). The variable *%COST1* is an inverse measure of the cost saving achieved by timing repurchases: the lower the repurchase cost, the smaller, i.e. the more negative, the variable. In computing the benchmark cost, we either use the un-weighted simple average daily price (*%COST1S*) or the volume-weighted average daily price (*%COST1W*).

For the variables *%COST1S* and *%COST1W*, descriptive statistics and univariate tests on mean and median values can be found in Panel B of Table 4. The maximum value of *%COST1S* (*%COST1W*) is 47.77% (72.413%) and the minimum value of the variable is -47.91% (-50.428%). The mean of *%COST1S* (-2.77%) is negative and statistically significant at a 1% level. The median of the variable (-1.767%) is also negative and statistically different from zero at the same level of significance. These findings indicate that companies, when repurchasing stock in the post-announcement period, spend less than what they would spend if repurchases were executed at the average market price over the period. Results are not qualitatively different for the

[21] See Appendix 2 for examples that illustrate the calculation of the ''between-month'' timing measure.

variable *%COST1W*. Both the mean (-2.837%) and the median (-1.235%) of this variable are negative and statistically different from zero at the 1 percent level. As shown in Section 3.4.4. below, the cost savings are also economically significant. Overall, this evidence indicates that consistent with companies timing their repurchases, the actual cost of repurchases in the post-announcement period is significantly lower than the benchmark cost based on average market prices. The greater cost savings for "within-month" and "between-month" timing together, compared to "within-month" timing alone (in the previous sub-section), suggests that companies reduce the cost of their repurchases not only by timing their repurchases within each month, but also by repurchasing more shares in months in which prevailing market prices are relatively low.

3.4.3. "Between-month" timing only: estimated versus benchmark cost of repurchases in the post-announcement period

In this section, we use both the sample of 265 companies with "clean" repurchase volume data and the sub-sample of 214 companies with reliable repurchase price data. For each company, we estimate the cost of repurchases in each of the 19 months following the company's repurchase announcement assuming that repurchases are executed at a monthly average of the daily closing price of the company's stock. For example, if in a month a company repurchases 250,000 shares and the average closing price in that month is $15, the estimated cost of repurchases is $3,750,000. We use both un-weighted and volume-weighted averages of closing prices. We find the total "estimated" cost of repurchases in the 19-month post-announcement period by cumulating the monthly costs of repurchases. We compare this total estimated cost with a benchmark total cost of repurchases that is the number of shares repurchased in the post-announcement period times the average of the daily closing price over the 19-month post-announcement period. Since the estimated cost is based on average market prices for months with repurchases rather than actual repurchase prices, we do not test for the presence of "within-month" timing. We only investigate the presence of "between-month" timing. For each company, we calculate the variable *%COST2S*, which is the percent difference between the estimated cost and the benchmark cost of repurchases over the 19-month post-announcement period. More specifically, *%COST2S*, which is expressed as a percentage, is the

estimated total cost of repurchases over the benchmark total cost of repurchases, minus one. We also create the variable *%COST2W* that differs from *%COST2S* in two ways. First, in estimating the cost of repurchases, *%COST2S* uses un-weighted simple average closing prices whereas *%COST2W* uses volume-weighted average closing prices. Second, for *%COST2S* the benchmark cost of repurchases is based on the un-weighted simple average closing price whereas for *%COST2W* it is based on the volume-weighted average closing price.

For the variables *%COST2S* and *%COST2W*, Panels C and D of Table 4 presents descriptive statistics and univariate tests on mean and median values. In both panels, the maximum value of *%COST2S* (*%COST2W*) is 47.5% (71.889%) and the minimum value of the variable is -47.722% (–50.636%). In the larger sample with 265 observations, both the mean (-2.183%) and the median (–1.126%) of *%COST2S* are negative and statistically significant at a 1% level. These results indicate that repurchasing companies buy back stock in months with relatively low prices. Findings are very similar for the variable *%COST2W*. Its mean (-2.474%) and its median (-0.915%) are negative and statistically different from zero at a 1% level. As for the sub-sample with 214 observations, the mean value of *%COST2S* (*%COST2W*) is -1.998% (-2.263%). Further, the median values of *%COST2S* and *%COST2W* are -1.126% and -0.634% respectively. We can conclude that consistent with repurchase timing, companies execute repurchases in months with average market prices that are significantly lower than those of months without repurchases.

3.4.4. Discussion of the main findings and economic significance

Overall we find that companies time OMRs both by buying shares at a relatively low price within each month in which the company repurchases shares and by buying more shares during months when prevailing market prices are relatively low. Through a combination of "within-month" and "between-month" timing, companies repurchase stock for roughly 2.8% below benchmark costs (see Panel B of Table 4). The majority of this trading gain comes from "between-month" timing, i.e., concentrating repurchases in months during which prevailing market prices are relatively low. In particular, in Panel D of Table 4 we report that owing to "between-month" timing repurchasing companies enjoy savings

that range from 2% to 2.3% of the benchmark costs. Appendix 2 presents some simple examples that further clarify the difference between "within-month" timing and "between-month" timing.

To evaluate the economic significance of the costs companies save through both "between-month" timing and "within-month" timing, we proceed as follows. First, for each of the 214 companies in the sub-sample with accurate repurchase price data, we compute two absolute measures of cost savings by multiplying the values of %COST1S and %COST1W by their respective benchmark costs. These benchmarks, which are defined in Section 3.4.2, are either based on average un-weighted daily prices or on volume-weighted average daily prices. The median values of the two absolute measures of cost savings are -$336,530 and -$209,073. Second, we calculate the ratios between the two absolute measures of cost savings and either the company's market value of equity (i.e. market capitalization) at the start of the sample period of 19 months or the company's book value of total assets for the latest fiscal year before the start of this period. We multiply each of the resulting four ratios by 100 to obtain percent measures of cost savings that are proportional to measures of company size. Finally, we calculate descriptive statistics for the four percent measures. The mean percent cost savings scaled by market capitalization are -0.24% (-0.1%) and -0.25% (-0.05%), respectively. The mean (median) values are roughly -0.54% (-0.04%) for measures scaled by total assets. These findings imply that the average cost savings over a 19-month period accounts for between 0.24% and 0.25% of a company's market capitalization and for 0.54% of a company's total assets. The maximum cost savings in the sample are equal to between 7.01% and 7.76% of market capitalization and to between 25.5% and 28.21% of total assets. We can conclude that the cost savings companies make over a 19-month period by timing OMRs correspond to a non-negligible portion of their market capitalizations and book values of total assets.

3.5. Alternative explanations

Even though the findings reported in the previous Sections 3.2, 3.3, and 3.4 are clearly consistent with repurchase timing, it is important to analyze whether there are alternative explanations.

Some of our findings could be explained by price support rather than timing. It is possible that companies use repurchases to support their stock prices. Price support activities are likely to take place

after price declines. The evidence we report in this paper, particularly in Tables 2 and 3, confirms that companies' propensity to purchase own stock is larger after falls in the prices of their shares. However, activities aimed at supporting stock prices cannot explain the abnormal price increases after periods with stock repurchases (see Tables 2 and 3). By contrast, we would expect to observe such increases if in fact companies do time their repurchases.

Announcements of repurchase programs may signal stock undervaluation, and probably for this reason, they are followed by positive short-term abnormal returns (e.g.,Vermaelen, 1981; Ikenberry et al., 1995; Grullon and Michaely, 2004). However, in our case, the short-term reactions to repurchase announcements cannot drive our findings because firm-months with announcements are excluded from our samples. Research on repurchase announcements also reports long-term positive abnormal returns in the post-announcement periods (e.g., Ikenberry et al., 1995; 2000). It could be argued that our finding that actual repurchase prices and costs are lower than benchmark prices and costs (as reported in Section 3.4) may be due to the long-term abnormal returns following repurchase announcements. This would be the case if repurchase transactions mostly took place in the first few (event) months after repurchase announcements that are followed by positive long-term abnormal returns. However, we observe no statistically significant variation in the frequency of repurchase transactions across event months (as highlighted in Section 2.5 and Panel C of Table 1). Figure A1 in Appendix 1 provides further evidence that repurchase transactions are not systematically clustered in the first few event months after repurchase announcements. The figure reports average values of repurchase volume, as measured by the variable *REP*, across event months. The time-series mean of *REP* averaged across stocks is the same for the first and the last nine event months (0.37%). We conclude that abnormal returns caused by repurchase announcements are unlikely to explain our findings.

Announcements of executed repurchase transactions may also signal undervaluation and generate positive market reactions. Zhang (2005) finds that in Hong Kong the cumulative abnormal return on the repurchase day and the subsequent two days, during which the transaction is disclosed, is positive and statistically significant. Similar evidence is reported by Wang et al. (2009) for the U.K. In the U.S. repurchase transactions are not disclosed immediately but only when companies file their 10-Q and

10-K reports (as outlined in Section 2). We investigate whether investors' responses on disclosure days of 10-Qs and 10-Ks drive some of our results. We create monthly dummies that identify the two firm-months after the end of 10-Q periods and the three firm-months after the end of 10-K periods.[22] We re-estimate the regressions of Table 3 with these dummies. The two 10-Q dummies have a statistically significant positive impact on stock returns. The same is true for the 10-K dummy that identifies the second month after the end of a fiscal period. Importantly, the coefficients on *MONTH +1* and *MONTH +1 TO +2* are still positive and significant. These results suggest that abnormal stock returns follow repurchase transactions even after controlling for the stock price reaction to transaction disclosures.

Overall, we conclude that our results are indicative of timing rather than being driven by common alternative explanations.

4. Determinants of open market repurchase timing

4.1. Informed ownership and the information effect

Next, we examine the determinants of the profits (through price advantages and cost savings) companies realize by timing OMRs. We expect the company to realize lower profits or cost savings by timing repurchases when a higher proportion of a company's outstanding shares are held by informed investors. We argue this "information effect" arises because more informed ownership results in more informed trading, which in turn renders the stock price more informative and undervaluation of the stock rarer and less pronounced. As a result, there is less opportunity for companies to profit from repurchases timed to exploit temporary undervaluation. As both insiders and institutions are normally considered well-informed investors (e.g., Seyhun, 1986; Sias et al., 2006), both insider and institutional ownership may give rise to an "information effect".

[22] In constructing these dummy variables we take into account the SEC rules (during our sample period) that companies must submit their filings within 75 days (for accelerated filers) to 90 days (for non-accelerated filers) after the end of the fiscal period for 10-Ks and within 40 or 45 days for 10-Qs (for accelerated and non-accelerated filers, respectively).

We expect informed ownership to be positively associated with informed trading. Our expectation is supported by Aslan et al. (2011) who report that ownership by informed investors (i.e. insider ownership and large institutional holdings) positively impact the probability of informed trading. Furthermore, previous research finds that trades by insiders are more common for companies with higher insider ownership (Demsetz, 1986; Sarin et al., 1999).

The impact of informed trading on the informativeness of share prices has been demonstrated theoretically. A single monopolistic informed trader is expected to trade in such a way that her private information is incorporated in the share price only gradually (e.g., Kyle, 1985). By contrast, with larger numbers of informed traders more private information is revealed more quickly as informed traders compete for trading profits; and as prices become more informative the rents available to private information are dissipated (Kyle 1984; O'Hara 1995). As the number of informed traders increases, their optimal strategy becomes more competitive (Holden and Subramanyam 1992; O'Hara 1995). Overall, when competition from informed trading increases, there is a reduction in the potential timing profits companies can make through repurchases.

There is no lack of empirical evidence supporting the notion that both insiders and institutions trade on price-relevant information and that by doing so they facilitate price discovery and boost price informativeness. Starting from institutional investors,[23] Chen et al. (2000) show that stocks recently bought by mutual funds outperform stocks that were recently sold by mutual funds. Ali et al. (2004) find that changes in institutional ownership in one quarter are positively related to the abnormal returns recorded when quarterly earnings are announced in the following periods. This evidence supports the notion that institutions have private information on future earnings surprises and that they trade on this information. Yan and Zhang (2009) find that trades by institutions with short term investment horizons predict future stock returns and earnings. Piotroski and Roulstone (2004) show that trades by institutions facilitate the incorporation of the company-specific component of future earnings into stock prices. Similarly, Boehmer and Kelley (2009) analyze the relation between

[23] The existing literature in the area is particularly large. In this section, we do not aim to thoroughly review this literature. We primarily focus on some recent research papers that we consider of particular interest.

informational efficiency and institutional ownership. They document that prices of stocks with greater institutional ownership more closely follow a random walk process.

As for insiders, existing empirical evidence shows that they trade on information that is not already reflected in market prices (e.g., Seyhun, 1986; Lakonishok and Lee, 2001; Ke et al., 2003; Piotroski and Roulstone, 2005) and that legal trading by insiders facilitates price discovery (Aktas et al., 2008). This evidence supports the widely-accepted notion that insiders are likely to have more information that most outside investors.[24] If trades by insiders convey private information, the relation between informational efficiency and insider ownership should be positive. Consistent with this inference, Fidrmuc et al. (2006) find that the profits generated by insider trades are a negative function of insider ownership.

The measure of informed ownership we use is the sum of insider and institutional ownership (*INSO+INSTO*).[25] For a particular company, *INSO* is the percentage of the company's outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month period that follows the company's repurchase announcement (post-announcement period). The variable *INSTO* is the percentage of the company's outstanding shares held by all institutional investors on the end-of-quarter date before the initiation of the company's post-announcement period that is nearest to the date of the proxy statement used to collect insider ownership data.

[24] This does not mean that all insiders are always better informed than any outside investor. Some outside shareholders may accumulate private information by analyzing public information through sophisticated and uncommon methods of investment analysis. By doing so, they may become better informed than insiders.

[25] Insider ownership plus long-term institutional holdings can also be interpreted as one minus the "free float", where the free float is the proportion of shares that are readily available for trading in the market. The smaller the free float, the larger may be the price impact of repurchase transactions, and the smaller the timing profits. We thank the anonymous referee for pointing out this interpretation. However, as we control for price impact and stock liquidity by including two widely-used liquidity measures discussed in Section 4.2., we do not interpret *INSO+INSTO* as a price-impact measure.

4.2 Insider ownership and the wealth effect

We recognize that the impact of insider ownership on profits from timing repurchases may not necessarily be negative as predicted by the information effect outlined above. Instead we expect a countervailing effect as larger insider ownership increases the incentives for insiders to trade on private information using repurchases as a substitute for direct insider transactions. The execution of repurchases at comparatively low prices transfers wealth from "selling shareholders" (shareholders that sell their stock back) to non-selling shareholders. Fried (2005) argues that by repurchasing shares at less than fair value, informed insiders (who are unlikely to sell at such prices) extract wealth from selling shareholders (who tend to be less informed). Non-selling shareholders benefit from this wealth transfer *pro rata* in relation to their pre-repurchase shareholdings. The higher the insiders' shareholdings the more they stand to benefit and the greater their incentive to time repurchases. This "wealth transfer effect" predicts a positive relation between profits from repurchase timing and insider ownership.

It is reasonable to expect that insider ownership has both a wealth transfer effect and an information effect. As the relative strengths of the two effects may vary depending on the level of inside ownership, it is possible that the relation between insider ownership and repurchase timing is non-linear. For instance, at low levels of informed ownership the positive wealth transfer effect of inside information may offset its negative information effect; while the information effect may prevail at high levels of inside information. We have no *ex ante* expectations regarding the relative strengths of the two effects over various ranges of inside ownership; instead we expect our empirical analysis to shed light on the matter.

4.3. Liquidity

We argue that another determinant of the profitability of repurchase timing is stock liquidity. Previous research shows the impact of repurchase transactions on stock liquidity. While Brockman and Chung (2001) find that repurchases reduce liquidity, Cook et al. (2004) document the opposite effect. More recently, Brockman et al. (2008) study the impact of liquidity on repurchase decisions and show that a stock's liquidity is a determinant of the company's payout policy. By contrast, our

analysis examines the impact of liquidity on the cost savings and price advantages achieved by companies timing repurchase transactions.

Repurchase transactions are likely to have greater price impact on less liquid stocks, increasing the actual open-market stock price at which shares are repurchased (relative to the benchmark price) and raising the total cost of repurchasing (relative to the benchmark). Likewise, companies with higher transaction costs of repurchasing in terms of bid-ask spread find it harder to repurchase stock at comparatively low prices (relative to the benchmark cost). Thus, we expect a negative relation between the profits from timing repurchase transactions and measures of transaction costs and stock liquidity. The potential endogeneity of liquidity is explored in Section 4.7. below.

We use the illiquidity ratio developed by Amihud (2002) as a measure of price impact.[26] *AMIHUD* is calculated as the average value of one million times the daily Amihud illiquidity ratio defined as the absolute value of daily return over daily dollar volume. We also consider an alternative liquidity measure, namely the bid-ask spread. *SPREAD* is defined as the average daily relative bid-ask spread, which is the difference between ask and bid prices over the average of the two prices. *AMIHUD* and *SPREAD* are computed using daily data from the post-announcement period.

4.4. Other determinants

We also investigate the relations between the timing of repurchases and the following other possible determinants.[27] First, we argue that companies with highly volatile stocks may have more

[26] The Amihud illiquidity ratio is easy to compute using widely-available daily data. We choose it as a price impact measure based on Goyenko et al. (2009), who show that the Amihud ratio is highly positively correlated with price impact measures based on intraday data. They also conclude that the Amihud ratio is normally preferable or not significantly worse than alternative daily price impact measures.

[27] Cook et al. (2004) find that NYSE firms have significant timing skills when repurchasing stock whereas Nasdaq firms do not make any timing gains. We therefore consider adding a dummy variable as a timing determinant to separate observations for NYSE and AMEX firms from those for NASDAQ firms. We do not find support for Cook et al.'s (2004) results in that the dummy is never statistically significant in our analyses. These results are not reported in the tables below but are available from the authors on request.

opportunities to repurchase stock at comparatively low prices than companies with more stable stock prices. To measure stock return volatility we create the variable *SD*, which is the standard deviation of a company's stock daily return over the post-announcement period.

The "fair value" of the stocks of small companies is likely to be less precisely known by investors than that of large and well-known companies. Hence, small companies should be more able than large companies to time OMRs. As measure of company size we use *MV*. This variable is the natural logarithm of a company's market capitalization (number of outstanding shares in thousands times stock price) on the last trading day before the start of the post-announcement period. The empirical findings are qualitatively similar if instead of MV we use the natural logarithm of the book value of total assets in our analyses.

We also consider the variables *CASH*, *CF*, and *MB* among the possible determinants of repurchase timing. These variables are calculated using market and accounting data relating to the last fiscal year that does not comprise parts of the post-announcement period. *CASH* is the value, at year end, of cash and short-term investments (Compustat item 1) scaled by the value, at year end, of total assets (Compustat item 6). *CF* is the value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *CF* is a measure of cash flow. *MB* is the market-to-book ratio. To be more specific, it is the sum of the end-of-year values of market capitalization (in millions) and total liabilities (Compustat item 181) scaled by the value, at year end, of total assets. Cash-rich companies (with high values of *CASH* and *CF*) are financially very flexible and can always find spare cash to repurchase stock whenever their own stock can be bought at a "cheap" price. In contrast, companies with low levels of *CASH* and *CF* may sometimes be forced to pass up good trading opportunities in their own stock owing to the lack of cash. On the whole, we may expect cash-rich companies to be able to time repurchases more than companies with low levels of liquid resources. *MB* is a measure of growth opportunities. Companies with a lot of growth opportunities (high *MB*) may be more reluctant to use cash to repurchase stock. These companies may prefer to retain high levels of liquid resources to finance future investments. The opposite can be said for companies with few growth opportunities (low *MB*). Overall, companies with low *MB* could make

repurchases in a more flexible way than companies with high *MB*. We may expect to find an inverse relation between a company's *MB* and the company's profits from timing repurchases.

4.5. Methodology and descriptive statistics

We analyze the relation between a company's profits from timing OMRs and the potential determinants (explanatory variables) of repurchase timing highlighted in the previous sections. We use six different (inverse) measures of timing profits ("timing measures"). The first two of these measures are *A%PRICES*, the value of *%PRICES* (as defined in Section 3.4.1) averaged over all the months in which the company repurchases shares, and *A%PRICEW*, defined as the average over repurchase months of the variable *%PRICEW* (Section 3.4.1). The other four timing measures *%COST1S*, *%COST1W*, *%COST2S*, and *%COST2W* are as defined in Sections 3.4.2 and 3.4.3. A *decrease* in any of the six timing measures reflects an increase in a company's profits from timing repurchases, and vice versa. We observe values of the variables *A%PRICES*, *A%PRICEW*, *%COST1S*, and *%COST1W* for a sample of 214 companies, and of the variables *%COST2S* and *%COST2W* for a larger sample of 265 companies.

Descriptive statistics for all the explanatory variables are reported in Table 5. Panel A reports descriptive statistics for the sample of 214 companies that is used in the regressions with the dependent variables *A%PRICES*, *A%PRICEW*, *%COST1S*, and *%COST1W*. Panel B presents descriptive statistics for the sample of 265 companies that is used when the dependent variables are *%COST2S* and *%COST2W*. In Panel A, the mean (median) value of the variable *INSO* is 8.17% (3.67%). The mean (median) value of the variable *INSTO* is 62.84% (70.108%). Mean and median values of the variables *INSO* and *INSTO* are very similar in Panel B.[28] The mean value of the variable *INSO+INSTO* (the sum of *INSO* and *INSTO*) is 71% and its median value is 78.25%.

[28] There are 9 observations in the sample with 214 companies and 10 observations in the sample with 265 companies with values of *INSTO* exceeding 100%. Asquith et al. (2005) provide a logical explanation for this apparent puzzle. When a stock is sold short, two different institutional investors may formally own the stock at the same time: the investor from which the short seller borrows the stock and the investor to whom the short

[Insert Table 5]

For company *i*, the baseline multivariate model we estimate in this section is described by Equation (1):

$$Timing\ Measure_i = \beta_0 + \beta_1 OwnershipVariables_i + \beta_2 Liquidity_i + \beta_3 SD_i + \\ + \beta_4 MV_i + \beta_5 CASH_i + \beta_6 CF_i + \beta_7 MB_i + e_i \quad (1)$$

The "timing measure" is alternately one of *A%PRICES*, *A%PRICEW*, *%COST1S*, *%COST1W*, *%COST2S* or *%COST2W*. "Ownership variables" specified alternately as (i) informed ownership, measured as the sum of insider and institutional ownership (*INSO+INSTO*), (ii) insider ownership *INSO* and institutional ownership *INSTO* separately, or (iii) institutional ownership *INSTO*, and insider ownership *INSO* and its square *INSO²*. In some of the specifications the explanatory variables include *INSO²* to allow for a possible quadratic relation between the insider ownership and the timing measures. "Liquidity" is either *AMIHUD* or *SPREAD*. *e* is the error term. In every regression, we include a set of industry dummies that are based on the ten main groups of SIC codes.[29] We adopt Ordinary Least Squares to estimate several versions of baseline regression (1).

Table 6 shows the correlation matrix for the regression variables. Correlation coefficients across pairs of explanatory variables that appear in the same regressions are sometimes quite high.

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seller subsequently sells the stock. Short sales can inflate *INSTO* and push its value above the 100% threshold. Hence, we do not discard observations with a value of *INSTO* exceeding 100%.

[29] We omit the industry dummies from Equation (1), and do not report coefficient estimates for the dummies in the tables; the results are available from the authors on request. As our sample includes companies from the financial sector, we investigate finance sector-specific effects by including interaction terms between the finance industry dummy and the explanatory variables *CASH*, *CF*, and *MB* to test whether these variables have a significant incremental impact among financial companies on the timing measures. Overall, we conclude that there are no statistically significant differences between financial and industrial companies. These results are not reported in the tables below but are available from the authors on request.

Specifically, we have relatively large correlation coefficients for the following pairs of variables: *SPREAD-MV* and *CF-MB*. Nevertheless, the coefficients never reach levels that could undermine the validity of the regression findings. We formally test this conclusion by running the regressions with the four variables dropped one at a time. The results of these regressions are qualitatively similar to those with the original full set of variables.

[Insert Table 6]

4.6. Empirical findings

Table 7 shows the estimated regressions of the six timing measures on informed ownership (the sum of insider and institutional ownership, *INSO+INSTO*), stock liquidity measured either by the Amihud illiquidity ratio (*AMIHUD*) or the relative bid-ask spread (*SPREAD*), and the other explanatory variables outlined in Section 4.4. Across the twelve regressions, the coefficient on *INSO+INSTO* is always positive and statistically significant at least at the 5 percent level of significance. This finding suggests that an increase in informed ownership (the shareholdings of insiders and institutions) in a company leads to a reduction in the company's profits from repurchasing stock at comparatively low prices. It appears that companies have fewer opportunities to time repurchases if a larger share of their stock is held by insiders and institutions. This is consistent with the information effect outlined in Section 4.1.: more informed ownership reduces the opportunities available for companies to time OMRs.

[Insert Table 7]

Another statistically significant finding is the positive relation between the two liquidity measures *AMIHUD* and *SPREAD* and the six timing measures. From a statistical viewpoint, this relation is stronger for *AMIHUD* than for *SPREAD*. The positive sign of this relation indicates that an increase in the transaction costs (price impact of transactions or bid-ask spread) companies face when repurchasing stock causes a reduction in the potential cost savings of repurchases made at relatively low prices. The coefficients of the other explanatory variables are normally not statistically different from zero. In only four cases out of twelve, the coefficient of *MV* is positive and statistically significant. The coefficient of *CASH* is negative and significant only in three regressions. It is worth

highlighting that the overall explanatory power of the regressions is quite large, with adjusted R-squared ranging from 8.25% to 27.03%.

In Table 8, we split *INSO+INSTO* into its two components to examine the separate effects of the two classes of owners: insiders and institutional investors. It is conceivable that the relative strength of the information effect differs between the two types of informed investor. Further, as explained above, there may be a wealth effect of insider ownership (which is absent for institutional investors). We present estimates of regressions of the six timing measures on insider ownership (*INSO*), institutional ownership (*INSTO*), stock liquidity measured either by the Amihud illiquidity ratio (*AMIHUD*) or the relative bid-ask spread (*SPREAD*), and the other explanatory variables (outlined in Section 4.4). The estimated coefficients on both *INSO* and *INSTO* are positive in all twelve specifications in Panels A and B. The coefficients on *INSTO* are statistically significant in all models while those of *INSO* are significant in eight of the twelve models. Overall, we can conclude that an increase in the holdings of either class of well-informed investors reduces the profits companies make from repurchasing at bargain prices.

[Insert Table 8]

The statistical significance of *INSTO* is far greater than that of *INSO*, which suggests that the results for the combined measure (*INSO+INSTO*) reported in Table 7 are primarily driven by *INSTO*. The coefficients on *AMIHUD* and *SPREAD* are always positive and statistically significant confirming our earlier conclusion: lower liquidity and higher transaction costs are associated with a reduction in the timing of repurchases. The remaining explanatory variables have coefficients that are normally statistically insignificant, although the coefficients on *CASH* and *MV* are significant in a few cases. Splitting the combined ownership measure (*INSO+INSTO*) into its two components increases the explanatory power of all the regressions as indicated by the higher adjusted R-squared statistics.

Finally, in Table 9, we add as an explanatory variable the squared term of insider ownership ($INSO^2$). The estimated coefficient on the linear term of *INSO* reported in Table 9 is negative while the coefficient on squared insider ownership $INSO^2$ is positive; and both coefficients are statistically significantly different from zero. These results suggest a non-linear relation between insider ownership and companies' profits from timing repurchases. At low levels of *INSO*, an increase in insider

ownership raises the propensity of company insiders to time OMRs (as shown by a decrease in the timing measures) given that the benefits from timing to non-selling insiders are positively related to their shareholdings. This result suggests that the wealth transfer effect dominates the information effect at low levels of insider ownership. At high levels of *INSO*, by contrast, higher insider ownership reduces the gains from timing OMRs. Here, the wealth transfer effect is more than offset by the information effect of more informed shareholders increasing the information contained in market valuations and reducing companies' profits from repurchasing stock at bargain prices. As a result, there is an inverted U-shaped relation between insider ownership (on the x-axis) and the gains from timing repurchases (on the y-axis). Across the twelve regressions reported in Table 9, the turning points for the variable *INSO* (i.e. values of *INSO* at which the values of the dependent variables are minimized) range from 15.14% to 18.36%.

[Insert Table 9]

As in the previous two tables, in Table 9 the coefficients on *INSTO*, *AMIHUD*, and *SPREAD* are positive and significant at standard levels in all or most specifications (the exceptions are the insignificant coefficients on *SPREAD* in two regressions). Further, the coefficients on the remaining explanatory variables are normally not statistically different from zero. Based on the higher adjusted R-squared values in Table 9, as compared to Tables 7 and 8, we conclude that the set of explanatory variables that explains most of the variation in the timing measures comprises both a linear and a squared term for insider ownership (*INSO* and $INSO^2$), a linear term for institutional ownership (*INSTO*), and one of the two measures of liquidity and transaction costs (*AMIHUD* or *SPREAD*).

Based on the estimates of Tables 7 to 9, we can draw the following three conclusions. First, an increase in the presence of well-informed shareholders is associated with a decrease in companies' profits from repurchasing stock at comparatively low prices. This finding is mainly driven by the shareholdings of institutional investors. Second, when insider ownership is low, an increase in this variable boosts companies' propensity to time repurchases. In contrast, when insider ownership is high, there is a negative relation between this variable and repurchase timing. This suggests that the companies achieving the highest profits from timing repurchases are those with intermediate levels of insider ownership. Finally, higher stock liquidity and lower transaction costs increase the gains from

repurchase timing in terms of the cost savings companies can make by repurchasing stock at comparatively low prices.

4.7. Endogeneity of liquidity measures

There is some previous evidence showing that stock repurchases can affect the liquidity of a stock (e.g., Brockman and Chung, 2001; Cook et al., 2004) and that repurchase decisions may be driven by liquidity considerations (Brockman et al., 2008). Although the dependent variables we use in Tables 7, 8, and 9 measure repurchase *timing* (in terms of price advantages and cost savings) and not the magnitude of repurchase activities as in most previous studies, we cannot *ex ante* rule out the possibility that our liquidity measures are endogenous in the regressions. We formally test the endogeneity of *AMIHUD* and *SPREAD* using a two-stage least squares (2SLS) estimator with robust standard errors and two endogeneity tests (Wooldridge's robust score and robust regression tests). For each company, we use the average value of the daily Amihud illiquidity ratio (relative bid-ask spread) in the six months before the start of the sample period as an instrument for the variable *AMIHUD* (*SPREAD*). We replicate the regressions of Table 9 and find that in most cases the null hypothesis that the liquidity measure (*AMIHUD* or *SPREAD*) is exogenous is not rejected.[30] The coefficients on all the independent variables are qualitatively similar to those obtained in the OLS regressions but those on *AMIHUD* and *SPREAD* are statistically significant in only three specifications. The loss of significance when using a 2SLS estimator is expected. As documented in the econometric literature, 2SLS estimates may be significantly biased in small samples, and 2SLS standard errors are likely to be comparatively larger than OLS standard errors (e.g., Wooldridge, 2002, Section 5.2.6). Given the problems of applying the 2SLS estimator to our sample, and considering that *AMIHUD* and *SPREAD*

[30] The adjusted R-squares of the first stage regressions range from 0.4708 to 0.8187, indicating that the instruments used are not weak. Also, the coefficients on the lagged liquidity measures are always statistically significant in the first stage regressions. The p-value of at least one of the two endogeneity tests we conduct is lower than 10%, rejecting exogeneity, in only two of the twelve regressions we estimate.

are normally exogenous in our specifications, we conclude that the OLS results reported in Table 9 are reliable.

5. Conclusion

We investigate the timing of open market repurchase (OMR) transactions using a novel dataset collected from SEC filings that have become available since 2004.

We present evidence that companies time repurchases and buy back stock at comparatively low prices. We show that companies tend to repurchase shares in months when the share price dips. We also show that there are negative abnormal returns in periods preceding months with repurchase activity and positive abnormal returns in periods following months with repurchase activity. Finally, we quantify the price advantages and cost savings companies make when repurchasing stock. The majority of trading gains come from repurchasing stock in months when prices are relatively low. The cost savings companies make by timing repurchases are economically significant. The average 19-month cost savings are about 0.25% of the market capitalization of a company and about 0.54% of the book value of total assets. For some companies the cost savings are very large; maximum savings are 7.76% of a market capitalization and 28.21% of total assets.

We present evidence that companies' profits from timing repurchases are significantly related to ownership structure. Specifically, institutional ownership reduces the gains from timing OMRs. This relation is consistent with the information effect that predicts that larger shareholdings by informed (institutional) investors increase the information contained in market valuations and reduce companies' opportunities to profit from repurchasing stock at bargain prices.

The impact of insider ownership on timing profits is nonlinear. Specifically, there is an inverted u-shaped relation between insider ownership (on the x-axis) and the gains from timing repurchases (on the y-axis). This suggests that at low levels of insider ownership the wealth transfer effect dominates the information effect. The wealth transfer effect predicts a positive impact of insider ownership on repurchase timing because the benefits to non-selling insiders from timing repurchases are directly related to their shareholdings. At high levels of insider ownership, by contrast, a further increase in insider ownership reduces the gains from timing. Here, the wealth transfer effect is more than offset by

the information effect of higher informed ownership that reduces a company's opportunities to buy back undervalued stock.

We also document a significant positive impact of stock liquidity on companies' profits from timing OMRs. This is consistent with our prediction that companies with illiquid stocks have fewer opportunities to time OMRs because of high transaction costs and the large price impact of transactions in illiquid markets.

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Appendix 1

Table A1
Distribution of the number of firm-months by calendar month

	All firm-months		Firm-months with repurchases		Firm-months without repurchases	
Calendar month	Frequency	% Frequency	Frequency	% Frequency	Frequency	% Frequency
February 2004	10	0.2	9	0.31	1	0.05
March 2004	37	0.73	26	0.88	11	0.52
April 2004	51	1.01	32	1.09	19	0.91
May 2004	66	1.31	55	1.87	11	0.52
June 2004	93	1.85	62	2.11	31	1.48
July 2004	114	2.26	70	2.38	44	2.1
August 2004	146	2.9	107	3.64	39	1.86
September 2004	182	3.61	101	3.44	81	3.86
October 2004	204	4.05	105	3.57	99	4.72
November 2004	220	4.37	119	4.05	101	4.82
December 2004	241	4.79	122	4.15	119	5.68
January 2005	265	5.26	132	4.49	133	6.35
February 2005	265	5.26	153	5.21	112	5.34
March 2005	265	5.26	170	5.78	95	4.53
April 2005	265	5.26	154	5.24	111	5.3
May 2005	265	5.26	180	6.12	85	4.06
June 2005	265	5.26	146	4.97	119	5.68
July 2005	265	5.26	126	4.29	139	6.63
August 2005	265	5.26	183	6.23	82	3.91
September 2005	255	5.06	153	5.21	102	4.87
October 2005	228	4.53	125	4.25	103	4.91
November 2005	214	4.25	129	4.39	85	4.06
December 2005	199	3.95	114	3.88	85	4.06
January 2006	172	3.42	69	2.35	103	4.91
February 2006	151	3	92	3.13	59	2.81
March 2006	119	2.36	69	2.35	50	2.39
April 2006	83	1.65	39	1.33	44	2.1
May 2006	61	1.21	45	1.53	16	0.76
June 2006	45	0.89	36	1.22	9	0.43
July 2006	24	0.48	16	0.54	8	0.38
Total	5,035	100	2,939	100	2,096	100

The table presents the distributions of the number of firm-months by calendar month over the period February 2004 – July 2006 for a sample of 5,035 firm-months, a sub-sample of 2,939 firm-months with open market share repurchases, and a sub-sample of 2,096 firm-months without open market share repurchases. The 5,035 observations in the sample are for 265 repurchasing companies (19 firm-months per company) that announced open market repurchase programs in 2004. These companies are identified through a search on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. For each sample of firm-months and each calendar month, the table reports the number of firm-months (*Frequency*) and the number of firm-months multiplied by 100 and divided by the total number of firm-months in the sample (*% Frequency*).

Table A2
Distribution of the number of firm-months by event month

	All firm-months		Firm-months with repurchases		Firm-months without repurchases	
Event month	Frequency	% Frequency	Frequency	% Frequency	Frequency	% Frequency
+1	265	5.26	179	6.09	86	4.1
+2	265	5.26	154	5.24	111	5.3
+3	265	5.26	161	5.48	104	4.96
+4	265	5.26	154	5.24	111	5.3
+5	265	5.26	143	4.87	122	5.82
+6	265	5.26	150	5.1	115	5.49
+7	265	5.26	158	5.38	107	5.1
+8	265	5.26	150	5.1	115	5.49
+9	265	5.26	153	5.21	112	5.34
+10	265	5.26	163	5.55	102	4.87
+11	265	5.26	156	5.31	109	5.2
+12	265	5.26	153	5.21	112	5.34
+13	265	5.26	156	5.31	109	5.2
+14	265	5.26	159	5.41	106	5.06
+15	265	5.26	158	5.38	107	5.1
+16	265	5.26	158	5.38	107	5.1
+17	265	5.26	136	4.63	129	6.15
+18	265	5.26	147	5	118	5.63
+19	265	5.26	151	5.14	114	5.44
Total	5,035	100	2,939	100	2,096	100

The table presents the distributions of the number of firm-months by event month for a sample of 5,035 firm-months, a sub-sample of 2,939 firm-months with open market share repurchases, and a sub-sample of 2,096 firm-months without open market share repurchases. The 5,035 observations in the sample are for 265 repurchasing companies (19 firm-months per company) that announced open market repurchase programs in 2004. These companies are identified through a search on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Event month +1 is the month that follows the month of the announcement of an open market repurchase program by a company (event month 0). Event month +19 is the 19^{th} month after event month 0. For each sample of firm-months and each event month, the table reports the number of firm-months (*Frequency*) and the number of firm-months multiplied by 100 and divided by the total number of firm-months in the sample (*% Frequency*).

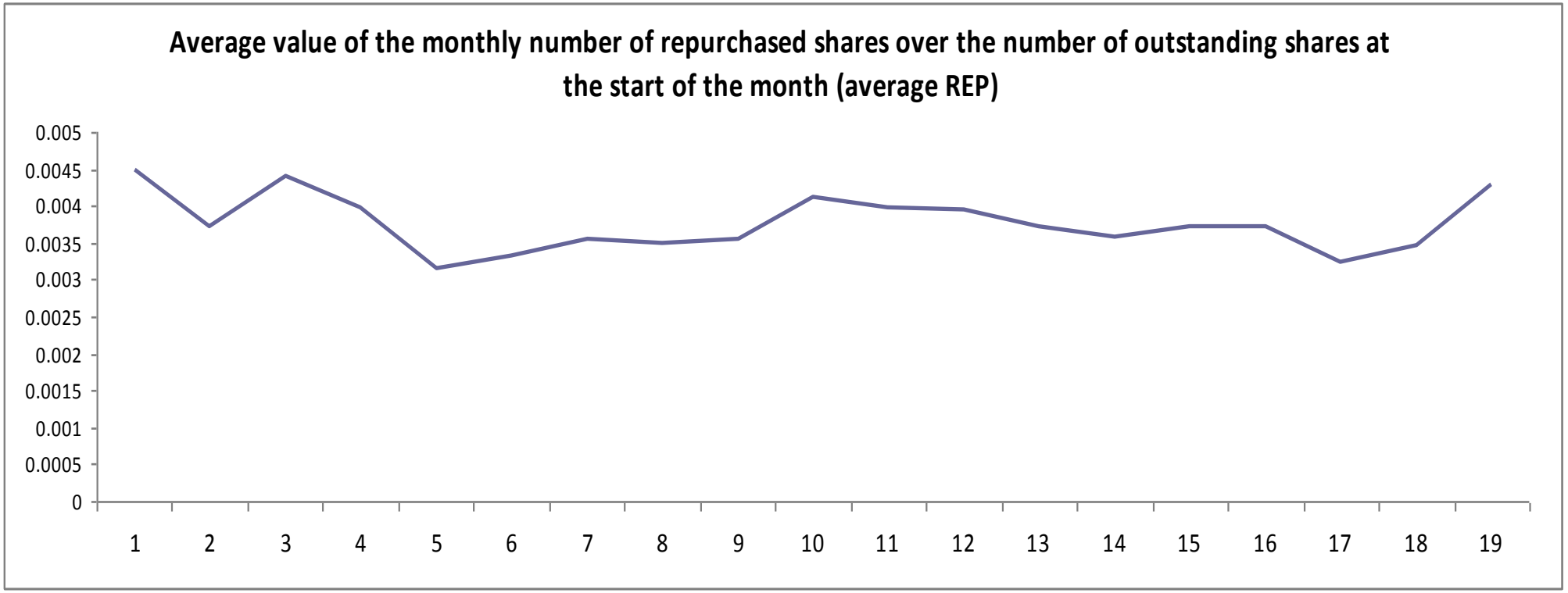

Fig. A1. The graph shows the average value of the variable *REP* for each event month. *REP* is equal to the number of shares repurchased by a company in a month over the company's number of outstanding shares at the start of the month. The average values of *REP* are computed using 5,035 firm-month observations for 265 repurchasing companies (19 firm-months per company) that announced open market repurchase programs in 2004. These companies are identified through a search on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Event month +1 is the month that follows the month of the announcement of an open market repurchase program by a company (event month 0). Event month +19 is the 19th month after event month 0. Event month numbers are reported on the horizontal axis.

Appendix 2

The numerical examples presented below illustrate the calculation of the "between-month" and the "within-month" cost savings, our so called "timing measures".

In the first example, we assume that the price of a stock always equals 10 except on day X in month Y when it is 7. Assuming that the company repurchases only one share on day X, we compute the total cost savings from timing by comparing the average repurchase price (7) with the average daily price over the 19-month sample period (approximately 9.99 assuming each month has 21 trading days). In relative terms, the total cost savings are -0.3 = ((7-9.99)/9.99). To compute the trading gains from "between-month" timing only, we assume that the share is bought back at the average price in month Y (9.86). The relative "between-month" savings are -0.01 = ((9.86-9.99)/9.99). In this example, the stock price is significantly lower than its average value for a very short period, i.e. only on day X. As a result, cost savings from "between-month" timing (-0.01) are far smaller than those from "within-month" timing (-0.3+0.01= -0.029).

In the second example, we assume that the stock price is equal to 7 on day X and equal to 8 on all the other days in month Y; in all other months it remains 10. Again assuming the company purchases one share on day X, the overall cost savings are -0.29 = ((7-9.89)/9.89) where 9.89 is the average daily price over the 19-month period. "Between-month" savings are -0.2 = ((7.95-9.89)/9.89) where 7.95 is the average daily price over month Y. Contrary to the previous example, most of the cost savings arise from "between-month" timing because the price of the stock is significantly below its average not only on day X but also on the other days in month Y. Hence, it is possible to repurchase at comparatively low prices on any of the days in month Y.

The finding in our paper that "between-month" savings are larger than "within-month" savings is not driven by the construction of our savings measures. "Between-month" savings are generally larger than "within-month" savings when stock prices are below average prices for comparatively long periods.

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Table 1
Firm-months with repurchases, firm-months without repurchases, and monthly number of repurchases over the number of outstanding shares (*REP*)

Panel A: total number of firm-months with repurchases and firm-months without repurchases

Variable	Observations	Observations over total number of firm-months (5,035 firm-months)
Firm-months with repurchases	2,939	0.58
Firm-months without repurchases	2,096	0.42

Panel B: the relative frequencies for firm-months with and without repurchases across calendar months

Variable	Calendar months	Average frequency	Median frequency	Standard deviation	Maximum frequency	Minimum frequency	p-value Kolmogorov-Smirnov
Relative frequency firm-months with repurchases	30	3.33%	3.61%	1.74%	6.23%	0.31%	0.006
Relative frequency firm-months without repurchases	30	3.33%	3.98%	2.03%	6.63%	0.05%	-

Panel C: the relative frequencies for firm-months with and without repurchases across event months

Variable	Event months	Average frequency	Median frequency	Standard deviation	Maximum frequency	Minimum frequency	p-value Kolmogorov-Smirnov
Relative frequency firm-months with repurchases	19	5.26%	5.24%	0.3%	6.09%	4.23%	0.451
Relative frequency firm-months without repurchases	19	5.26%	5.3%	0.41%	6.15%	4.1%	-

Panel D: number of months in which a company repurchases stock within the 19-month sample period and *REP* (defined as the ratio of monthly number of repurchased shares over number of shares outstanding)

Variable	Observations	Mean	Median	Standard deviation	Maximum	Minimum
Firm-months with repurchases	265	11.09	11	5.5	19	1
REP	5,035	0.38%	0.08%	0.74%	15.95%	0%

The table presents the descriptive statistics for a sample of 5,035 firm-months (2,939 with repurchases and 2,096 without repurchases) and *REP*, which is equal to the number of shares repurchased by a company in a month over the company's number of outstanding shares at the start of the month. The 5,035 firm-months are for 265 repurchasing companies (19 firm-months per company) that announced open market repurchase programs in 2004. These companies are identified through a search on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Data on the number of outstanding shares are from CRSP. *Panel A* provides the number of observations both for firm-months with repurchases and for firm-months without repurchases and the shares of the two groups of observations in the overall sample of firm-months. *Panel B* shows descriptive statistics of the relative frequencies for calendar firm-months with and without repurchases. For each calendar month, the relative frequency is the ratio between the number of observations of the month and the total number of observations. The panel also includes the p-value of a Kolmogorov-Smirnov test to investigate whether the distributions of relative frequencies for the two groups of observations are statistically different. The sample period comprises 30 calendar months (February 2004 – July 2006). *Panel C* presents descriptive statistics of the relative frequencies for event firm-months with and without repurchases. The panel also presents the p-value of a Kolmogorov-Smirnov test to analyze whether the distributions of relative frequencies for the two sub-samples are statistically different. There are 19 event months, and the event month 0 is the month in which the announcement of an open market repurchase program takes place. *Panel D* reports descriptive statistics of the number of months in which a company repurchases stock within the 19-month sample period and the variable *REP*.

Table 2
Repurchase volume and market-adjusted returns

	Dependent variable: REP					
	S&P Composite	VW index	EW index	S&P Composite	VW index	EW index
Independent variables:	(i)	(ii)	(iii)	(iv)	(v)	(vi)
MAR 0	-0.0101 ***	-0.01 ***	-0.0078 ***	-0.0106 ***	-0.0106 ***	-0.0086 ***
	(-4.65)	(-4.6)	(-3.62)	(-4.59)	(-4.57)	(-3.73)
MAR -1	-0.018 ***	-0.017 ***	-0.0142 ***			
	(-8.06)	(-7.7)	(-6.49)			
MAR +1	-0.003	-0.0032	-0.0032			
	(-1.4)	(-1.47)	(-1.5)			
MAR -1 to -2				-0.0152 ***	-0.015 ***	-0.0135 ***
				(-9.2)	(-9.03)	(-8.21)
MAR +1 to +2				0.0028 *	0.003 *	0.003 *
				(1.74)	(1.85)	(1.86)
Constant	0.0003 *	0.0002	0.0001	0.0003 *	0.0002	0.0001
	(1.7)	(1.04)	(0.38)	(1.81)	(1.11)	(0.45)
Observations	4,505	4,505	4,505	3,975	3,975	3,975
Log likelihood full model	6,867.1126	6,864.078	6,851.3542	6,097.2241	6,095.6167	6,084.9437
Log likelihood constant only	6,822.441	6,822.441	6,822.441	6,041.463	6,041.463	6,041.463

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table contains estimates of Tobit regressions of a company's monthly number of repurchased shares on a set of market-adjusted returns on the company's stock. Regressions are run on samples of firm-months for 265 companies that announced open market repurchase programs in 2004. These companies are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Data on stock returns and returns on market indices are obtained from CRSP. For each firm-month, *REP* is equal to the number of shares repurchased by the company in the month over the company's number of outstanding shares at the start of the month. *MAR* is the return on the company's stock in the current month minus the return on a market index in the current month. *MAR -1* (*MAR +1*) is the return on the company's stock in the previous (following) month minus the return on a market index in the previous (following) month. *MAR -1 TO -2* (*MAR +1 TO +2*) is the return on the company's stock in the previous (following) two months minus the return on a market index in the previous (following) two months. In regressions (i) and (iv), the market index used to compute market-adjusted returns is the S&P's Composite Index. In regressions (ii) and (v), it is a value-weighted market index (comprising NYSE, NASDAQ, and AMEX stocks), whereas in regressions (iii) and (vi) it is an equally-weighted market index (comprising NYSE, NASDAQ, and AMEX stocks). For each regression, the table reports estimates of the *constant*, the number of *observations*, and the value of the *log likelihood* function both for the estimated *full model* and for the model with only a *constant*. *t-statistics* are reported in parenthesis.

Table 3
Abnormal returns around firm-months with repurchase activity

	Dependent variable: R - Rf					
Independent variables:	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Rm - Rf	0.9654 ***	0.9869 ***	0.9692 ***	1 ***	0.9737 ***	1.01 ***
	(11.88)	(10.51)	(10.6)	(8.71)	(11.61)	(9.27)
SMB	0.3652 ***	0.4339 ***	0.3065 **	0.3617 ***	0.3137 **	0.3638 ***
	(3.6)	(4.5)	(2.45)	(2.96)	(2.45)	(2.95)
HML	-0.1057	0.0672	-0.1323	0.0591	-0.0611	0.1617
	(-0.74)	(0.39)	(-0.88)	(0.32)	(-0.4)	(0.86)
UMD		-0.1936		-0.2047		-0.2329 *
		(-1.7)		(-1.67)		(-1.88)
MONTH 0			-0.0003 ***	-0.0004 ***	-0.0006 ***	-0.0006 ***
			(-3.11)	(-3.13)	(-4.25)	(-4.2)
MONTH -1			-0.0006 ***	-0.0006 ***		
			(-4.95)	(-4.87)		
MONTH +1			0.0003 **	0.0003 **		
			(2.43)	(2.51)		
MONTHS -1 to -2					-0.0009 ***	-0.0009 ***
					(-5.35)	(-5.41)
MONTHS +1 to +2					0.001 ***	0.001 ***
					(6.81)	(7.1)
Constant	0.0002	0.0002	0.0006 ***	0.0006 ***	0.0004 **	0.0004 **
	(1.45)	(1.68)	(2.95)	(3.05)	(2.14)	(2.27)
Observations	5,035	5.035	4,505	4,505	3,975	3,975
Adjusted R-squared	0.1374	0.1389	0.1463	0.1478	0.1548	0.1564

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table contains estimates of ordinary least squares regressions of a company's risk premium on a set of dummies based on the company's repurchase activity and on standard risk factors. Regressions are run on samples of firm-months. Observations in the samples are for 265 companies that announced open market repurchase programs in 2004. These companies are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Data on stock returns, market returns, risk-free returns, and risk factors are obtained from CRSP. For each firm-month, the dummy *MONTH 0* is equal to one if some repurchases are executed. The dummy *MONTH -1* (*MONTH +1*) is set to one if repurchases are carried out in the following (previous) month. The dummy *MONTHS -1 TO -2* (*MONTHS +1 TO +2*) is equal to one if repurchases are executed in at least one of the two following (previous) months. *R* is the average daily return in the month and *Rf* is the average daily risk-free rate of return. *Rm* is the average daily market return. The market return is the return on a value-weighted portfolio of U.S. stocks. *SMB* and *HML* are the average daily Fama and French's size factor and the average daily Fama and French's book-to-market factor respectively. *UMD* is the average daily Carhart's momentum factor. For each regression, the table reports estimates of the *constant*, the number of *observations*, and the *adjusted R-squared*. *t-statistics* adjusted for heteroscedasticity and clustering across observations from the same calendar month are reported in parenthesis.

Table 4
Descriptive statistics and univariate tests for the variables *%PRICES*, *%PRICEW*, *%COST1S*, *%COST1W*, *%COST2S*, and *%COST2W*

Panel A: % difference between monthly repurchase price and monthly average daily market price

Variable	Observations	Mean	Median	Standard deviation	Skewness	Kurtosis	Maximum	Minimum
%PRICES	2,316	-0.619 ***	-0.207 ***	2.926	-0.945	8.7481	21.543	-21.624
%PRICEW	2,316	-0.513 ***	-0.147 ***	2.875	-1.015	9.381	18.875	-23.199

Panel B: % difference between effective total cost of repurchases and benchmark total cost of repurchases in the post-announcement period

Variable	Observations	Mean	Median	Standard deviation	Skewness	Kurtosis	Maximum	Minimum
%COST1S	214	-2.77 ***	-1.767 ***	11.054	0.529	6.082	47.77	-47.91
%COST1W	214	-2.837 ***	-1.235 ***	12.157	0.788	10.04	72.413	-50.428

Panel C: % difference between estimated total cost of repurchases and benchmark total cost of repurchases in the post-announcement period: sample with accurate repurchase volume data

Variable	Observations	Mean	Median	Standard deviation	Skewness	Kurtosis	Maximum	Minimum
%COST2S	265	-2.183 ***	-1.126 ***	9.919	0.302	6.44	47.5	-47.722
%COST2W	265	-2.474 ***	-0.915 ***	10.979	0.603	11.468	71.889	-50.636

Panel D: % difference between estimated total cost of repurchases and benchmark total cost of repurchases in the post-announcement period: sample with accurate repurchase volume and repurchase price data

Variable	Observations	Mean	Median	Standard deviation	Skewness	Kurtosis	Maximum	Minimum
%COST2S	214	-1.998 ***	-1.126 ***	10.435	0.407	6.197	47.5	-47.722
%COST2W	214	-2.263 ***	-0.634 ***	11.595	0.711	11.086	71.889	-50.636

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table reports descriptive statistics and univariate tests on the mean and median values of the variables *%PRICES*, *%PRICEW*, *%COST1S*, *%COST1W*, *%COST2S*, and *%COST2W*. In the first panel of the table (*panel A*), the dataset under analysis comprises 2,316 firm-months with repurchase activity. In the other three panels (*panel B*, *panel C*, and *panel D*), the two datasets consist of 214 and 265 companies that announced repurchase programs in 2004. These companies are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. Data on the repurchase activity of these companies are collected from SEC 10-Ks and 10-Qs filings. Data on market stock prices and market stock trading volumes are obtained from CRSP. For each firm-month with repurchase activity, *%PRICES* is the percent difference between the average repurchase price and the average daily closing price of the company's stock. The percent difference is 100 times the difference between the average repurchase price and the average daily price over the average daily price. For each firm-month, *%PRICEW* is the percent difference between the average repurchase price and the volume-weighted average daily closing price of the company's stock. Trading volume data for the company's stock are used to compute this volume-weighted average. For each company, *%COST1S* is the percent difference between the effective total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's average daily closing price over the 19 months. *%COST1W* differs from *%COST1S* in that the benchmark used is computed assuming that repurchases are executed at the volume-weighted average closing daily price. For each company, *%COST2S* is the difference between the estimated total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's average daily closing price over the 19 months. The monthly estimated total cost of repurchases is the number of repurchased shares times the average daily closing price over the month; monthly estimated costs are cumulated to find the estimated total cost of repurchases over the 19-month period. *%COST2W* differs from *%COST2S* in two ways. First, in each month, the estimated cost of repurchases is computed using the volume-weighted average daily price. Second, the benchmark cost of repurchases is calculated assuming that stock is repurchased at the volume-weighted average daily price. For each variable, the table shows the number of *observations*, the *mean*, the *median*, the *standard deviation*, the *skewness*, the *kurtosis*, the *maximum* value, and the *minimum* value of the variable. It also reports the significance levels of Student's *t*-tests on means and of Mann-Whitney tests on medians.

Table 5
Descriptive statistics for the variables *INSO*, *INSTO*, *INSO+INSTO*, *AMIHUD*, *SPREAD*, *SD*, *MV*, *CASH*, *CF*, and *MB*

Panel A: repurchase price dataset

Variable	Observations	Mean	Median	Standard deviation	Minimum	1st percentile	1st quartile	3rd quartile	99th percentile	Maximum
INSO	214	8.168	3.67	11.859	0.07	0.08	1.13	9.44	57.12	80.6
INSTO	214	62.837	70.108	28.905	0.33	1.66	40.765	86.413	108.004	117.294
INSO + INSTO	214	71.005	78.246	25.265	7.33	15.273	55.869	90.083	109.233	119.024
AMIHUD	214	0.313	0.002	2.011	0.00001	0.00001	0.0004	0.02	4.401	27.135
SPREAD	214	0.003	0.001	0.005	0.0004	0.0004	0.0009	0.003	0.026	0.038
SD	214	0.019	0.018	0.007	0.008	0.009	0.014	0.023	0.041	0.055
MV	214	13.82	13.694	1.847	9.241	10.417	12.436	14.97	18.826	18.842
CASH	214	0.203	0.123	0.203	0.0003	0.004	0.035	0.328	0.793	0.897
CF	214	0.132	0.123	0.113	-0.146	-0.063	0.033	0.187	0.537	0.579
MB	214	2.179	1.633	1.58	0.691	0.768	1.094	2.471	8.66	10.332

Panel B: repurchase volume dataset

Variable	Observations	Mean	Median	Standard deviation	Minimum	1st percentile	1st quartile	3rd quartile	99th percentile	Maximum
INSO	265	7.796	3.13	12.164	0.07	0.08	0.82	8.44	58.23	80.6
INSTO	265	63.361	69.361	27.216	0.33	1.66	46.196	84.008	108.004	117.294
INSO + INSTO	265	71.157	77.262	23.859	7.33	15.273	57.623	88.633	109.303	119.024
AMIHUD	265	0.253	0.001	1.81	0.00001	0.00001	0.0003	0.009	4.401	27.135
SPREAD	265	0.003	0.001	0.005	0.0004	0.0004	0.0007	0.003	0.026	0.038
SD	265	0.018	0.017	0.007	0.008	0.009	0.014	0.023	0.041	0.055
MV	265	14.156	14.13	1.977	9.241	10.417	12.661	15.406	19.197	19.773
CASH	265	0.186	0.102	0.193	0.0003	0.002	0.034	0.286	0.793	0.897
CF	265	0.136	0.127	0.116	-0.146	-0.063	0.038	0.187	0.564	0.739
MB	265	2.202	1.66	1.581	0.691	0.768	1.117	2.574	9.355	10.605

The table contains descriptive statistics for the variables *INSO*, *INSTO*, *INSO+INSTO*, *AMIHUD*, *SPREAD*, *SD*, *MV*, *CASH*, *CF*, and *MB* for two samples: one with 214 (*panel A*) and one with 265 (*panel B*) companies that announced repurchase programs in 2004. The companies in the two samples are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. For each repurchasing company, a 19-month sample period is identified. The first month in the sample period is that following the month in which the company announces a repurchase program. Data on insider ownership and on ownership by institutional investors are obtained from proxy statements and from Thomson Financial respectively. Market data on stock prices, stock returns, trading volumes, ask and bid prices, and numbers of outstanding shares are downloaded from CRSP. Accounting data are obtained from Compustat. For each company, *INSO* is the percentage of the outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month sample period. *INSTO* is the percentage of the outstanding shares held by all institutional investors (required to file Form 13F) on the end-of-quarter date before the initiation of the 19-month sample period that is nearest to the date of the proxy statement that is used to collect *INSO*. *INSO+INSTO* is the sum of *INSO* and *INSTO*. *AMIHUD* is the average value of 1,000,000 times the daily Amihud illiquidity ratio (absolute value of daily return over daily dollar volume) in the sample period. *SPREAD* is the average daily relative bid-ask spread (difference between ask and bid prices over the average of the two prices) in the sample period. *SD* is the standard deviation of the daily return over the sample period. *MV* is the natural logarithm of the market capitalization (stock price multiplied by the number of outstanding shares in thousands) on the last trading day before the start of the sample period. The variables *CASH*, *CF*, and *MB* are computed using market and accounting data for the last fiscal year that does not include parts of the sample period. *CASH* is the end-of-year value of cash and short-term investments (Compustat item 1) scaled by the end-of-year value of total assets (Compustat item 6). *CF* is the annual value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *MB* is the sum of the values of market capitalization (in millions) and total liabilities (Compustat item 181), both at year end, scaled by the end-of-year value of total assets. For each variable, the table shows the number of *observations*, the *mean*, the *median*, the *standard deviation*, the *minimum* value, the value of the *1st percentile*, the value of the *1st quartile*, the value of the *3rd quartile*, the value of the *99th percentile*, and the *maximum* value of the variable.

Table 6
Pair-wise correlations for the variables *INSO*, *INSTO*, *INSO+INSTO*, *AMIHUD*, *SPREAD*, *SD*, *MV*, *CASH*, *CF*, and *MB*

	INSO	INSTO	INSO+INSTO	AMIHUD	SPREAD	SD	MV	CASH	CF	MB
INSO	1									
INSTO	-0.4824	1								
	(< 0.0001)									
INSO+INSTO	-0.0405	0.8948	1							
	(0.5115)	(< 0.0001)								
AMIHUD	0.1324	-0.2631	-0.2326	1						
	(0.0312)	(< 0.0001)	(0.0001)							
SPREAD	0.3444	-0.6049	-0.5144	0.6877	1					
	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)						
SD	0.3165	-0.0201	0.1384	0.0209	0.1392	1				
	(< 0.0001)	(0.7441)	(0.0243)	(0.7355)	(0.0234)					
MV	-0.291	0.4245	0.3359	-0.2417	-0.6215	-0.4006	1			
	(< 0.0001)	(< 0.0001)	(< 0.0001)	(0.0001)	(< 0.0001)	(< 0.0001)				
CASH	-0.0064	0.1867	0.2098	-0.0525	-0.1387	0.51	-0.0568	1		
	(0.9179)	(0.0023)	(0.0006)	(0.3943)	(0.0239)	(< 0.0001)	(0.3571)			
CF	-0.052	0.4306	0.4647	-0.1372	-0.3402	0.0124	0.2758	0.1914	1	
	(0.3993)	(< 0.0001)	(< 0.0001)	(0.0256)	(< 0.0001)	(0.8408)	(< 0.0001)	(0.0017)		
MB	0.0695	0.2223	0.2891	-0.1144	-0.262	0.2292	0.2491	0.4188	0.6981	1
	(0.2592)	(0.0003)	(< 0.0001)	(0.0629)	(< 0.0001)	(0.0002)	(< 0.0001)	(< 0.0001)	(< 0.0001)	

The table contains pair-wise Pearson correlation coefficients for the variables *INSO*, *INSTO*, *INSO+INSTO*, *AMIHUD*, *SPREAD*, *SD*, *MV*, *CASH*, *CF*, and *MB* for a sample with 265 companies that announced repurchase programs in 2004. The companies are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. For each repurchasing company, a 19-month sample period is identified. The first month in the sample period is that following the month in which the company announces a repurchase program. Data on insider ownership and on ownership by institutional investors are obtained from proxy statements and from Thomson Financial respectively. Market data on stock prices, stock returns, trading volumes, ask and bid prices, and numbers of outstanding shares are downloaded from CRSP. Accounting data are obtained from Compustat. For each company, *INSO* is the percentage of the outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month sample period. *INSTO* is the percentage of the outstanding shares held by all institutional investors (required to file Form 13F) on the end-of-quarter date before the initiation of the 19-month sample period that is nearest to the date of the proxy statement that is used to collect *INSO*. *INSO+INSTO* is the sum of *INSO* and *INSTO*. *AMIHUD* is the average value of 1,000,000 times the daily Amihud illiquidity ratio (absolute value of daily return over daily dollar volume) in the sample period. *SPREAD* is the average daily relative bid-ask spread (difference between ask and bid prices over the average of the two prices) in the sample period. *SD* is the standard deviation of the daily return over the sample period. *MV* is the natural logarithm of the market capitalization (stock price multiplied by the number of outstanding shares in thousands) on the last trading day before the start of the sample period. The variables *CASH*, *CF*, and *MB* are computed using market and accounting data for the last fiscal year that does not include parts of the sample period. *CASH* is the end-of-year value of cash and short-term investments (Compustat item 1) scaled by the end-of-year value of total assets (Compustat item 6). *CF* is the annual value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *MB* is the sum of the values of market capitalization (in millions) and total liabilities (Compustat item 181), both at year end, scaled by the end-of-year value of total assets. *p-values* are reported in parentheses.

Table 7
Determinants of the timing of OMRs: shareholding of informed investors (*INSO+INSTO*), Amihud ratio (*AMIHUD*), and bid-ask spread (*SPREAD*)

Panel A: Amihud ratio (AMIHUD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO + INSTO	0.0002 ***	0.0002 **	0.0011 **	0.0013 ***	0.0007 **	0.001 ***
	(2.71)	(2.57)	(2.57)	(3.13)	(2.17)	(2.92)
AMIHUD	0.0012 **	0.0011 **	0.0039 **	0.0046 ***	0.0024 **	0.0032 **
	(2.34)	(2.41)	(2.19)	(2.66)	(2.02)	(2.6)
SD	0.0177	0.3001	-0.9807	-1.5597	-2.3988	-3.2993
	(0.04)	(0.7)	(-0.33)	(-0.46)	(-0.98)	(-1.21)
MV	0.001	0.0014	0.0049	0.0097	-0.0008	0.0019
	(1.17)	(1.57)	(1)	(1.6)	(-0.22)	(0.43)
CASH	-0.0214 *	-0.0248 **	-0.082	-0.1002	-0.059	-0.0705
	(-1.93)	(-2.34)	(-0.95)	(-1.1)	(-0.76)	(-0.85)
CF	-0.0267	-0.0167	-0.1337	-0.1272	-0.1008	-0.1166
	(-1.17)	(-0.78)	(-0.97)	(-0.9)	(-0.93)	(-1.04)
MB	0.0006	0.0005	0.0049	0.0063	0.0086	0.0107
	(0.46)	(0.4)	(0.51)	(0.58)	(1.03)	(1.18)
Constant	-0.0163	-0.0211	-0.03	-0.1176	0.0022	-0.0575
	(-0.73)	(-0.88)	(-0.23)	(-0.77)	(0.02)	(-0.46)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.2091	0.2142	0.1294	0.1581	0.0825	0.1178

Panel B: bid-ask spread (SPREAD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO + INSTO	0.0002 ***	0.0002 ***	0.0013 ***	0.0016 ***	0.0009 **	0.0012 ***
	(3.66)	(3.36)	(2.88)	(3.31)	(2.38)	(2.98)
SPREAD	1.4665 ***	1.3543 ***	4.8774 **	4.7757 **	3.3389 *	3.2828 *
	(4.01)	(3.9)	(2.47)	(2.24)	(1.92)	(1.74)
SD	-0.0194	0.2658	-1.1039	-1.6812	-2.4891	-3.4196
	(-0.05)	(0.68)	(-0.39)	(-0.52)	(-1.07)	(-1.29)
MV	0.0028 ***	0.003 ***	0.011 *	0.0155 **	0.0028	0.0053
	(2.79)	(2.93)	(1.75)	(2.13)	(0.61)	(1.02)
CASH	-0.0164	-0.0202 **	-0.0652	-0.084	-0.0492	-0.0609
	(-1.6)	(-2.04)	(-0.78)	(-0.95)	(-0.65)	(-0.75)
CF	-0.0221	-0.0125	-0.1186	-0.1122	-0.0922	-0.108
	(-1.07)	(-0.64)	(-0.92)	(-0.84)	(-0.89)	(-1.01)
MB	0.0004	0.0003	0.0045	0.0058	0.0082	0.0103
	(0.38)	(0.31)	(0.47)	(0.55)	(1.01)	(1.16)
Constant	-0.0514 **	-0.0536 **	-0.1478	-0.2301	-0.0721	-0.1279
	(-2.11)	(-2.04)	(-0.94)	(-1.29)	(-0.55)	(-0.87)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.2703	0.2473	0.1496	0.1725	0.0932	0.1252

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table reports ordinary least squares regressions of six measures of a company's profits from timing OMRs on ownership, liquidity, and other explanatory variables. Two samples are used: one with 214 and one with 265 companies that announced repurchase programs in 2004. The companies in the two samples are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. For each repurchasing company, a 19-month sample period is identified. The first month in the sample period is that following the month in which the company announces a repurchase program. Data on the repurchase activity of the companies in the samples are collected from SEC 10-Ks and 10-Qs filings. Market data on stock prices, stock returns, trading volumes, ask and bid prices, and numbers of outstanding shares are downloaded from CRSP. Data on insider ownership and on ownership by institutional investors are obtained from proxy statements and from Thomson Financial respectively. Accounting data are obtained from Compustat. For each company, *A%PRICES* (*A%PRICEW*) is calculated using months in which the company repurchases stock. For each of these months, *%PRICES* (*%PRICEW*) is the percent difference between the average repurchase price and the simple (volume-weighted) average daily closing price of the company's stock. *A%PRICES* (*A%PRICEW*) is the average value of *%PRICES* (*%PRICEW*) over the months in which repurchases are made. *%COST1S* (*%COST1W*) is the percent difference between the effective total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. *%COST2S* (*%COST2W*) is the difference between the estimated total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. The monthly estimated total cost of repurchases used to compute *%COST2S* (*%COST2W*) is the number of repurchased shares times the simple (volume-weighted) average daily closing price over the month; monthly estimated costs are cumulated to find the estimated total cost of repurchases over the 19-month period. *INSO+INSTO* is the sum of *INSO* and *INSTO*. *INSO* is the percentage of the outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month sample period. *INSTO* is the percentage of the outstanding shares held by all institutional investors (required to file Form 13F) on the end-of-quarter date before the initiation of the 19-month sample period that is nearest to the date of the proxy statement that is used to collect *INSO*. *AMIHUD* is the average value of 1,000,000 times the daily Amihud illiquidity ratio (absolute value of daily return over daily dollar volume) in the sample period. *SPREAD* is the average daily relative bid-ask spread (difference between ask and bid prices over the average of the two prices) in the sample period. *SD* is the standard deviation of the daily return over the sample period. *MV* is the natural logarithm of the market capitalization (stock price multiplied by the number of outstanding shares in thousands) on the last trading day before the start of the sample period. The variables *CASH*, *CF*, and *MB* are computed using market and accounting data for the last fiscal year that does not include parts of the sample period. *CASH* is the end-of-year value of cash and short-term investments (Compustat item 1) scaled by the end-of-year value of total assets (Compustat item 6). *CF* is the annual value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *MB* is the sum of the values of market capitalization (in millions) and total liabilities (Compustat item 181), both at year end, scaled by the end-of-year value of total assets. A set of industry dummies is included among the explanatory variables. Estimates for these dummies are not reported. For each regression, the table reports estimates of the *constant*, the number of *observations*, and the *adjusted R-squared*. *t-statistics* adjusted for heteroscedasticity are reported in parenthesis.

Table 8
Determinants of the timing of OMRs: insider ownership (*INSO*), institutional ownership (*INSTO*), Amihud ratio (*AMIHUD*), and bid-ask spread (*SPREAD*)

Panel A: Amihud ratio (AMIHUD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO	0.0003	0.0003	0.0025 **	0.0026 **	0.0016 *	0.0016 *
	(1.43)	(1.65)	(2.12)	(2.03)	(1.93)	(1.79)
INSTO	0.0002 ***	0.0002 **	0.001 **	0.0013 ***	0.0007 **	0.001 ***
	(2.67)	(2.57)	(2.5)	(3.1)	(2.05)	(2.85)
AMIHUD	0.0012 **	0.0011 **	0.0032 **	0.004 **	0.0019 *	0.0028 **
	(2.34)	(2.42)	(2.03)	(2.51)	(1.76)	(2.542)
SD	-0.0665	0.1795	-1.9813	-2.4322	-3.0161	-3.7597
	(-0.17)	(0.5)	(-0.79)	(-0.81)	(-1.4)	(-1.46)
MV	0.0012	0.0016 *	0.0066	0.0111 *	0.0001	0.0025
	(1.22)	(1.67)	(1.26)	(1.8)	(0.04)	(0.58)
CASH	-0.0197 *	-0.0223 **	-0.061	-0.0819	-0.0448	-0.0606
	(-1.92)	(-2.31)	(-0.74)	(-0.92)	(-0.6)	(-0.74)
CF	-0.0258	-0.0153	-0.1226	-0.1176	-0.0909	-0.1097
	(-1.17)	(-0.77)	(-0.96)	(-0.89)	(-0.89)	(-1.04)
MB	0.0004	0.0002	0.0026	0.0043	0.0068	0.0095
	(0.31)	(0.17)	(0.28)	(0.41)	(0.86)	(1.1)
Constant	-0.0168	-0.0218	-0.036	-0.1228	-0.00006	-0.0591
	(-0.75)	(-0.91)	(-0.28)	(-0.83)	(-0.00)	(-0.48)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.2137	0.2236	0.1483	0.17	0.0936	0.1222

Panel B: bid-ask spread (SPREAD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO	0.0003	0.0003	0.0024 **	0.0025 **	0.0016 *	0.0016 *
	(1.39)	(1.64)	(2.11)	(2.02)	(1.93)	(1.79)
INSTO	0.0002 ***	0.0002 ***	0.0012 ***	0.0015 ***	0.0008 **	0.0011 ***
	(3.67)	(3.4)	(2.8)	(3.28)	(2.25)	(2.92)
SPREAD	1.4581 ***	1.2958 ***	3.995 **	4.0302 **	2.6642 *	2.8662 *
	(4.09)	(4.05)	(2.39)	(2.13)	(1.79)	(1.66)
SD	-0.0267	0.215	-1.8717	-2.3299	-2.9662	-3.7142
	(-0.07)	(0.61)	(-0.75)	(-0.77)	(-1.39)	(-1.45)
MV	0.0028 ***	0.0031 ***	0.0112 *	0.0156 **	0.0029	0.0054
	(2.76)	(2.94)	(1.82)	(2.17)	(0.63)	(1.03)
CASH	-0.0163	-0.0193 **	-0.0518	-0.0726	-0.0398	-0.0551
	(-1.65)	(-2.05)	(-0.64)	(-0.83)	(-0.54)	(-0.68)
CF	-0.0221	-0.0121	-0.1125	-0.107	-0.0859	-0.1041
	(-1.08)	(-0.64)	(-0.91)	(-0.84)	(-0.86)	(-1.01)
MB	0.0004	0.0002	0.0027	0.0043	0.0069	0.0095
	(0.36)	(0.21)	(0.3)	(0.42)	(0.88)	(1.12)
Constant	-0.0512 **	-0.0524 **	-0.1305	-0.2155	-0.0586	-0.1196
	(-2.17)	(-2.07)	(-0.9)	(-1.27)	(-0.47)	(-0.83)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.2703	0.2679	0.1606	0.179	0.0999	0.1273

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table reports ordinary least squares regressions of six measures of a company's profits from timing OMRs on ownership, liquidity, and other explanatory variables. Two samples are used: one with 214 and one with 265 companies that announced repurchase programs in 2004. The companies in the two samples are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. For each repurchasing company, a 19-month sample period is identified. The first month in the sample period is that following the month in which the company announces a repurchase program. Data on the repurchase activity of the companies in the samples are collected from SEC 10-Ks and 10-Qs filings. Market data on stock prices, stock returns, trading volumes, ask and bid prices, and numbers of outstanding shares are downloaded from CRSP. Data on insider ownership and on ownership by institutional investors are obtained from proxy statements and from Thomson Financial respectively. Accounting data are obtained from Compustat. For each company, *A%PRICES* (*A%PRICEW*) is calculated using months in which the company repurchases stock. For each of these months, *%PRICES* (*%PRICEW*) is the percent difference between the average repurchase price and the simple (volume-weighted) average daily closing price of the company's stock. *A%PRICES* (*A%PRICEW*) is the average value of *%PRICES* (*%PRICEW*) over the months in which repurchases are made. *%COST1S* (*%COST1W*) is the percent difference between the effective total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. *%COST2S* (*%COST2W*) is the difference between the estimated total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. The monthly estimated total cost of repurchases used to compute *%COST2S* (*%COST2W*) is the number of repurchased shares times the simple (volume-weighted) average daily closing price over the month; monthly estimated costs are cumulated to find the estimated total cost of repurchases over the 19-month period. *INSO* is the percentage of the outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month sample period. *INSTO* is the percentage of the outstanding shares held by all institutional investors (required to file Form 13F) on the end-of-quarter date before the initiation of the 19-month sample period that is nearest to the date of the proxy statement that is used to collect *INSO*. *AMIHUD* is the average value of 1,000,000 times the daily Amihud illiquidity ratio (absolute value of daily return over daily dollar volume) in the sample period. *SPREAD* is the average daily relative bid-ask spread (difference between ask and bid prices over the average of the two prices) in the sample period. *SD* is the standard deviation of the daily return over the sample period. *MV* is the natural logarithm of the market capitalization (stock price multiplied by the number of outstanding shares in thousands) on the last trading day before the start of the sample period. The variables *CASH*, *CF*, and *MB* are computed using market and accounting data for the last fiscal year that does not include parts of the sample period. *CASH* is the end-of-year value of cash and short-term investments (Compustat item 1) scaled by the end-of-year value of total assets (Compustat item 6). *CF* is the annual value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *MB* is the sum of the values of market capitalization (in millions) and total liabilities (Compustat item 181), both at year end, scaled by the end-of-year value of total assets. A set of industry dummies is included among the explanatory variables. Estimates for these dummies are not reported. For each regression, the table reports estimates of the *constant*, the number of *observations*, and the *adjusted R-squared*. *t-statistics* adjusted for heteroscedasticity are reported in parenthesis.

Table 9
Determinants of the timing of OMRs: insider ownership (*INSO*), squared insider ownership ($INSO^2$), institutional ownership (*INSTO*), Amihud ratio (*AMIHUD*), and bid-ask spread (*SPREAD*)

Panel A: Amihud ratio (AMIHUD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO	-0.0006 **	-0.0006 *	-0.0044 ***	-0.0045 **	-0.0039 **	-0.0039 **
	(-2.25)	(-1.97)	(-2.73)	(-2.39)	(-2.56)	(-2.23)
$INSO^2$	0.00002 ***	0.00002 ***	0.0001 ***	0.0001 ***	0.0001 ***	0.0001 ***
	(3.29)	(3.18)	(4.44)	(3.72)	(3.42)	(2.92)
INSTO	0.0002 **	0.0001 **	0.0009 **	0.0012 ***	0.0006 *	0.0009 ***
	(2.54)	(2.41)	(2.37)	(2.98)	(1.84)	(2.67)
AMIHUD	0.0012 ***	0.0011 ***	0.0035 ***	0.0043 ***	0.0024 **	0.0033 ***
	(2.82)	(3.01)	(2.9)	(3.39)	(2.45)	(3.07)
SD	-0.3265	-0.0761	-3.9343 *	-4.4303	-4.2265 **	-4.9654 **
	(-1)	(-0.27)	(-1.8)	(-1.61)	(-2.3)	(-2.17)
MV	0.0002	0.0006	-0.0008	0.0035	-0.0049	-0.0024
	(0.21)	(0.7)	(-0.17)	(0.58)	(-1.36)	(-0.58)
CASH	-0.0148	-0.0175 *	-0.0242	-0.0443	-0.0203	-0.0362
	(-1.45)	(-1.82)	(-0.3)	(-0.5)	(-0.28)	(-0.45)
CF	-0.0163	-0.006	-0.0514	-0.0448	-0.0647	-0.0836
	(-0.89)	(-0.37)	(-0.5)	(-0.43)	(-0.74)	(-0.93)
MB	0.0005	0.0003	0.0034	0.005	0.0075	0.0102
	(0.4)	(0.26)	(0.36)	(0.47)	(0.97)	(1.19)
Constant	0.005	-0.0004	0.1276	0.0445	0.1174	0.0579
	(0.26)	(-0.02)	(1.05)	(0.3)	(1.17)	(0.49)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.2702	0.2774	0.2397	0.2491	0.1647	0.1798

Panel B: bid-ask spread (SPREAD)

	Dependent variable:					
	A%PRICES	A%PRICEW	%COST1S	%COST1W	%COST2S	%COST2W
Independent variables:						
INSO	-0.0005 *	-0.0005 *	-0.0042 **	-0.0043 **	-0.0038 **	-0.0038 **
	(-1.95)	(-1.72)	(-2.6)	(-2.26)	(-2.51)	(-2.17)
$INSO^2$	0.00002 ***	0.00002 ***	0.0001 ***	0.0001 ***	0.0001 ***	0.0001 ***
	(2.87)	(2.8)	(4.22)	(3.5)	(3.38)	(2.86)
INSTO	0.0002 ***	0.0002 ***	0.001 **	0.0013 ***	0.0007 **	0.001 ***
	(3.5)	(3.19)	(2.55)	(3.04)	(1.99)	(2.7)
SPREAD	1.3278 ***	1.1657 ***	2.9168 **	2.9269 *	2.0234	2.2303
	(4.4)	(4.33)	(2.07)	(1.66)	(1.58)	(1.41)
SD	-0.259	-0.0169	-3.7938 *	-4.2964	-4.1693 **	-4.908 **
	(-0.8)	(-0.06)	(-1.73)	(-1.55)	(-2.27)	(-2.13)
MV	0.0018 *	0.002 **	0.0026	0.0068	-0.0028	-0.0003
	(1.96)	(2.15)	(0.46)	(0.98)	(-0.69)	(-0.06)
CASH	-0.0123	-0.0153	-0.0187	-0.0387	-0.017	-0.0325
	(-1.24)	(-1.62)	(-0.23)	(-0.44)	(-0.23)	(-0.41)
CF	-0.0141	-0.0041	-0.0461	-0.0391	-0.0613	-0.0796
	(-0.81)	(-0.26)	(-0.45)	(-0.38)	(-0.71)	(-0.9)
MB	0.0005	0.0003	0.0034	0.005	0.0075	0.0102
	(0.44)	(0.29)	(0.36)	(0.47)	(0.98)	(1.2)
Constant	-0.0286	-0.0299	0.0566	-0.024	0.0731	0.0111
	(-1.41)	(-1.36)	(0.42)	(-0.15)	(0.66)	(0.08)
Observations	214	214	214	214	265	265
Adjusted R-squared	0.3129	0.3096	0.2441	0.2513	0.1672	0.1814

***: significant at 1%; **: significant at 5%; *: significant at 10%.

The table reports ordinary least squares regressions of six measures of a company's profits from timing OMRs on ownership, liquidity, and other explanatory variables. Two samples are used: one with 214 and one with 265 companies that announced repurchase programs in 2004. The companies in the two samples are identified through a search of announcements of repurchase programs on SDC Platinum Database of Mergers and Acquisitions. For each repurchasing company, a 19-month sample period is identified. The first month in the sample period is that following the month in which the company announces a repurchase program. Data on the repurchase activity of the companies in the samples are collected from SEC 10-Ks and 10-Qs filings. Market data on stock prices, stock returns, trading volumes, ask and bid prices, and numbers of outstanding shares are downloaded from CRSP. Data on insider ownership and on ownership by institutional investors are obtained from proxy statements and from Thomson Financial respectively. Accounting data are obtained from Compustat. For each company, *A%PRICES* (*A%PRICEW*) is calculated using months in which the company repurchases stock. For each of these months, *%PRICES* (*%PRICEW*) is the percent difference between the average repurchase price and the simple (volume-weighted) average daily closing price of the company's stock. *A%PRICES* (*A%PRICEW*) is the average value of *%PRICES* (*%PRICEW*) over the months in which repurchases are made. *%COST1S* (*%COST1W*) is the percent difference between the effective total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. *%COST2S* (*%COST2W*) is the difference between the estimated total cost of repurchases in the 19 months following the company's repurchase announcement and a benchmark total cost of repurchases based on the assumption that stock is repurchased at the stock's simple (volume-weighted) average daily closing price over the 19 months. The monthly estimated total cost of repurchases used to compute *%COST2S* (*%COST2W*) is the number of repurchased shares times the simple (volume-weighted) average daily closing price over the month; monthly estimated costs are cumulated to find the estimated total cost of repurchases over the 19-month period. *INSO* is the percentage of the outstanding shares held by all the company's officers and directors on the last proxy statement date before the start of the 19-month sample period. *INSTO* is the percentage of the outstanding shares held by all institutional investors (required to file Form 13F) on the end-of-quarter date before the initiation of the 19-month sample period that is nearest to the date of the proxy statement that is used to collect *INSO*. *AMIHUD* is the average value of 1,000,000 times the daily Amihud illiquidity ratio (absolute value of daily return over daily dollar volume) in the sample period. *SPREAD* is the average daily relative bid-ask spread (difference between ask and bid prices over the average of the two prices) in the sample period. *SD* is the standard deviation of the daily return over the sample period. *MV* is the natural logarithm of the market capitalization (stock price multiplied by the number of outstanding shares in thousands) on the last trading day before the start of the sample period. The variables *CASH*, *CF*, and *MB* are computed using market and accounting data for the last fiscal year that does not include parts of the sample period. *CASH* is the end-of-year value of cash and short-term investments (Compustat item 1) scaled by the end-of-year value of total assets (Compustat item 6). *CF* is the annual value of operating income before depreciation and amortization (Compustat item 13) scaled by the end-of-year value of total assets. *MB* is the sum of the values of market capitalization (in millions) and total liabilities (Compustat item 181), both at year end, scaled by the end-of-year value of total assets. A set of industry dummies is included among the explanatory variables. Estimates for these dummies are not reported. For each regression, the table reports estimates of the *constant*, the number of *observations*, and the *adjusted R-squared*. *t-statistics* adjusted for heteroscedasticity are reported in parenthesis.