

Share Buyback and Equity Issue Anomalies Revisited

Theodoros Evgeniou*, Enric Junqué de Fortuny*,
Nick Nassuphis**, and Theo Vermaelen*

February 24, 2016

Abstract

We re-examine the behavior of stock returns after net issue announcements using the five-factor model proposed by Fama and French (2015a). We confirm their findings that the equity issue anomaly disappears with the five-factor model, but the buyback anomaly does not. Buyback announcements by firms with high pre-announcement (idiosyncratic) volatility are followed by higher long-term abnormal returns. This is inconsistent with the widely documented low volatility anomaly, but consistent with Stambaugh, Yu, and Yuan (2015) who find a positive relation between stock returns and idiosyncratic volatility for undervalued stocks.

JEL classification: G35

Keywords: Share Buybacks, Seasoned Equity Offerings

*INSEAD, Bd de Constance, 77300 Fontainebleau, France, phone: +33(0)1 6072 4000, **31, St. Martin's Lane WC2N 4ER London, United Kingdom, e-mail: theodoros.evgeniou@insead.edu, enric.junquedefortuny@insead.edu, nicknassuphis@gmail.com, and theo.vermaelen@insead.edu.

1. Introduction

The fact that companies experience long-term positive excess returns after share buybacks and negative long term excess returns after equity issues, has been documented extensively in the academic literature.¹ In spite of these well documented anomalies investors are not less excited today about e.g., a buyback announcement than 30 years ago: on average stock prices increase by approximately 2 to 3% when companies announce that the board of directors has approved a buyback program. Moreover, we find very few funds that specialize in exploiting these anomalies.² The fact that these anomalies have not generated a significant response from investors and asset management firms is somewhat surprising considering that other anomalies have disappeared after being documented in academic research (Engelberg, McLean, and Pontiff, 2015). What makes these capital structure anomalies different so that they stand the test of time?

One straightforward explanation is that they are not really anomalous returns but compensation for risk. Excess returns in previous research are calculated using the Fama and French (1993) three-factor model or the Carhart (1997) 4-factor model as benchmarks. However, Fama and French (2015b) argue that the buyback and equity issue anomalies do not survive after using the more recent Fama and French (2015a) five-factor asset pricing model as a model of expected returns. This model incorporates new evidence that profitability and investment patterns, besides market to book and size, explain stock returns (Novy-Marx (2013)). If buybacks (equity issues) are done by firms with high (low) profitability and few (many) investment opportunities, then these factors may well explain the excess returns re-

¹For evidence on long-term excess returns after buybacks see e.g., Ikenberry, Lakonishok, and Vermaelen (1995); Peyer and Vermaelen (2009); Manconi, Peyer, and Vermaelen (2015). For evidence on underperformance after equity issues see e.g., Loughran and Ritter (1995); Spiess and Affleck-Graves (1995); Eckbo, Masulis, and Norli (2000); Dittmar and Thakor (2007); Brav, Geczy, and Gompers (2000).

² For example, a Google search for “buyback funds” gives very few results: Powershare Buyback Achievers fund, KBC Buyback America, S&P 500 Buyback ETF, Catalyst/Equity Compass Buyback Strategy fund, and PV Buyback USA. The first 3 funds focus on large caps after buyback completions although the academic research shows abnormal returns are more significant in small, under-priced, value stocks and the relevant event is not the completion of the buyback but the buyback authorization. We are also not aware of event-driven hedge funds that buy repurchasing firms and short equity issuers; typical event-driven strategies are for example based on M&A arbitrage, capital structure arbitrage or on investing in distressed securities.

ported in previous research. Note, however, that Fama and French (2015b) do not exactly replicate the papers that first reported the anomalies. First, they assume investors buy after the completion of the buyback and the equity issue, not around the announcement date as e.g., Peyer and Vermaelen (2009). For buybacks this may be an issue as repurchases may be completed several years after the buyback authorization (Stephens and Weisbach (1998)). Moreover Fama and French (2015b) do not examine repurchases and equity issues separately: they calculate returns after net equity issues (funds spent on buybacks minus funds spent on equity issues). The part of their sample where net equity issues are positive is defined as the “buyback sample”. But this sample still contains some equity issuers, which may introduce a downward bias in the excess returns calculations. Moreover the idea of pooling buybacks and equity issues in “net issues” assumes that the decision to issue equity is simply the mirror of buying back shares. However, issuing stock to new investors is not the same as buying back stock from “old” selling investors. In the first case, the management has to face new shareholders that may face potential losses, while in the second case the firm only takes advantage of selling shareholders who leave the firm. In this paper we re-examine the anomaly using the Fama and French (2015a) model but use announcement dates and separate buyback announcements and equity announcements.

A second possible reason for the funds’ lack of interest in the buyback anomaly is that event studies aggregate returns over a very long horizon. The fact that buying shares after a buyback announcement generates positive excess returns during for example 1990-2014 does not mean that, if one starts a fund in 2016, one can expect to beat the market during the next 3 years. In other words, the anomaly may be time dependent, and investor patience may not extend beyond 3 years. Moreover, because of the growth of institutional investors and the reduction in trading costs markets may have become more efficient in recent years as argued by Fu and Huang (2015). The anomaly may also be industry-specific so that an investor who follows a buyback strategy may end up with a highly undiversified portfolio.

The long-term event studies also do not give much guidance about when to sell after a

buyback or cover after shorting an equity issue. Trading strategies, such as *M&A* arbitrage (Mitchell and Pulvino (2001)), often have “natural” exit decision points (e.g., at *M&A* deal completion or termination), but the literature does not provide clear guidance about when to exit a buyback position. Empirical studies tend to show that, on average, excess returns continue for up to 3 or 4 years after a buyback authorization, but there is no reason why such a horizon is optimal. One straightforward “early” selling strategy that we study is to combine the buyback and equity issuance anomalies by selling buyback stocks after the firm announces an equity issue. Note that the fact that equity issues in general are followed by negative abnormal returns does not necessarily imply that equity issues after buybacks should generate the same result.

Finally, the results from event studies which use either Ibbotson RATS or the Calendar Time method estimate excess returns and risks contemporaneously. Investors, such as hedge funds, who would like to exploit the anomaly and hedge market risk need however to estimate the factor betas using historical information. If the buyback signals a change in risk (Grullon and Michaely (2004)) hedging market risk may be complicated. That is why in this paper we also simulate hedged investment strategies where we estimate risk *before* forming the portfolios.

The purpose of this paper is to explore these concerns by studying the robustness of the buybacks and issuance anomalies over the 30 year period starting in January 1985 and ending in December 2014, using the Fama and French (2015a) five-factor model. Although there are other models of market equilibrium proposed to explain excess returns after buyback authorizations (i.e. Lin, Stephens, and Wu (2014)) our focus is on the Fama and French (2015a) challenge. We confirm the Fama and French (2015b) conclusion that the five-factor model makes the equity issue anomaly disappear, but the buyback anomaly remains statistically and economically significant. Even though we find that equity issues are not followed by significant negative excess returns in general, it turns out that using a SEO announcement as a sell signal improves the performance of a buyback portfolio. The interpretation is that firms

that are timing the market by buying back shares when they are cheap are also successful timing the market when stocks are expensive. We also confirm that the Undervaluation Index developed by Peyer and Vermaelen (2009) is a good predictor of excess returns, although it emphasizes smaller firms, and that the anomaly does not disappear if we exclude specific industries.

We also test whether the buyback anomaly is related to the even better known *low volatility anomaly*: that (idiosyncratic) volatility is negatively related to future returns. For example, Ang, Hodrick, Xing, and Zhang (2006) find negative alphas for high volatility and high idiosyncratic volatility stocks, using the 3 factor Fama and French (1993) model. Moreover, Fama and French (2015b) show that, using the 5-factor model, this anomaly persists for small firms. However, in our buyback sample we find a significant positive relation between excess returns, using the Fama-French 5-factor model as a benchmark. This is consistent with the *information advantage hypothesis*: in firms with high idiosyncratic risk volatility is largely driven by company-specific information, and for such firms it is more likely that management is better informed than the market. The result is also consistent with Stambaugh, Yu, and Yuan (2015) who find a positive relation between stock returns and idiosyncratic volatility for undervalued³ stocks.

Turning to total volatility we also find that buyback authorizations of high risk stocks are followed by larger excess returns. This is consistent with the *option hypothesis*: a repurchase authorization is an option to take advantage of undervaluation and this option should be more valuable for high volatility stocks (Ikenberry and Vermaelen (1996)). If markets underestimate the value of this option at the time of the buyback authorization, excess returns should be positively correlated with volatility. Combining idiosyncratic risk and total volatility with the Peyer and Vermaelen (2009) Undervaluation Index into an Enhanced Undervaluation Index, improves the predictability of excess returns. In particular, during the four years following the buyback announcement, the high Enhanced Undervaluation In-

³They define undervaluation on the basis of a combination of 11 return anomalies reported in the literature, including net equity issuance.

dex portfolio generates an excess return of 0.82% per month with the Calendar Time event study method. Using the IRATS method the cumulative excess return reaches 54.69% after 48 months.

This paper is organized as follows. In section 2 we describe our data. In section 3 we test whether buyback and equity issue anomalies survive when we use the Fama and French (2015a) five-factor model. We also compare firms that buy back stock and issue equity within 48 months of a buyback announcement with firms that do not issue stock subsequently. In section 4 we test whether the buyback anomaly is robust across time, investment horizon and industry. In section 5 we test whether idiosyncratic risk as well as volatility can improve the predictability of excess returns, relative to simply using the Undervaluation Index proposed by Peyer and Vermaelen (2009). Section 6 concludes.

2. Data

Our sample spans the period from January 1985 to December 2014. We start in 1985 as SDC's coverage is poor before that year. We stop in 2014, the last year all CRSP and Compustat data were available. We retrieved buyback authorization announcements and announcements of Secondary Equity Offerings (SEO's) from the Securities Data Corporation (SDC) database. Daily and monthly returns, pre-announcement daily closing prices and market capitalization data were taken from CRSP. Book value of equity (BE) was taken from Compustat. The Fama-French factors and breakpoints were obtained from Kenneth French's website.

For the buybacks we combined all open market repurchase announcements from both the SDC Repurchases data base and the SDC US mergers and acquisitions (*M&A*) data base.⁴ We ended up with a total of 24,190 repurchases events, out of which 12,030 were only from the SDC Repurchases database, 6,593 only from the SDC *M&A* database and 5,567 from

⁴More information is available upon request. An interactive online tool to explore data variations and robustness analyses of all results in this paper is also available upon request.

both. Finally, we removed the following events: no CRSP returns available (5,287 events); not all Compustat data available (2,185 events); the percent of shares authorized was larger than 50% (63 events), or the closing price was less than \$1 for events before 1995 or \$3 for the other (713 events), or the primary stock exchange was not the NYSE, the Nasdaq, or Amex (1,586 events). Finally, we removed all events from firms in the Financial and Utilities sectors (3,594 events).⁵ At the end we are left with 10,124 buyback events made by 3,661 firms. The average percent of share authorized for these firms was 7.3% (median of 5.8%), the average Market Capitalization at announcement was \$6,039 Million (median of \$806.9 Million), while the BE/ME was on average 0.6 (median of 0.4).

For the issuers, we started with 12,265 events from SDC, filtered to exclude rights issues, pure secondary offerings where existing shareholders sell shares without generating proceeds for the company, issues made by non-U.S. firms or in non-U.S. markets, issues made by closed-end funds or unit investment trusts, as well as block trades, accelerated offers and best efforts. We removed all SDC events for which either the event date (1,923 events) or the CUSIP (1,802 events) was missing or where we found duplicate events with mismatching information (40 events), a total of 3,402 events - given the overlap between these cases. Finally, as for the buybacks, we removed the following events: no CRSP returns available (1,982 events); not all Compustat data available (1,735 events); the percent of shares authorized was larger than 50% (44 events), or the closing price was less than \$1 for events before 1995 or \$3 for the other (278 events), or the stocks were not listed on the NYSE, Nasdaq or Amex (312 events). We again removed all events from firms in the Financial and Utilities sectors (476 events). Our final sample contains 3,250 issuers events made by 2,353 firms. The average percent of shares issued was 16.9% (median of 15.8%), the average Market Capitalization on the announcement day was \$1,210 Million (median of \$314.1 Million), while the BE/ME was on average 0.6 (median of 0.4).

⁵We are using the industries from Kenneth French's Website. The Financial Sector consists of all firms with SIC code at the time of the buyback announcement that belonged in the "Banks" or "Fin" industries (SIC codes 6000 to 6300 and 6700 to 6799). The Utilities Sector consists of all firms with SIC code 4900 to 4942.

Figure 1 shows the number of announcements per year in the sample period as well as the (standardized) level of the *S&P* 500. Buyback activity rises prior to stock market increases and tends to fall afterwards, especially during the financial crisis of 2008 when buyback announcements fell to a 15 year low. Note the structural decline in equity issues since 2000.

3. Share Buybacks, Equity Issues and Abnormal Returns

We start with revisiting past research but now using a longer time period and the five-factor model of Fama and French (2015a) to measure expected returns. In particular, we test whether buyback (equity issue) announcements are followed by significant positive (negative) long term excess returns, and if so, whether the returns can be explained by proxies for undervaluation as proposed by Peyer and Vermaelen (2009).

3.1. *Share buybacks and Equity Issues in Isolation*

Table 1, Panel A, shows long-term cumulative excess returns for various holding periods after the announcement using the Ibbotson RATS event study method. Each event month t we run cross-sectional regressions of stock returns against the factors. The intercept in the regression measures the average abnormal excess return in event month t . We then accumulate these excess returns over various time horizons (up to 48 months after the event). The advantage of this method is that each event gets the same weight and that factor betas are allowed to change in event time, something that may be important as capital structure changes may signal a change in risk (Grullon and Michaely, 2004). The table compares the excess returns using the Fama and French (1993) three-factor model and the Fama and French (2015a) five-factor model. The results show that, although using a five-factor model lowers excess returns, the excess returns are statistically significantly positive over all investment horizons and reach 13.02% after 4 years ($t=11.92$). So the buyback

anomaly does not disappear when we use a five-factor model. In all the tables we also calculate cumulative excess returns in the 6 months prior to the buyback. Consistent with past research (e.g., Peyer and Vermaelen (2009)) buyback authorization announcements are preceded by significant negative excess returns of around -7%. This is consistent with the hypothesis that the typical repurchase announcement is triggered by at least the perception of insiders that the stock is undervalued.

Table 2, Panel A, shows the results for all equity issues, using the same methodology as in Table 1, Panel A. Our results are largely consistent with Fama and French (2015b). Using the three-factor model, we find statistically significant long term (after 48 months) negative cumulative excess returns of -4.86% ($t=-2$). However, once we use the five-factor model as a benchmark, excess returns fall and become statistically insignificant after 48 months. This shows that when searching for anomalies, buybacks and equity issues should not be pooled in a “net issue” measure. Unlike buybacks, equity issues are firm commitments and announced and completed at the same point in time. Using actual shares issued (the measure used by Fama-French (1995b)) and equity announcements (our measure) should therefore produce similar results. Buyback authorization announcements on the other hand are not firm commitments and are often executed over a long period after the announcement. Actual repurchase dates thus do not correspond to announcement dates. Note also that equity issues are typically preceded by large positive excess returns of around 35% in the 6 months prior to the equity issue. However, the lack of post announcement negative excess returns shows that this was not reflecting “irrational exuberance” but rather that these firms experienced a substantial increase in growth opportunities and issued equity to finance them. One critique of the Ibbotson (1975) RATS method is that the result may be time-specific. Indeed as every event is equally weighted the cumulative average abnormal returns are dominated by periods when there are a large number of events. So we also use the Calendar Time method where in each calendar month we form an equally-weighted portfolio of all firms that announce a buyback (or an equity issue) in the previous t months. We then run a time series regression

of the portfolio returns against the factors. The intercept of the regression is the average monthly excess return in the t months after the event.

The results in Panel B of Tables 1 and 2 are similar to Panel A of the same tables. Abnormal returns after buybacks are smaller when the five-factor model is used but remain statistically significant over all horizons. For example, over the 48 month horizon the average monthly excess return is 0.22% ($t=2.95$) which corresponds to 10.56% over 48 months. Note also that excess returns fall when the investment horizon increases. The largest monthly excess return (0.64%) is earned by the portfolio that holds buyback stocks for one month (not reported in Table 1) and the smallest excess return (0.22%) is earned by the portfolio that picks buybacks announced during the previous 48 months. This clearly shows that forming portfolios after buybacks are completed (as is done by measuring net issues in Fama and French (2015b)) is introducing a downward bias as many repurchase programs are completed several months (sometimes years) after the buyback announcement. Waiting until the buyback is completed means missing the largest excess returns earned shortly after the buyback authorization. Finally, there are no statistically significant excess returns after equity issues, regardless whether we use the three or five-factor model.

Next we test whether the “Undervaluation Index” (U-index) developed by Peyer and Vermaelen (2009) using buyback announcements from 1991 to 2002 is a robust indicator to separate companies that are buying back stock because they are undervalued from companies that repurchase shares for other reasons. We calculate the U-index as follows. Companies get a size score from 1 (large firms) to 5 (small firms) depending on the quantile of their market value of equity in the month prior to the buyback announcement. Then, we calculate the 11-months pre-announcement absolute returns of months -12 to -1 before announcement for all events and assign a score of 5 to the low returns firms and 1 to the high returns ones. Finally, companies get a book value to market value (BE/ME) score depending on the quantile of their BE/ME value of equity in the year prior to the buyback announcement, with a score of 1 to small BE/ME firms and 5 to large ones. Unlike Peyer and Vermaelen

(2009) who use all CRSP companies to define the quantile thresholds, we use the Fama-French breakpoints for prior returns the month before, ME the month before, and BE/ME the year before the event to rank the firms from 1 to 5: for example, firms falling below the 5th BE/ME breakpoint are assigned a score of 1, while companies above the 16th BE/ME breakpoint are assigned a score of 5.

We sum up these three scores for each firm and we then define as “high U-index” the firms with total score more than 11 and as “low U-index” those with total score less than 6. Note that unlike Peyer and Vermaelen (2009) we do not consider the stated reasons for the buyback in the press release, hence we define different thresholds for the high U-index and low U-index buyback firms. We end up with 2,955 “high U-index” buyback stocks (29.19% of all buyback events), and 2,100 “low U-index” ones (20.74% of all buyback events). The distribution of the U-index of all buyback events is shown in Figure 2.

Table 1, Panel A, shows the three-factor as well as the five-factor IRATS for high U-index and low U-index firms. The interesting conclusion is that using the five-factor model improves the predictive power of the U-index: high U-index firms earn 4 year excess returns of 23.59% ($t=9.41$) while low U-index firms only earn 5.95% ($t=3.17$), hence 17.64% less than the high U-index ones. Starting from 12 months after the announcement, high U-index firms always beat low U-index firms. When we use the three-factor model, we find similar conclusions, but the results are weaker. For example after 48 months the high U-index firms now earn excess returns of 24.21%, which is only 11.66% higher than the low-U-index firms. Note that, consistent with Peyer and Vermaelen (2009) the low U-index buyback stocks earn significant positive excess returns too. It is difficult to find a portfolio of buyback stocks that under-performs in the long run. So the term “overvaluation” should be interpreted with caution. The Undervaluation Index is a proxy for the likelihood that the buyback is driven by undervaluation. It does not imply that low U-index firms are overvalued. It means that for these firms the buyback is less likely to be driven by undervaluation, but by other reasons such as managing capital structure, avoiding dilution from executive stock options etc.

Table 1, Panel B, shows that this conclusion holds when we use the Calendar Time method. Regardless of the horizon, high U-index stocks almost always beat low U-index stocks. As in the case of IRATS, the five-factor model improves the selectivity of the Under-valuation Index: low U-index now no longer earn significant excess returns after 48 months.

Figure 3 summarizes the IRATS results in more detail by showing the cumulative abnormal returns during the 6 month pre and 48 month post event period, using the five-factor model. Results are shown for the total sample of buybacks and equity issues, as well as for high and low U-index buyback samples.

3.2. Buybacks followed by Equity Issues

The results so far show that firms that repurchase shares are good at market timing, in particular the small beaten up value stocks. On the other hand the average equity issuer does not seem to be driven by market timing in general. However, firms that are good at market timing when buying back undervalued stock are perhaps also good at recognizing when their shares are overvalued. Note that successful market timing requires two managerial characteristics: ability to time the market as well as willingness, i.e., accepting the idea that using superior information to benefit long term shareholders at the expense of other shareholders is the “right” thing to do.

During our sample period (1985-2014) 1,085 companies in our data set both announced buybacks and issued equity, but in only 506 cases a company announced a subsequent equity issue within 4 years after the buyback announcement. We now compute the cumulative excess returns for these firms under two scenarios. First, the “no exit” scenario, where we hold the stock for 48 months after the buyback announcement. Second, the “exit” scenario, where we sell the shares as soon as the company announces an equity issue.

Of the 506 such events, 103 happen within 1 year from the buyback announcement, 261 happen within 2 years and 407 happen within 3 years. Note that this grouping of the events is done with hindsight: it is not possible to know at the time of the buyback announcement

whether there will be a subsequent SEO or not. We are simply asking the question whether those firms that announced a buyback when they appeared undervalued issued equity when they were overvalued. Figure 4 shows the percentage of repurchasing firms that announced an equity issue within 48 months. The average percentage is 4.9% and there are only 2 years (1989 and 1990) where the percentage is larger than 10%.

Table 3 shows that repurchasing firms that issued stock within 48 months after the buyback are remarkable timers. Long-term excess returns after 4 years are 50.24% ($t=9.59$), more than four times as large as for the overwhelming majority of firms that do not issue stock subsequently. These results are graphically displayed in Figure 5 (Panel A). Repurchases by firms that do not issue equity in the next 48 months are followed by long term excess returns of only 10.84%. One interpretation is that these firms believe they are undervalued but as long as they remain undervalued they do not think it is appropriate to issue stock.

The Calendar Method results in Panel B of Table 3 show a relatively large drop of the excess returns over time (e.g., from 1.03% after 12 months to 0.73% after 48 months) indicating potential benefits of exiting a buyback position when there is a subsequent issue. Figure 5 (Panel B) shows the benefits of exiting early. The figure shows a strategy with hindsight where, starting in 1985, we invest in an equally weighted portfolio of only firms that announced a buyback and subsequently issued equity within the 48 months after the buyback announcement. The dashed line shows the cumulative excess return if we sold the stock whenever the firm issued shares within 48 months (the exit strategy). The solid line shows the cumulative excess returns if we sold 48 months after the buyback announcement (the no exit case). The investor who had followed the exit strategy would have earned (after 30 years) a cumulative excess return of 595.3%, significantly larger than the 280.1% of a buy hold for 48 months strategy. Note, however, that because very few firms that buy back stock issue equity within 48 months, a strategy “without hindsight” where one bought all companies after a buyback and sold only those after a subsequent equity issue would not substantially increase excess returns.

Table 4 shows the long run excess returns after the announcement of an equity issue for two samples. The first sample (After a Buyback) shows the excess returns for issues for which in the previous 48 months the firm announced a buyback. The second sample (No Prior Buyback) shows the excess returns for all other issue announcements. The fact that excess returns are not significantly different from zero for the post-buyback issuers agrees with the intuition of Figure 5: exiting when there is a subsequent equity issue is the right thing to do for the long-term buyback investor.

4. How robust is the buyback anomaly?

The results so far are based on a sample of all buyback and equity announcements over a thirty-year period. As the equity issue anomaly does not survive the Fama and French (2015a) five-factor model, the remainder of the paper focuses on better understanding the buyback anomaly and uses the five-factor model as a benchmark.⁶ The purpose of this section is to test the robustness of this anomaly: has it become less important over time because markets have become more efficient? How sensitive is it to the length of the investment period? Could the anomaly be industry-specific?

4.1. *Robustness across time periods and investment horizons*

Table 5 shows excess returns, using both the IRATS and Calendar Time method for different time periods. We consider time periods, which overlap to some extent with past research (Ikenberry, Lakonishok, and Vermaelen 1995, Peyer and Vermaelen 2009, Manconi, Peyer, and Vermaelen 2015 and Fu and Huang 2015): 1985-1990; 1991-2000; 2001-2014 and 2008-2014. The last period was chosen to incorporate the financial crisis and to test whether indeed markets have become more efficient in recent years, or whether managers have been discouraged from market timing by the obvious mistakes that were made by buying back

⁶All analyses below are also done for equity announcements. However, in agreement with the results in Section 3.1, we find no consistent/robust results for issuers. All issuers results are available upon request.

shares before a major financial crisis.

Table 5 shows that, regardless of the time period chosen or the method to calculate excess returns, the buyback anomaly remains economically and statistically significant and there is no clear time trend in the data that suggests that markets have become more efficient over time. For example, although the 2001-2014 period shows smaller timing ability than the 1990-2000 period, excess returns in the 2008-2014 period are as large as in 1991-2000 period: approximately 16.34% after 4 years using IRATS or 0.49% per month (23.52% after 4 years) when we use the Calendar Time method. There is one exception to the consistency between the IRATS and the Calendar Time results: in the period of 1991-2000, the IRATS method generates excess returns after 48 months of 21.7% ($t=10.73$) but the Calendar Time method produces statistically insignificant excess returns of 0.19% per month. This result appears to also be inconsistent with Peyer and Vermaelen (2009). However, if one includes the financial sector firms or considers the three-factor model, as Peyer and Vermaelen (2009) do, the calendar method abnormal returns do become significant.⁷

Table 6 re-examines whether the U-index of Peyer and Vermaelen (2009) predicts the five factor excess returns for different time periods. The first two columns show the IRATS results and the last two columns show the Calendar Time results. Regardless of the method to compute excess returns, the U-index is an excellent predictor: except for the very short 1985-1990 period, buybacks announced by high U-index firms are followed by significantly larger returns than buybacks announced by low U-index firms. There is also no evidence that the U-index is losing its predictive power over time: for example, in the 2001-2014 period the difference between high U-index and low index firms (after 48 months, IRATS) was 12.12%, while in the most recent 2008-2014 period high U-index firms had 21.61% larger abnormal returns than low U-index firms.

⁷Details available upon request.

4.2. *Robustness with respect to estimation of factor betas*

Note that both event study methods measure alpha (excess return) and betas jointly. In other words, we do not use prior (to investing) information to estimate risk. An investor who wants to exploit the anomaly, however, may want to hedge market (and other) risk and would need to estimate betas using past data. If the buyback signals a change in risk (Grullon and Michaely (2004)) it is not obvious that such a hedged strategy would work.

To further study the robustness of the buyback anomaly, we simulate a portfolio investment strategy starting in 1985. The strategy uses past data to estimate the factor betas and measures the abnormal returns of buyback portfolios over different investment horizons. While this is not an accurate measure of the returns of a buyback fund - as we do not consider transaction costs, turnover issues, or other operational issues (see for example Mitchell and Pulvino (2001)) - it provides us with an estimate of what would have happened to an investor who starts investing in 1985 in an equally weighted portfolio of buyback stocks and holds them over various horizons.

Specifically, we consider the following trading strategy: construct the first day of every month an equally weighted portfolio of all companies that announced buybacks during the previous N months, for a given holding period of length N (which can be chosen). Thus, once a company makes an announcement, it enters the portfolio on the first day of the following month and remains there for N months. Note that the portfolio is re-balanced (the first day of) each month. This “unhedged” strategy generates a time series of returns. Each month (when we re-balance the portfolio) we also use the previous 18 monthly returns of this time series to calculate the (portfolio level) time series betas of all five factors. This allows an investor to determine the betas for the factor risks using data available at the time of portfolio formation.

We report the returns of such a portfolio strategy for different holding months $N = 1, 3, 6, 12, 24, 36, 48$ in Figure 6.⁸ The basic conclusion is that the shorter the investment horizon

⁸Results for other holding periods, as in Figure 6, are available upon request.

the larger the excess returns. Specifically, at the end of 2014 the cumulative returns from the 1 month, 6 month, 12 month, 24 month, 36 month and 48 month holding periods are respectively equal to 288.3%, 220.5%, 141.1%, 119.4%, 100.6%, 104.4% and 100.2%. This is not surprising as the Calendar Time results in Table 1 show that the monthly excess returns decline when the investment horizon becomes longer. However, Figure 6 allows us to verify that the excess returns are not simply the result of outperformance during a particular time period. Table 9 shows the monthly and yearly returns of this five-factors hedged strategy for $N=12$. The table shows that in 20 of 30 years the returns are positive, with a large 31.6% excess return in 2001. In only one year (2000) the strategy generates an abnormal loss larger than 2.8%.

Despite using pre-portfolio formation data to estimate the betas, unlike both the IRATs and Calendar Time methods that use hindsight to estimate risk, the hedged portfolio has very low betas with the five factors. For example for the $N = 12$ months holding period, the betas for the five factors Market, SMB, HML, RMW, and CMA are respectively 0.007, 0.023, -0.003, 0.015 and -0.157. The corresponding betas for the “unhedged” strategy are 1.042, 0.567, 0.201, 0.181 and -0.093. This also indicates that the returns shown in Figure 6 and Table 9 are close to “excess” returns, i.e. returns that have basically eliminated all factors risk. This is also consistent with the hypothesis that the buyback announcement itself does not materially change the risk of the repurchasing firms (in the short term).

4.3. *Robustness across Sectors*

Figure 7 shows the number of buyback events per industry in our sample. The software and semiconductor industries are the most active repurchasers. They also tend to be the most volatile industries, industries where disagreement about fundamental value is large - as we report later in Table 10. Table 7 shows the IRATS cumulative abnormal returns and Table 8 the Calendar Time method monthly average abnormal returns when we remove one industry at the time, for the top most frequent buyback industries (those for which

there are at least 300 events in our sample). Note from Table 1 that, after 48 months, the cumulative abnormal returns for the whole sample (using IRATS) is 13.02% and the monthly average excess return (Calendar Time) is 0.22%. So the larger the difference between these numbers and the corresponding numbers for the industry indicated in Tables 7 and 8, the larger the excess returns in the industry removed. For example, using IRATS, deleting the software industry lowers the CAR from 13.02% to 9.62%, a 3.4% decline. This is the largest decline in Table 7, indicating that buybacks in the software industry are followed by the largest excess returns. However, deleting Retail, Insurance, Machinery, Meals and especially Chemical stocks improves the excess returns. Of course, these differences could be explained by differences in U-index levels or other indicators of the likelihood of misvaluation, a topic we turn to next.

5. Excess returns and volatility

There exists a large literature on volatility and stock returns. One of the most puzzling findings is the fact that total volatility and idiosyncratic volatility are negatively correlated with future abnormal returns, when expected returns are calculated using the 3 factor Fama and French (1993) model (see e.g. Ang et al. (2006) (Table VII)). This volatility anomaly also survives after using the Fama and French (2015a) 5-factor model, at least for small firms. Perhaps the buyback and the volatility anomaly are related: are the buyback firms with the largest excess returns also firms with the smallest (idiosyncratic) risk? Or can we make arguments that the opposite is true, if we accept the fundamental proposition of this paper, i.e. that excess returns are a result of the fact that managers are on average successful in taking advantage of an undervalued stock price?

5.1. *Idiosyncratic Risk*

The main “theory” behind the buyback anomaly is that firms may have superior *company-specific* information. Such situations are more likely in industries or companies where the value is driven less by market wide factors, i.e., by highly “idiosyncratic” companies. So if buybacks are driven by market timing this superior information hypothesis predicts that there should be a positive relation between idiosyncratic returns and volatility. To test this hypothesis, for each event we measure the five-factor regression R^2 using the 6-months daily returns just before the event announcement.⁹ We define two types of events: “low idiosyncratic” (high R^2) and “high idiosyncratic” (low R^2) events, depending on whether the five-factor regression R^2 was in the top or bottom 20% of the R^2 of all CRSP companies: each month we use the daily returns of all CRSP stocks for the previous 6 months until the one before last day of the previous month to calculate all companies’ five-factor regression R^2 . We also define the idiosyncratic score of a firm to be the percentile of its $1 - R^2$ across all CRSP firms that month. Note that we do not need to define 20 breakpoints as Fama-French do, and for simplicity we focus on the two extreme quantiles only. Table 10, columns (1) and (2) show the percentage of high and low idiosyncratic risk events across all industries for which we have at least 100 buyback events in our sample. The healthcare industry has the largest percentage of firms classified as “high idiosyncratic”, while cyclical industries such as steel, construction and chemicals contain a large number of “low idiosyncratic” firms.

Table 11 shows the IRATS and Calendar Time abnormal returns for high and low idiosyncratic buyback events-companies. Focusing on IRATS, high idiosyncratic buyback stocks earn 23.52% after 48 months, more than three times the excess returns of the low idiosyncratic announcements. The results using the Calendar Time method confirm these findings. Table 11 also tests whether adjusting for idiosyncratic risk improves the predictive power

⁹Using shorter time windows, e.g., 1 month, or using the idiosyncratic volatility as in Ang et al. (2006), leads to the same conclusions - results available upon request. However, as we want to differentiate between “idiosyncratic” companies and “high volatility” ones, to consider both the effects of company specific information and of the option value of a buyback announcement, we separately study the relations with R^2 and volatility. See also Li, Rajgopal, and Venkatachalam (2014) for a discussion on this issue.

of the U-index. Regardless of the time horizon and the event study method, the U-index works only for idiosyncratic companies. After 48 months, based on the IRATS methods, high U-index high idiosyncratic companies earn 39.68% ($t=8.53$). Low idiosyncratic high U-index firms have only an insignificant excess return of 5.45% ($t=0.76$), while for low idiosyncratic firms the low U-index IRATS excess returns are significant (7.95%, $t=2.26$). Note however that we only have few events in low idiosyncratic, high U-index (303 events) and high idiosyncratic, low U-index (165 events) categories. The Calendar Time results provide the same picture: only for the high idiosyncratic, high U-index firms we obtain significant ($t=3.49$) monthly excess returns of 0.65%. The high idiosyncratic and low U-index firms have non-significant ($t=0.86$) monthly excess returns of 0.15%.¹⁰

Figure 8 summarizes our results. It shows the CAR based on IRATS (Panel A for the high U-index firms, B for the low U-index firms, and C for all firms). In agreement with Table 11, the striking result (Panel A) is that the U-index is not a good predictor of excess returns for stocks largely driven by market factors (low idiosyncratic firms). This is strong evidence that excess returns after buybacks are driven by superior company-specific information of the management.

The finding that $1 - R^2$ and idiosyncratic volatility (IVOL in Ang et al. (2006), measured as the standard deviation of the residuals of the factor model regression) are positively related to future excess returns is inconsistent with Ang et al. (2006) who find a negative relation between IVOL and expected returns. However, Stambaugh et al. (2015) argue that the relationship between IVOL and returns becomes positive for undervalued stocks. Their argument is that IVOL represents risk that deters arbitrage and therefore creates mispricing. Using a proxy for mispricing based on 11 anomalies they find indeed a positive relation between IVOL and future returns for undervalued stocks. Their most under-priced high

¹⁰We also calculated the returns of a hedged strategy similar to Figure 6 (Panel B). Starting in 1985 we form a portfolio of all stocks that announced a buyback during the previous N months and hold the stock for N months. High idiosyncratic companies earn cumulative excess returns of 194.1% (153.1%) for the 12 (48) month holding strategy. These excess returns are higher than the 107.8% (83.5%) of the corresponding low idiosyncratic sample.

IVOL stocks earn monthly excess returns (relative to the Fama-French three-factor model) of 0.56% per month which is quite similar to the 0.41% per month reported in our Table 11 Panel B (using the five-factor model).

5.2. *Volatility*

The announcement of a buyback program is not a firm commitment, but an option to buy back stock. Ikenberry and Vermaelen (1996) model this flexibility as an exchange option in which the market price of the stock is exchanged for the true value of the stock. They predict that, as with all options, the value increases with the volatility. The intuition is that the larger the volatility, the larger the probability that the market price may deviate from the true value. This enhances the timing ability of the manager-insider. They show that this option can have a lot of value, something that may not be realized at the time of the announcement of the buyback authorization. Hence, perhaps total volatility is a better prediction of excess returns than idiosyncratic volatility or the U-index. Or perhaps volatility can be an additional, next to the U-index and idiosyncratic volatility, indicator of the likelihood that the buyback is driven by undervaluation.

For each event we measure their pre-announce returns volatility with the standard deviation of their daily stock returns over the 6 months prior to the buyback announcement. We define two types of events: “low volatility” and “high volatility” events, depending on whether volatility was in the top or bottom 20% of the volatilities of all CRSP companies, as we did for R^2 above: each month we use the daily returns of all CRSP stocks for the previous 6 months until the one before last day of the previous month to calculate all companies’ daily returns volatilities. We also define the volatility score of a firm to be the percentile of its volatility across all CRSP firms that month. Note that, again, we do not need to define 20 breakpoints as Fama-French do, and for simplicity we focus on the two extreme quantiles only. In total we have 2,531 “high volatility” buybacks-events and 2,531 “low volatility” ones. Table 10, columns (3) and (4) show the percentage of high and low volatility events

across all industries for which we have at least 100 buyback events in our sample.

Table 12 shows the IRATS and Calendar Time abnormal returns for high and low volatility buybacks events-companies. Focusing on IRATS, high volatility buyback stocks earn 36.92% after 48 months, while low volatility events have non significant abnormal returns for any period. The results using the Calendar Time method confirm these findings.¹¹

Table 12 also tests whether the U-index is valid for high volatility events, as well as whether adjusting for volatility improves the predictive power of the U-index. Regardless of the time horizon and the event study method, the U-index works for high volatile companies. After 48 months, based on the IRATS methods, high U-index high volatility companies earn 45.61% ($t = 9.05$). Low U-index high volatility companies earn 31.12% ($t = 4.32$). The Calendar Time results provide the same picture. Figure 9 summarizes the results for the total sample and the high and low U-index sample. The main difference with Figure 8 is that now also low volatility/high U-index firms earn significant excess returns of 15.3% after 48 months.

5.3. *An Enhanced U-index for Buybacks*

Table 13 shows how the high/low U-index low/high idiosyncratic risk, and low/high volatility buyback events overlap, while Table 14 shows the correlations between the idiosyncratic, volatility, and U-index scores. Overall we see that although high U-index firms tend to have high idiosyncratic risk and high volatility, while high idiosyncratic risk firms tend to also have high volatility, the overlap is not very high. For example from Table 13 we learn that only 27.1% of the high volatility stocks that are classified as having either high or low idiosyncratic risk - note that we only consider the 20% tails - have high idiosyncratic risk. From Table 14 we infer that the correlation between idiosyncratic risk and volatility

¹¹We also calculated the returns of a hedged strategy similar to Figure 6 (Panel B). Starting in 1985 we form a portfolio of all stocks that announced a buyback during the previous N months and hold the stock for N months. High volatility companies earn cumulative excess returns of 160.1% (167.9%) for the 12 (48) month holding strategy, which are higher than the 129.1% (103.3%) of the corresponding low volatility sample.

is only 9.7%. A natural question is therefore whether one can further enhance the Peyer and Vermaelen (2009) U-index by incorporating information about the firms pre-announce idiosyncratic risk and volatility. We consider one such combination where we simply take an equal-weighted combination of the 4 criteria into one “Enhanced Undervaluation Index” (EU-index). Specifically, in the spirit of the U-index of Peyer and Vermaelen (2009), we calculate the EU-index simply as the sum of three numbers: high U-index firms get a score of 2, low get a 0; high idiosyncratic firms get a score of 2, low get a 0; and high volatility firms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores.

Figure 10 shows the distribution of the EU-index. The index has a symmetric distribution with a mean of 3.08. Table 15 shows how the EU-index relates to a number of firm characteristics. Firm leverage, based on data the year before announcement, is defined as the ratio $debt/(debt + equity)$ ¹². “Missed (beat) EPS” measures the percentage of firms in the specific EU index category that missed (beat) the last EPS consensus analyst forecast before the buyback announcement. “ISS later” measures the percentage of firms that announced an equity issue within 48 months after the buyback announcement. Next, we measure the percentage of buybacks financed with cash (CASH) when the data is available¹³ (this data was available only for 6,981 of the events) and whether the reported purpose (available only for 7,416 events) included the term “Undervalued”, or “Enhance Shareholder Value” or “stock option plan”.

First there is a striking negative relation between the EU index and financial leverage. This makes sense according to the static trade-off theory of optimal capital structure: high

¹²We use the definitions from [http://www.ivo-welch.info/professional/leverage.placebo/Ivo Welch's website following http://www.ivo-welch.info/professional/leverage.placebo/r-sourcecode/mksane.R](http://www.ivo-welch.info/professional/leverage.placebo/IvoWelch's%20website%20following%20http://www.ivo-welch.info/professional/leverage.placebo/r-sourcecode/mksane.R). Debt is the sum of the Compustat variables $dlc + dlth$, where dlc is “Debt in Current Liabilities” and $dlth$ is “Long Term Debt - Total”. Equity is the Compustat variable seq which is “Total Parent Stockholders' Equity”. We use the most recent data pre-announce, and make the winsorization and other adjustments as in the websites above. Note that we followed the same steps as in these websites to handle negative book value of equity (in the BE/ME calculations) and any other Compustat data issues.

¹³As this SDC data was not available for many events, we did not consider the in the U-index calculation

risky firms have more financial distress and should have less debt. Second, the high EU index firms are more likely to miss earnings forecasts. To the extent that analysts base their recommendations on these earnings misses, stock prices may become undervalued. Evidence that analyst extrapolation forecast errors are a partial explanation for the buyback anomaly is documented by Peyer and Vermaelen (2009). High EU index firms are more likely to mention “undervaluation” as a motivation for the buyback. High EU index firms tend to have more cash. This could of course be related to the fact that risky firms should have more cash holdings. They also tend to follow up with equity offerings after the buyback which suggests that they are more likely to be in the “market timing” business. The table also shows a strong negative relation between market-to-book ratios and market capitalization and the EU index, which is not surprising as these are components of the index. It should be noted that the EU 6 portfolio is composed of very small stocks with an average market capitalization of \$128.5 million. The average market capitalization of portfolios with long term (after 48 months) monthly excess return of larger than 0.3% (i.e. portfolios EU4 through EU6 in Table 17) is \$0.8 billion (not indicated in the Table). So the buyback anomaly is to some extent a small cap anomaly, although portfolio EU3 for which the average market capitalization of its 2,818 firms is \$3.1 billion still has significant abnormal returns.

Tables 16 and 17 show respectively the IRATS and Calendar Time monthly abnormal returns for all values of the EU-index. Focusing on IRATS, as the EU-index increases, the long term abnormal returns increase (from -1.5% to 54.7%). Figure 11 show the same results over time for each EU-index. Long-term cumulative excess returns after 48 months are becoming statistically significantly positive at EU-index levels of 3 and higher, and then steadily increase from 9.2% to 54.7%. The Calendar Time results are similar although they only show significance starting at EU-index levels of 4. Investing in the very high EU index firms (EU=6) generates alphas of 0.82% per month for 48 months.¹⁴

¹⁴We also calculated the returns of a hedged strategy similar to Figure 6 (Panel B). Starting in 1985 we form a portfolio of all stocks that announced a buyback during the previous N months and hold the stock for N months. The 12-month holding period high EU-index portfolio has average annual abnormal returns of 6.7%, while the low EU-index one earns only 3.4% annual excess returns. For the 48-month holding periods

The bottom line is that combining volatility, idiosyncratic risk and the U-index in one EU- index generates a more selective predictor of excess returns than each of the indicators separately. Indeed, high U-index stocks, stocks with high idiosyncratic risk, and high volatile stocks generate cumulative excess returns of respectively 23.59% (Table 1), 23.52% (Table 11) and 36.92% (Table 12).

5.4. *Robustness of the EU-index over Time*

As volatility and idiosyncratic risk are time dependent, the performance of the new EU-index may not be robust over time - e.g., relative to the U-index of Peyer and Vermaelen (2009). Tables 18 (IRATS) and 19 (Calendar Time method), like Table 6 for the U-index, show the relative performance of high and low EU-index repurchases. In order to have roughly similar number of under/overvalued firms as when we use the U-index, we define low EU-index firms to those for which the EU-index is 0-1, and high for which it is 5-6 (the index takes values from 0 to 6). With this definition we have 1,209 low EU-index and 1,596 high EU-index firms in our sample (in comparison with 2,100 low U-index and 2,955 high U-index ones).

Tables 18 and 19 indicate that the EU-index is robust over time, with the exception of the 1985-1990 period. However during this period our high EU index sample only contains 80 observations which results in statistically insignificant excess returns beyond the 12 month horizon.

6. Conclusion

The buyback anomaly first reported by Ikenberry, Lakonishok and Vermaelen (1995) is still alive and robust. Long term excess returns are large, highly statistically significant and robust even when we replace the Fama-French three-factor model with the Fama-French

the high and low EU-index portfolio earn annual excess returns of respectively, 5.7% and 2.2%.

five-factor model. We believe that the difference with the conclusions of Fama and French (2015b) is a result of the fact that we do not pool buybacks and equity issues in a “net issuance” anomaly. A buyback is not simply the inverse of an equity issue, especially in a world with asymmetric information. Managers who buy back undervalued stock from selling investors benefit their long-term shareholders at the expense of selling shareholders who are “leaving” the company. Issuing overvalued stock to new investors is not exactly enhancing good investor relations. Hence it is not surprising to find that the equity issue anomaly does not survive after appropriately adjusting for risk. Moreover buyback authorizations are options, not firm commitments such as equity issues. Using net issues as a measure of (negative) buyback activity ignores the reality that an actual repurchase may occur several months, if not years after a buyback authorization. By the time the buyback is completed the firm may already have experienced significant excess returns.

Not all buybacks are the same: we find that buybacks made by small beaten up risky low market to book companies earn the largest excess returns. We find that both idiosyncratic risk (small R^2) and total risk are positively correlated with future returns. The results that idiosyncratic risk is positively correlated with returns is inconsistent with Ang et al. (2006) but consistent with Stambaugh et al. (2015) who show that for undervalued firms IVOL is positively related to expected returns. We combine these characteristics in a new measure: the EU index or Enhanced Undervaluation Index, building on the analysis of Peyer and Vermaelen (2009). Investing in very high EU index firms generates Fama-French five-factor adjusted returns of 0.82% per month during the 48 months after the buyback announcement. These are also firms that mention in their press releases that they are buying back stock because they are undervalued. They are more likely to miss earnings forecasts relative to the other buyback firms and therefore falling out of favor with analysts. However investing in high EU index firms to some extent implies investing in small caps and micro-caps, which may explain partially why the anomaly persists as these firms may not satisfy, for example, liquidity risk constraints of many funds.

References

- Ang, A., Hodrick, R. J., Xing, Y., Zhang, X., 2006. The cross-section of volatility and expected returns. *The Journal of Finance* 61, 259–299.
- Brav, A., Geczy, C., Gompers, P. A., 2000. Is the abnormal return following equity issuances anomalous? *Journal of Financial Economics* 56, 209–249.
- Dittmar, A., Thakor, A., 2007. Why do firms issue equity? *The Journal of Finance* 62 (1), 1–54.
- Eckbo, B. E., Masulis, R. W., Norli, O., 2000. Seasoned public offerings: resolution of the ‘new issues puzzle’. *Journal of Financial Economics* 66, 251–291.
- Engelberg, J., McLean, R. D., Pontiff, J., 2015. Anomalies and news. Available at SSRN .
- Fama, E. F., French, K. R., 1993. Common risk factors in the returns of stocks and bonds. *Journal of Financial Economics* 33, 3–56.
- Fama, E. F., French, K. R., 2015a. A five-factor asset pricing model. *Journal of Financial Economics* 116, 1–22.
- Fama, E. F., French, K. R., 2015b. Dissecting anomalies with a five-factor model. Fama-Miller Working Paper .
- Fu, F., Huang, S., 2015. The persistence of long-run abnormal returns following stock repurchases and offerings. *Management Science* (Forthcoming) .
- Grullon, G., Michaely, R., 2004. The information content of share repurchase program. *Journal of Finance* 59, 651–681.
- Ibbotson, R. G., 1975. Price performance of common stock new issues. *Journal of Financial Economics* 2, 235–272.

- Ikenberry, D., Lakonishok, J., Vermaelen, T., 1995. Market underreaction to open market share repurchases. *Journal of Financial Economics* 39, 181–208.
- Ikenberry, D., Vermaelen, T., 1996. The option to repurchase stock. *Financial Management* 25, 9–24.
- Li, B., Rajgopal, S., Venkatachalam, M., 2014. *The Accounting Review* 89 (6), 2261–2295.
- Lin, J.-C., Stephens, C. P., Wu, Y., 2014. Limited attention, share repurchases, and takeover risk. *Journal of Banking and Finance* 42, 283–301.
- Loughran, T., Ritter, J., 1995. The new issues puzzle. *Journal of Finance* 50, 23–52.
- Manconi, A., Peyer, U., Vermaelen, T., 2015. Buybacks around the world market timing, governance and regulation. INSEAD Working Paper .
- Mitchell, M., Pulvino, T., 2001. Characteristics of risk and return in risk arbitrage. *Journal of Finance* 56, 2135–2175.
- Peyer, U., Vermaelen, T., 2009. The nature and persistence of buyback anomalies. *The Review of Financial Studies* 22, 1693–1745.
- Spiess, D. K., Affleck-Graves, J., 1995. Underperformance in long-run stock returns following seasoned equity offerings. *Journal of Financial Economics* 38, 243–267.
- Stambaugh, R. F., Yu, J., Yuan, Y., 2015. Arbitrage asymmetry and the idiosyncratic volatility puzzle. *The Journal of Finance* 70, 1903–1948.

Table 1: Buyback announcements during 1985-2014

The table presents the abnormal returns for firms after open market repurchase announcements from the announcement date until t months after announcement. We include a version of the abnormal returns for the full sample and one for both companies with a high U-index and a low U-index. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama French (1993) three-factor model and the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regressions are run each event month j :

$$\begin{aligned}(R_{i,t} - R_{f,t}) &= a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + \epsilon_{i,t}, \\ (R_{i,t} - R_{f,t}) &= a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},\end{aligned}$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	All 3F		All 5F		High U-index 3F		Low U-index 3F		High U-index 5F		Low U-index 5F	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-6.6**	-22.64	-6.77**	-22.43	-17.01**	-30.71	4.18**	7.46	-16.88**	-29.54	3.79**	6.49
+12	4.03**	8.84	2.87**	6	4.7**	4.73	5.07**	5.84	4.38**	4.21	3.6**	3.95
+24	8.91**	12.91	6.63**	9.12	11.25**	7.33	6.55**	5.35	10.84**	6.68	3.68**	2.86
+36	13.71**	15.77	10.58**	11.54	16.86**	8.58	10.79**	7.08	16.73**	8.04	6.33**	3.94
+48	17.33**	16.76	13.02**	11.92	24.21**	10.28	12.55**	7.05	23.59**	9.41	5.95**	3.17
Observations	10124		10124		2955		2100		2955		2100	

Panel B: Calendar Time Method Monthly Abnormal Returns

	All 3F		All 5F		High U-index 3F		Low U-index 3F		High U-index 5F		Low U-index 5F	
	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat
-6	-0.9**	-9.04	-0.95**	-9.61	-2.57**	-14.63	0.76**	5.88	-2.51**	-13.79	0.67**	5.06
+12	0.33**	3.72	0.28**	3.07	0.35**	2.68	0.42**	3.5	0.33*	2.41	0.36**	2.94
+24	0.33**	4.01	0.25**	2.98	0.32**	2.89	0.3**	2.93	0.29**	2.47	0.21*	2.04
+36	0.32**	4.17	0.24**	3.15	0.34**	3.2	0.3**	3.03	0.32**	2.83	0.2*	1.99
+48	0.29**	3.95	0.22**	2.95	0.37**	3.41	0.27**	2.77	0.35**	3.09	0.16	1.64
Observations	10124		10124		2955		2100		2955		2100	

Table 2: Issue announcements during 1985-2014

The table presents the abnormal returns for firms after issue announcements from the announcement date until t months after the announcement. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama French (1993) three-factor model and the Fama French (2015) five-factor model for the sample of firms that announced equity issuance plus various subsamples. The following regressions are run each event month j :

$$\begin{aligned}(R_{i,t} - R_{f,t}) &= a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + \epsilon_{i,t}, \\ (R_{i,t} - R_{f,t}) &= a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},\end{aligned}$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	All 3F		All 5F	
	CAR	t -stat	CAR	t -stat
-6	35.02**	35.79	36.65**	35.58
+12	-0.64	-0.61	1.86	1.69
+24	-6.51**	-4.22	-1.98	-1.23
+36	-10.11**	-5.17	-4.37*	-2.14
+48	-4.86*	-2	2.18	0.85
Observations	3250		3250	

Panel B: Calendar Method Monthly Abnormal Returns

	All 3F		All 5F	
	AR	t -stat	AR	t -stat
-6	5.34**	20.83	5.58**	21.08
+12	-0.06	-0.35	0.19	1.06
+24	-0.23	-1.54	0	-0.03
+36	-0.24	-1.67	-0.03	-0.2
+48	-0.15	-1.03	0.05	0.32
Observations	3250		3250	

Table 3: Buybacks with and without subsequent issue

The table presents the long-run abnormal returns for firms repurchase announcements for events with and without a subsequent SEO announcement. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	No Issue		Issue	
	CAR	t -stat	CAR	t -stat
-6	-6.55**	-21.38	-10.01**	-6.28
+12	2.35**	4.83	13.03**	5.17
+24	5.25**	7.11	31.19**	8.49
+36	8.54**	9.15	46.05**	10.19
+48	10.84**	9.73	50.24**	9.59
Observations	9618		506	

Panel B: Calendar Method Monthly Abnormal Returns

	No Issue		Issue	
	AR	t -stat	AR	t -stat
-6	-0.94**	-9.66	-1.05**	-2.79
+12	0.24**	2.69	1.03**	2.7
+24	0.2*	2.43	0.92**	4.01
+36	0.2**	2.52	0.89**	4.73
+48	0.18*	2.41	0.73**	4.04
Observations	9618		506	

Table 4: Issue announcements with and without a prior buyback

The table presents the long-run abnormal returns (CAR) for firms after issue announcements for events with and without a prior buyback announcement within 48 months. We report the monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors.

	After a Buyback		No Prior Buyback	
	CAR	t -stat	CAR	t -stat
-6	32.07**	11.81	37.71**	34.01
+1	0.81	0.94	1.41**	4.03
+3	3.35*	2.12	3.22**	5.44
+6	4.34*	2	3.22**	3.95
+24	5.54	1.32	-2.15	-1.24
+48	-0.18	-0.03	3.46	1.25
Observations	359		2891	

Table 5: Buyback returns over different time periods

The table presents the long-run abnormal returns for firms after repurchase announcements for different time periods. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	1985-1990		1991-2000		2001-2014		2008-2014	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-3.27**	-3.1	-11.29**	-21.03	-2.23**	-5.55	-2.16**	-3.92
+12	7.36**	4.6	4.68**	5.05	3.96**	6.98	6.38**	7.44
+24	7.71**	3.21	11.37**	8.1	8.15**	9.64	12.13**	9.85
+36	8.15**	2.64	17.97**	10.3	11.18**	10.43	16.55**	10.59
+48	13.94**	3.6	21.7**	10.73	13.69**	10.38	16.34**	8.17
Observations	715		4220		5189		2417	

Panel B: Calendar Method Monthly Abnormal Returns

	1985-1990		1991-2000		2001-2014		2008-2014	
	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat
-6	-0.75**	-3.28	-1.81**	-9.8	-0.39**	-3.31	-0.39**	-3.05
+12	0.43**	2.57	0.28	1.49	0.42**	4.02	0.5**	3.58
+24	0.17	1.07	0.14	0.74	0.46**	4.12	0.52**	3.91
+36	0.15	1.11	0.25	1.65	0.44**	3.97	0.5**	3.94
+48	0.27*	2.21	0.19	1.35	0.41**	3.68	0.49**	3.9
Observations	715		4220		5189		2417	

Table 6: Buyback returns for the U-index over time

The table presents the long-run abnormal returns for firms after open market repurchase announcements for high and low U-index firms in different time periods and shows significantly larger returns by buybacks announced by high U-index firms compared to those with a low U-index. We report both the IRATS cumulative average abnormal returns (CAR, Panel A) and the calender time method (AR, Panel B) abnormal returns on the full sample. *t*-Statistics are provided and stars indicate significance at the 5% (*), and 1% level (**).

1985-1990	High U-index (IRATS)		Low U-index (IRATS)		High U-index (CAL)		Low U-index (CAL)	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-15.73**	-6.25	2.75	1.63	-2.29**	-3.85	0.43	1.25
+12	9.81**	2.49	9.07**	3.56	0.44	1.27	0.69**	2.6
+24	8.25	1.35	9.36**	2.55	-0.07	-0.24	0.53*	2.42
+36	10.02	1.19	8.12	1.83	0.19	0.67	0.27	1.41
+48	25.45*	2.25	10.82*	1.99	0.45	1.73	0.47*	2.32
Observations	181		182		181		182	
1991-2000	High U-index (IRATS)		Low U-index (IRATS)		High U-index (CAL)		Low U-index (CAL)	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-19.6**	-21.08	-0.27	-0.23	-3.24**	-11.86	0.2	0.68
+12	7.7**	4.18	7.25**	3.77	0.37	1.1	0.43	1.46
+24	19.49**	6.91	6.38*	2.39	0.32	1.31	-0.04	-0.17
+36	27.89**	7.89	10.97**	3.37	0.39	1.71	0.13	0.61
+48	37.15**	9.07	10.25**	2.76	0.51*	2.41	-0.05	-0.27
Observations	1418		818		1418		818	
2001-2014	High U-index (IRATS)		Low U-index (IRATS)		High U-index (CAL)		Low U-index (CAL)	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-11.71**	-14.73	6.97**	9.69	-1.99**	-8.79	1.14**	6.46
+12	3.4**	2.63	1.88	1.83	0.43*	2.34	0.33*	1.98
+24	8.87**	4.43	3.23*	2.22	0.45**	2.89	0.32*	2
+36	12.79**	4.92	6.03**	3.25	0.44**	2.89	0.34*	2.11
+48	18.63**	5.74	6.51**	2.95	0.43**	2.86	0.31	1.92
Observations	1356		1100		1356		1100	
2008-2014	High U-index (IRATS)		Low U-index (IRATS)		High U-index (CAL)		Low U-index (CAL)	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-12.86**	-12.15	6.83**	7.14	-2.38**	-7.3	1.11**	5.92
+12	9.26**	4.46	4.63**	2.94	0.67*	2.48	0.33	1.93
+24	16.43**	5.29	8.02**	3.81	0.73**	3.44	0.33*	2.27
+36	21.55**	5.42	10.25**	3.82	0.7**	3.41	0.34**	2.49
+48	29.34**	5.65	7.73*	2.26	0.72**	3.62	0.32*	2.39
Observations	611		537		611		537	

Table 7: Buyback IRATS Abnormal Returns: Industry Robustness

The table presents the long-run abnormal returns for firms after repurchase announcements after removing each of the industries indicated from the sample. We report the monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. The 48 month abnormal return for the full sample is equal to 13.02%, other values are reported in Table 1.

	Software		Chips		Retail		Business Serv.		Insurance		Med. Equip.	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-6.8**	-22.35	-6.49**	-21.025	-6.85**	-21.724	-6.68**	-21.385	-6.89**	-21.736	-6.75**	-21.863
+12	1.79**	3.699	2.41**	4.905	3.02**	6.202	3.11**	6.249	3**	5.961	2.73**	5.569
+24	4.42**	5.991	5.39**	7.265	7.03**	9.384	6.82**	9.049	7.05**	9.253	6.46**	8.67
+36	7.65**	8.173	8.79**	9.381	11.37**	11.967	10.7**	11.252	11.12**	11.614	10.11**	10.781
+48	9.62**	8.598	10.79**	9.624	14.21**	12.487	12.96**	11.428	13.41**	11.802	12.32**	11.016
Observations	9238		9305		9338		9350		9474		9743	

	Computers		Chemicals		Machinery		Pharm. Prod.		Meals		Wholesale	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-6.85**	-22.447	-6.87**	-22.181	-6.78**	-22.022	-6.93**	-22.989	-6.7**	-21.776	-6.74**	-21.906
+12	2.69**	5.551	2.99**	6.101	2.89**	5.924	2.75**	5.649	3.05**	6.254	2.86**	5.879
+24	6.44**	8.744	6.9**	9.263	6.81**	9.175	6.15**	8.337	7.08**	9.559	6.64**	8.998
+36	10.17**	10.983	11.14**	11.845	10.98**	11.728	9.83**	10.568	11.19**	11.985	10.56**	11.34
+48	12.58**	11.381	13.87**	12.379	13.55**	12.138	11.82**	10.672	13.78**	12.382	12.85**	11.557
Observations	9747		9786		9787		9793		9796		9819	

Table 8: Buyback Calendar Method Abnormal Returns: Industry Robustness

The table presents the long-run calendar method abnormal returns for firms after repurchase announcements after removing each of the industries indicated from the sample. Specifically, we report the monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors (the difference between the risk-free rate and the return on the equally weighted CRSP index, the monthly return on the size, book-to-market factor, profitability factor and investment factor in month) as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test. The 48 month abnormal return for the full sample is equal to 0.22%, other values are reported in Table 1.

	Software		Chips		Retail		Business Serv.		Insurance		Med. Equip.	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-0.96**	-10.295	-0.91**	-9.107	-0.96**	-9.849	-0.93**	-9.388	-0.96**	-9.452	-0.95**	-9.483
+12	0.19*	2.139	0.26**	2.995	0.31**	3.483	0.3**	3.283	0.27**	2.816	0.28**	3.038
+24	0.16*	1.999	0.22**	2.73	0.28**	3.508	0.25**	3.018	0.25**	2.829	0.25**	2.989
+36	0.17*	2.192	0.21**	2.778	0.28**	3.741	0.25**	3.148	0.24**	2.995	0.24**	3.101
+48	0.15*	2.028	0.19*	2.505	0.26**	3.588	0.22**	2.885	0.22**	2.805	0.22**	2.881
Observations	9238		9305		9338		9350		9474		9743	

	Computers		Chemicals		Machinery		Pharm. Prod.		Meals		Wholesale	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-0.96**	-9.554	-0.97**	-9.649	-0.95**	-9.517	-0.96**	-9.579	-0.9**	-8.249	-0.95**	-9.62
+12	0.27**	3.037	0.28**	3.045	0.28**	3.057	0.27**	2.956	0.29**	3.089	0.27**	2.993
+24	0.25**	3.03	0.25**	2.948	0.26**	3.087	0.23**	2.703	0.26**	3.047	0.24**	2.913
+36	0.24**	3.163	0.25**	3.19	0.26**	3.307	0.22**	2.802	0.26**	3.172	0.24**	3.063
+48	0.22**	2.958	0.23**	3.047	0.24**	3.126	0.2*	2.571	0.23**	2.971	0.21**	2.846
Observations	9747		9786		9787		9793		9796		9819	

Table 9: Monthly and Yearly Five Factor Abnormal Rerurns of a strategy investing in all buybacks

Monthly and yearly five-factor rolling hedged abnormal returns of an equally weighted (with monthly rebalancing) portfolio of all buybacks. The holding period for each buyback is 12 months per event.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1985	0.0	-0.9	-1.0	0.5	5.3	0.7	0.3	1.7	-6.2	3.3	3.2	0.7	7.4
1986	-3.5	2.2	1.3	5.8	0.2	-1.4	-2.6	-1.1	0.5	-0.2	0.3	0.1	1.0
1987	-2.1	5.2	-1.9	-1.1	0.8	0.9	2.9	-2.4	0.8	-0.6	-1.1	2.7	4.0
1988	-0.1	2.0	-0.2	0.1	0.1	0.2	-1.7	1.3	1.3	1.3	0.4	-0.8	3.9
1989	0.2	-1.1	1.6	-0.0	-0.4	-0.9	-1.9	0.3	-1.5	1.3	1.1	-0.9	-2.2
1990	2.0	-0.2	1.0	-0.1	1.2	-0.1	1.2	-0.3	0.2	0.3	2.1	2.2	9.9
1991	4.1	0.3	2.5	-1.0	0.1	-0.1	-1.0	-0.7	-0.3	-0.3	-0.8	-3.2	-0.4
1992	1.9	4.3	2.5	3.2	-1.6	-1.2	-2.0	2.3	-0.1	1.6	0.0	-1.7	9.4
1993	1.0	-2.4	0.1	-0.5	1.8	-0.5	-1.2	1.4	-2.0	0.5	3.8	1.2	3.0
1994	2.0	2.0	0.3	0.5	1.4	1.8	0.6	0.6	1.8	0.5	-1.4	-0.5	10.0
1995	0.7	-0.2	-1.4	0.1	0.4	0.7	0.2	1.6	-0.8	-0.2	1.1	-0.0	2.0
1996	0.5	1.3	0.5	1.4	-0.6	0.1	2.2	-1.8	-0.3	1.0	2.5	0.4	7.5
1997	-0.6	0.6	0.6	-1.1	0.3	-2.3	2.8	2.8	-0.4	-0.7	0.3	-2.6	-0.4
1998	0.2	-0.3	-0.1	-0.3	0.6	-4.1	-0.8	0.9	-0.7	4.4	0.8	-1.9	-1.6
1999	3.2	1.8	-0.1	2.1	0.8	-2.2	-1.1	-0.6	-0.9	0.2	-0.5	-2.4	0.0
2000	0.3	-0.7	2.7	2.0	1.4	-2.6	-3.1	-1.3	-2.3	-1.3	-2.9	-1.0	-8.7
2001	11.2	0.2	-3.0	3.7	4.5	2.4	0.1	3.6	-2.7	5.9	2.1	0.6	31.6
2002	-0.8	-1.0	0.1	-2.3	1.4	-3.4	3.2	-0.9	-1.2	-0.6	3.5	1.7	-0.5
2003	1.7	-0.7	0.6	-2.3	-0.6	-0.1	0.7	0.5	0.2	-0.4	1.9	-2.0	-0.7
2004	-0.8	2.2	1.5	2.0	0.0	-1.6	0.7	-0.5	1.8	1.9	0.6	0.5	8.7
2005	0.7	0.8	0.8	-1.5	-0.1	-0.4	0.6	1.7	-0.1	0.1	0.8	0.1	3.7
2006	-0.9	-0.2	0.3	0.8	1.0	-0.5	-1.1	-1.1	0.5	-0.0	0.1	0.4	-0.7
2007	0.3	1.2	0.7	0.4	1.0	-0.6	-1.2	-0.7	-2.1	-0.7	-0.8	-0.6	-2.8
2008	0.6	0.5	-0.2	-0.3	0.9	-3.2	-1.0	2.0	-2.1	-2.0	-0.7	3.5	-2.1
2009	4.4	2.3	1.8	3.8	1.0	-1.0	-1.8	1.7	-0.3	3.4	-1.3	-2.5	11.8
2010	1.2	-1.4	-1.3	-1.1	1.6	1.8	1.5	0.9	0.6	0.6	0.6	0.6	5.5
2011	0.6	1.0	0.3	1.0	0.8	0.3	-0.6	-0.1	0.9	0.3	0.9	1.8	7.3
2012	0.5	1.1	0.1	0.1	0.9	-0.7	-0.1	1.8	0.1	0.6	2.2	0.9	7.6
2013	1.0	0.3	0.3	0.7	-0.1	0.2	0.5	-0.4	0.0	0.4	0.2	0.7	3.8
2014	-0.2	0.5	0.9	1.2	0.8	-0.7	0.1	1.0	-0.6	-0.1	1.1	0.5	4.5

Table 10: Industry Characteristics

Percentage of high and low idiosyncratic risk and volatility companies for all industries for which we have at least 100 events in our sample.

	H Idsync. (1)	L Idsync. (2)	H Vol. (3)	L Vol. (4)	U/valued (5)	O/valued (6)
Software	20.7	21.2	49.9	10.9	24.9	20.4
Chips	15.5	30.9	46.9	18.3	36.6	16.7
Retail	17.4	15.4	19.3	17.2	21.1	31.0
Business Serv.	26.0	13.2	29.8	21.6	32.9	14.7
Insurance	18.6	24.3	6.2	45.5	30.5	11.5
Med. Equip.	27.8	7.6	23.9	31.2	24.9	28.1
Computers	22.0	30.8	38.2	18.6	27.9	28.6
Chemicals	9.8	25.7	10.1	46.2	13.6	32.2
Machinery	16.0	21.1	19.3	22.8	33.8	14.8
Pharm. Prod.	17.5	20.5	27.8	24.2	17.2	36.3
Meals	25.0	10.7	19.5	16.5	31.7	14.9
Wholesale	18.4	19.7	20.0	30.8	31.5	15.7
Transportation	15.7	19.4	22.7	15.1	37.8	11.0
Oil	17.2	28.1	17.6	25.8	20.2	16.9
Lab Equip.	18.1	21.0	28.2	22.3	25.6	25.6
Consumer Goods	24.8	15.8	19.7	24.8	30.8	26.9
Construct. Mat.	20.7	15.3	13.1	39.2	36.0	20.3
Telco	17.4	19.8	15.5	30.0	31.4	20.3
Autos	17.5	31.6	19.4	21.8	34.5	16.5
Healthcare	32.5	10.2	29.4	22.3	33.0	20.8
Food Prod.	22.4	16.9	8.2	43.7	21.3	38.3
Personal Serv.	28.3	13.9	22.5	13.3	35.3	13.3
Apparel	27.4	11.6	19.5	17.1	39.0	11.6
Steel	13.2	32.2	22.4	25.0	38.2	10.5
Construction	14.2	31.8	18.9	15.5	43.2	6.8
Paper	23.6	18.9	9.5	34.5	24.3	17.6
Elec. Equip.	15.1	23.5	16.0	35.3	24.4	21.8
Recreation	26.6	11.9	27.5	14.7	33.0	26.6
Entertainment	23.4	12.1	28.0	26.2	37.4	20.6

Table 11: Buyback for Low and High idiosyncratic and for Low and and High U-index companies

This table presents the long-term abnormal return after open market repurchase announcements from the announcement date until t months after, for low and high idiosyncratic and for low and high U-index companies. Regardless of event study method and time horizon, the U-index works only for idiosyncratic companies. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	Low Id.		High Id.		Low Id./High U-Ind.		Low Id./Low U-Ind.		High Id./High U-Ind.		High Id./Low U-Ind.	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-4.08**	-6.13	-8.83**	-11.08	-15.54**	-9.08	2.87**	2.61	-16.29**	-15.26	5.33*	2.11
+12	1.9	1.85	4.02**	3.14	0.02	0.01	6.89**	4.03	6.47**	3.01	0.28	0.09
+24	4.03**	2.64	8.62**	4.52	1.72	0.35	7.48**	3.14	15.95**	5.07	-1.18	-0.26
+36	6.6**	3.47	17.19**	7.19	5.11	0.83	10.71**	3.58	29.64**	7.51	2.89	0.5
+48	6.41**	2.86	23.52**	8.37	5.45	0.76	7.95*	2.26	39.68**	8.53	9.62	1.37
Observations	2021		2021		303		658		963		165	

Panel B: Calendar Method Monthly Abnormal Returns

	Low Id.		High Id.		Low Id./High U-Ind.		Low Id./Low U-Ind.		High Id./High U-Ind.		High Id./Low U-Ind.	
	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat
-6	-0.36	-1.8	-1.22**	-6.12	-2.2**	-5.05	0.67**	2.92	-2.45**	-8.34	1.29**	2.67
+12	0.2	1.17	0.35**	2.59	-0.24	-0.69	0.44*	2.34	0.4	1.9	0.11	0.39
+24	0.21	1.31	0.34**	2.78	-0.03	-0.13	0.24	1.45	0.49**	2.67	-0.03	-0.15
+36	0.19	1.4	0.4**	3.45	0.15	0.71	0.22	1.43	0.64**	3.32	-0.07	-0.35
+48	0.15	1.17	0.41**	3.68	0.15	0.72	0.12	0.8	0.65**	3.49	0.15	0.86
Observations	2021		2021		303		658		963		165	

Table 12: Buyback for Low and High Volatility and for Low and High U-index companies

This table presents the long-term abnormal return after open market repurchase announcements from the announcement date until t months after, for low and high volatility and for low and high U-index companies. Regardless of event study method and time horizon, the U-index works only for idiosyncratic companies. Panel A reports monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors. Panel B reports monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

Panel A: IRATs Cumulative Abnormal Returns

	Low Vol.		High Vol.		Low Vol./High U-ind.		Low Vol./Low U-ind.		High Vol./High U-ind.		High Vol./Low U-ind.	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-3.6**	-8.07	-12.56**	-14.45	-13.72**	-12.66	2.61**	3.81	-22.16**	-18.04	6.46**	2.61
+12	-0.38	-0.55	8.51**	6.37	1.6	0.87	0.44	0.42	8.23**	3.6	13.5**	3.61
+24	-0.7	-0.66	20.07**	9.9	3.26	1.15	-0.56	-0.37	20.7**	6.02	21.22**	4.16
+36	0.55	0.38	30.88**	12.39	8.26*	2.1	0.04	0.02	33.71**	7.85	29.89**	4.77
+48	5.14**	2.81	36.92**	12.7	15.3**	2.96	1.05	0.43	45.61**	9.05	31.12**	4.32
Observations	2531		2531		604		701		1036		312	

Panel B: Calendar Method Monthly Abnormal Returns

	Low Vol.		High Vol.		Low Vol./High U-ind.		Low Vol./Low U-ind.		High Vol./High U-ind.		High Vol./Low U-ind.	
	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat	AR	t -stat
-6	-0.42**	-3.2	-1.75**	-6.94	-1.79**	-7.23	0.57**	3.88	-3.45**	-9.69	1.19*	2.38
+12	0.01	0.08	0.65**	3.47	0.25	1.21	0.04	0.32	0.53*	2.09	0.36	0.89
+24	-0.01	-0.09	0.58**	3.57	0.09	0.53	-0.07	-0.65	0.47*	2.35	0.68*	2.39
+36	0.04	0.44	0.54**	3.64	0.19	1.19	-0.05	-0.48	0.47**	2.52	0.54*	2.1
+48	0.1	1.18	0.52**	3.65	0.29	1.88	-0.02	-0.18	0.53**	2.9	0.48*	1.96
Observations	2531		2531		604		701		1036		312	

Table 13: Relations across firm characteristics for Buybacks

Relation between Under/Overvaluation, High/Low Idiosyncratic Risk, High/Low volatility for buybacks. Numbers indicate percentage of firms in the row that are also categorized as noted in the columns.

	H Idiosync.	L Idiosync.	H Vol.	L Vol.
high U-index	32.6	10.3	35.1	20.4
low U-index	7.9	31.3	14.9	33.4
High Idiosync.	100.0	0.0	33.9	21.6
Low Idiosync.	0.0	100.0	23.8	24.9
High Vol.	27.1	19.0	100.0	0.0
Low Vol.	17.2	19.9	0.0	100.0

Table 14: Correlations of Buybacks Characteristics

Correlation between the three buybacks characteristics considered: Idiosyncratic score (percentile across all CRSP companies of firm's $1 - R^2$, 0 to 1), Volatility score (percentile across all CRSP companies, 0 to 1) and U-index score (0 to 15). All scores are defined using the universe of all CRSP companies at the time of the announcement with data up to the month before the announcement.

	Idiosyncratic Score	Volatility Score	U-Index Score
Idiosyncratic Score	1.00	0.10	0.29
Volatility Score	0.10	1.00	0.17
U-Index Score	0.29	0.17	1.00

Table 15: EU relations with Firm Characteristics

Firm characteristics for each of the 7 EU-index samples. Percentages indicated for all but the last 3 rows, and averages for the last 3 rows. We consider firm *leverage*, based on data the year before announcement, defined as the ratio $debt/(debt + equity)$. *Missed (Beat) EPS* measures the percentage of firms in the specific EU index category that missed (beat) the last EPS consensus analyst forecast before the buyback announcement. *ISS later* measures the percentage of firms that announced an equity issue within 48 months after the buyback announcement. Next, we measure the percentage of buybacks financed with cash (*CASH*) when the data is available and whether the reported purpose included the term *Undervalued*, *Enhance Shareholder Value* or *stock option plan*. Market Cap. is in millions, BE/ME Score is from 1, for firms below the 4th Fama-French BE/ME breakpoint, to 5 for firms above the 16th. Percentage Shares is the percentage shares authorized at announcement.

	EU0	EU1	EU2	EU3	EU4	EU5	EU6
Low Leverage	9.4	14.8	16.9	25.5	32.1	38.5	38.9
High Leverage	37.9	34.5	32.7	24.1	20.2	16.2	13.3
Missed EPS	30.5	28.0	30.4	36.7	40.3	44.7	44.6
Beat EPS	69.5	72.0	69.6	63.3	59.7	55.3	55.4
ISS Later	2.0	3.5	4.3	4.6	6.2	6.4	5.7
Cash	4.4	5.9	5.3	6.3	6.8	6.9	7.3
Good purpose	22.2	22.0	21.2	19.3	21.9	22.0	24.0
Undervalued	0.0	1.5	2.0	2.6	4.6	6.9	7.6
Enhance Shareholder Value	19.2	19.4	19.0	17.8	17.5	16.7	15.7
Stock Option Plan	4.9	3.5	3.0	3.0	3.3	2.6	4.7
Market Cap.	29985.7	22241.5	9124.1	3083.4	1108.6	396.1	128.5
BE/ME Score	1.3	1.6	2.0	2.3	2.6	2.8	3.0
Percentage Shares	5.1	5.3	5.8	6.4	7.0	7.2	7.6

Table 16: Buyback announcements IRATS for all EU-index Values

IRATS five factor cumulative abnormal returns after open market repurchase announcements for each Enhanced Undervaluation Index value from 0 to 6. We calculate the EU-index simply as the sum of three numbers: high Peyer and Vermaelen (2009) U-index terms get a score of 2, low get a 0; high idiosyncratic terms get a score of 2, low get a 0; and high volatility terms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores. For each EU-index value, we report the monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors.

	EU-index 0		EU-index 1		EU-index 2		EU-index 3	
	CAR	t -stat	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	1.58	0.997	0.52	0.817	0.04	0.083	-5.56**	-10.07
+12	0	0	1.55	1.473	-0.18	-0.225	3.3**	3.837
+24	-2.77	-0.866	1.24	0.816	-0.52	-0.448	5.09**	3.974
+36	-4	-0.954	0.86	0.434	0.41	0.273	7.28**	4.542
+48	-1.53	-0.28	1.34	0.57	1.33	0.731	9.16**	4.71
Observations	203		1006		2300		2818	

	EU-index 4		EU-index 5		EU-index 6	
	CAR	t -stat	CAR	t -stat	CAR	t -stat
-6	-11.35**	-16.23	-16.09**	-13.95	-21.46**	-10.263
+12	3.87**	3.499	5.28**	3.137	10.85*	2.388
+24	11.1**	6.192	14.63**	5.484	25.15**	3.923
+36	15.72**	6.912	23.9**	6.941	42.89**	5.606
+48	17.08**	6.347	34.54**	8.319	54.69**	6.278
Observations	2201		1213		383	

Table 17: Buyback announcements Calendar Time for all EU-index Values

IRATS five factor cumulative abnormal returns after open market repurchase announcements for each Enhanced Undervaluation Index value from 0 to 6. We calculate the EU-index simply as the sum of three numbers: high Peyer and Vermaelen (2009) U-index terms get a score of 2, low get a 0; high idiosyncratic terms get a score of 2, low get a 0; and high volatility terms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores. For each EU-index value, we report the monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors (the difference between the risk-free rate and the return on the equally weighted CRSP index, the monthly return on the size, book-to-market factor, profitability factor and investment factor in month) as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

	EU-index 0		EU-index 1		EU-index 2		EU-index 3	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	0.5*	2.092	0.18	1.232	0.15	1.242	-0.92**	-5.728
+12	-0.15	-0.752	0.21	1.8	0.14	1.139	0.28*	2.297
+24	-0.33	-1.892	0.15	1.522	0.08	0.75	0.2	1.792
+36	-0.25	-1.682	0.12	1.246	0.08	0.858	0.19*	1.981
+48	-0.21	-1.569	0.11	1.157	0.06	0.692	0.18*	2.011
Observations	203		1006		2300		2818	

	EU-index 4		EU-index 5		EU-index 6	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-1.75**	-9.373	-2.55**	-9.255	-3.02**	-6.765
+12	0.46**	2.912	0.42	1.914	0.69	1.965
+24	0.41**	3.418	0.31	1.819	0.6*	2.238
+36	0.35**	3.165	0.35*	2.226	0.81**	3.213
+48	0.3**	2.892	0.43**	2.757	0.82**	3.381
Observations	2201		1213		383	

Table 18: Long-run IRATS abnormal returns after open market repurchase announcements for low and high EU-index companies over different time periods.

Long-run abnormal returns five factor monthly abnormal returns after open market repurchase announcements for low and high Enhanced Undervaluation (EU) Index companies over different time periods. We define low EU-index firms those for which the EU-index is 0-1, and high for which it is 5-6 (note that the index takes values from 0 to 6). IRATS five factor cumulative abnormal returns after open market repurchase announcements for each EU-index value from 0 to 6. We calculate the EU-index simply as the sum of three numbers: high Peyer and Vermaelen (2009) U-index terms get a score of 2, low get a 0; high idiosyncratic terms get a score of 2, low get a 0; and high volatility terms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores. For each EU-index value, we report the monthly cumulative average abnormal returns (CAR) in percent using Ibbotson's (1975) returns across time and security (IRATS) method combined with the Fama and French (2015a) five-factor model for the sample of firms that announced an open market share repurchase plus various subsamples. The following regression is run each event month j :

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_jSMB_t + d_jHML_t + e_tRMW_t + f_tCMA_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the monthly return on security i in the calendar month t that corresponds to the event month j , with $j = 0$ being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t , HML_t , RMW_t , CMA_t are the monthly returns on the size, book-to-market factor, profitability factor and investment factor in month t , respectively. The numbers reported are sums of the intercepts of cross-sectional regressions over the relevant event-time-periods expressed in percentage terms. The standard error (denominator of the t -statistic) for a window is the square root of the sum of the squares of the monthly standard errors.

	1985-1990: High-EU		Low-EU		1991-2000: High-EU		Low-EU	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat
-6	-12.14**	-2.69	1.48	0.78	-22.61**	-14.58	-2.42*	-2.16
+12	15.54*	2.22	3.45	1.13	13.23**	4.29	0.5	0.27
+24	-2.42	-0.22	2.81	0.64	31.23**	6.78	-3.04	-1.17
+36	-14.15	-1	2.92	0.54	50.17**	8.78	-2.16	-0.65
+48	11.24	0.64	6.8	0.99	66.22**	10.09	-0.69	-0.17
Observations	80		117		748		534	

	2001-2014: High-EU		Low-EU		2008-2014: High-EU		Low-EU	
	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat	CAR	<i>t</i> -stat
-6	-11.15**	-7.39	3.93**	5.77	-12.4**	-4.98	3.61**	4.49
+12	4.43*	2.26	2.92**	2.64	10.68**	3.3	4.96**	3.65
+24	12.64**	4.35	5.68**	3.59	18.56**	3.94	9.25**	4.84
+36	19.59**	5.3	6.1**	3.02	26.45**	4.41	11.31**	4.3
+48	27.49**	6.01	5.61*	2.33	34.48**	4.4	12.1**	3.69
Observations	768		558		351		329	

Table 19: Calendar method monthly abnormal returns after open market repurchase announcements for low and high EU-index companies over different time periods.

Long-term monthly abnormal returns after open market repurchase announcements for low and high Enhanced Undervaluation (EU) Index companies over different time periods. We define low EU-index firms those for which the EU-index is 0-1, and high for which it is 5-6 (note that the index takes values from 0 to 6). We calculate the EU-index simply as the sum of three numbers: high Peyer and Vermaelen (2009) U-index terms get a score of 2, low get a 0; high idiosyncratic terms get a score of 2, low get a 0; and high volatility terms get a score of 2, low get a 0. Firms that get neither 0 nor 2 (hence are in the middle of the range) get a score of 1 for each of these 3 scores. For each EU-index value, we report the monthly average abnormal returns (AR) of equally weighted Calendar Time portfolios using the Fama and French (2015a) five-factor model. In this method, event firms that have announced an open market buyback in the last calendar months form the basis of the calendar month portfolio. A single time-series regression is run with the excess returns of the calendar portfolio as the dependent variable and the returns of five factors (the difference between the risk-free rate and the return on the equally weighted CRSP index, the monthly return on the size, book-to-market factor, profitability factor and investment factor in month) as the independent variables. The significance levels are indicated by * and ** and correspond to a significance level of 5% and 1% respectively, using a two-tailed test.

	1985-1990: High-EU		Low-EU		1991-2000: High-EU		Low-EU	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-1.91*	-2.12	0.41	0.99	-3.34**	-6.47	-0.04	-0.14
+12	0.77	1.25	0.44	1.55	0.65	1.61	-0.02	-0.07
+24	-0.7	-1.19	0.45	1.76	0.57	1.83	-0.15	-0.47
+36	-0.27	-0.6	0.24	1.16	0.84**	2.81	0	-0.01
+48	0.38	0.86	0.38	1.74	0.85**	3.26	-0.14	-0.72
Observations	80		117		748		534	
	2001-2014: High-EU		Low-EU		2008-2014: High-EU		Low-EU	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-6	-1.93**	-5.33	0.63**	4.42	-2.06**	-4.34	0.62**	3.96
+12	0.46	1.81	0.26*	2.27	0.75*	2.02	0.41**	2.62
+24	0.6**	2.77	0.25**	2.62	0.81**	2.85	0.4**	3.1
+36	0.61**	2.96	0.19*	2.05	0.82**	3	0.38**	2.9
+48	0.62**	3.06	0.14	1.62	0.88**	3.34	0.37**	2.93
Observations	768		558		351		329	

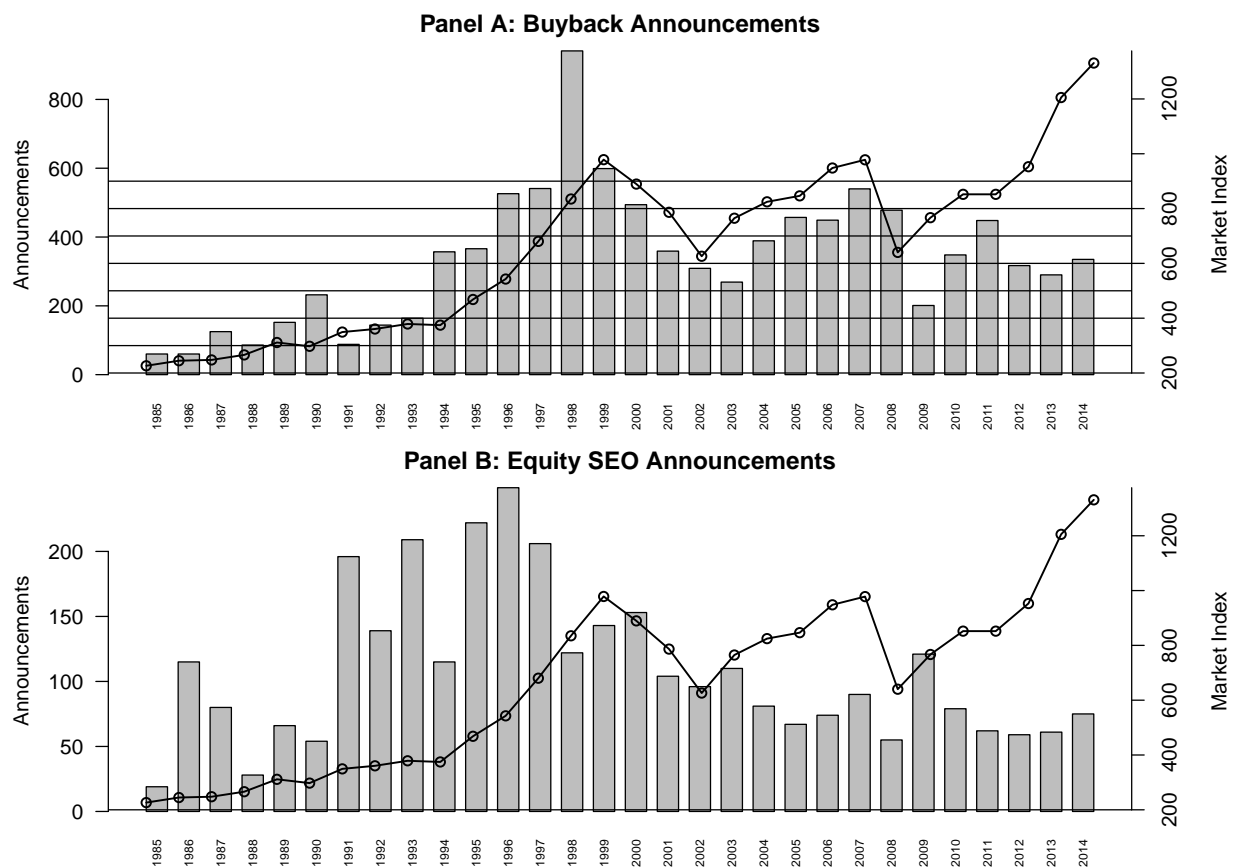


Fig. 1: Buyback and equity announcements. Number of announcements per year. Panel A: Buyback announcements; Panel B: Equity SEO announcements. Solid line and right hand axis shows the *S&P* index at the end of each year, starting from 100 in January 1985. Buyback activity rises prior to stock market increases and tends to fall afterwards. Also note the structural decline in equity since 2000.

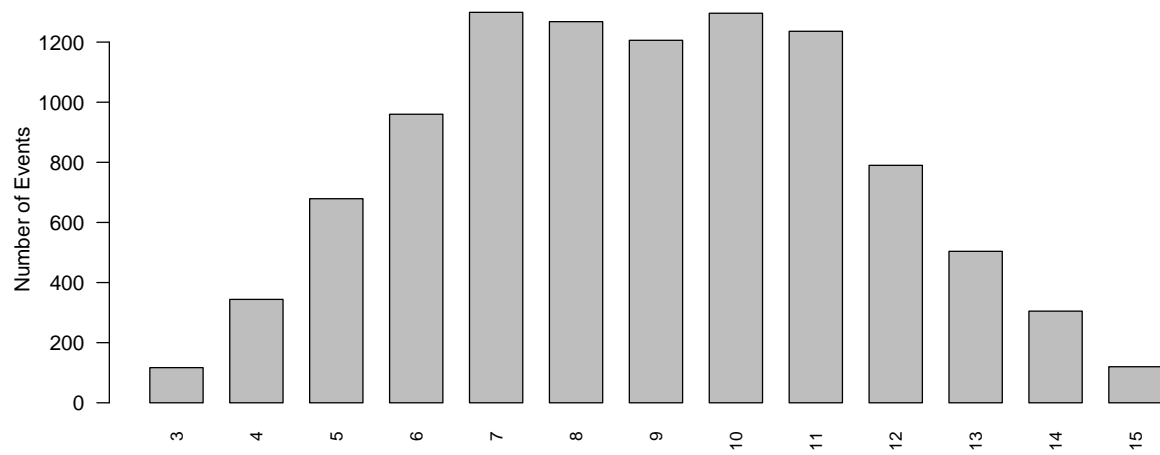


Fig. 2: Distribution of the Undervaluation Index of all buyback events.

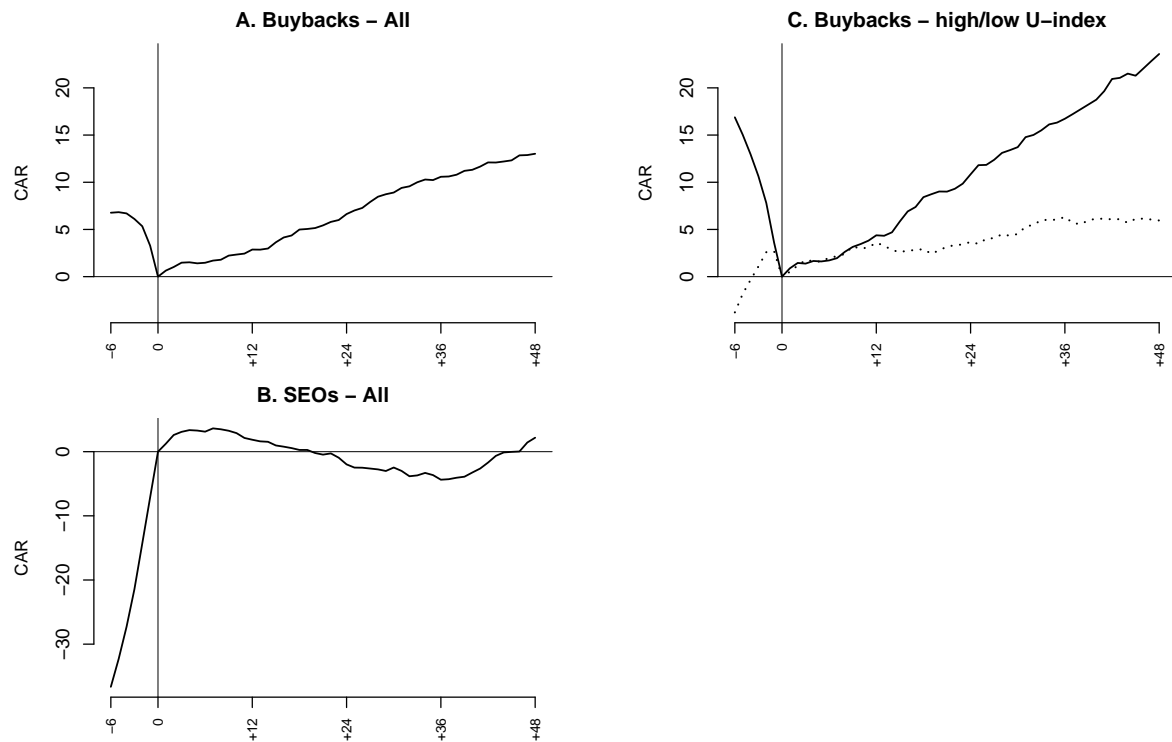


Fig. 3: Long-run five factors cumulative average abnormal returns (CAR) of buyback and SEO portfolios. The x-axis indicates months from the date of the event announcement. Panel A shows all buyback events, whereas Panel C shows all high (solid line) and low (dashed lines) U-index buyback events. Panel B includes all SEOs.

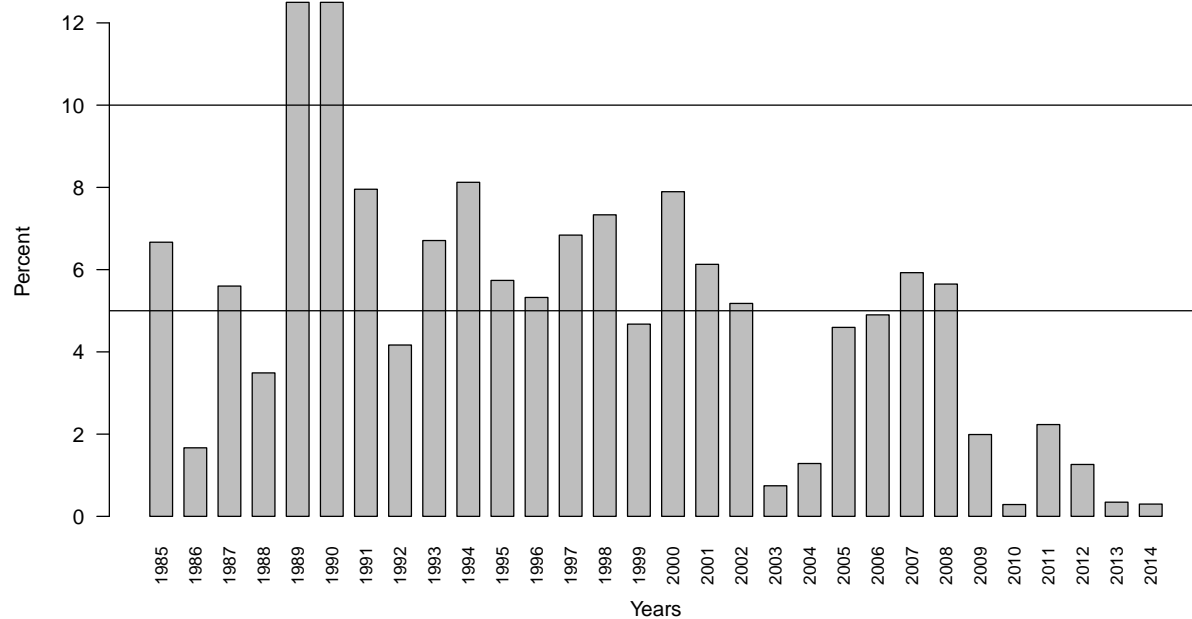


Fig. 4: Buybacks with a follow-up equity issue within 48 months. We show the percent of announced buyback events each year, that had a follow-up issue within 48 months after the event. The average percentage is 4.9% and there are only 2 years (1989 and 1990) where the percentage is larger than 10%.

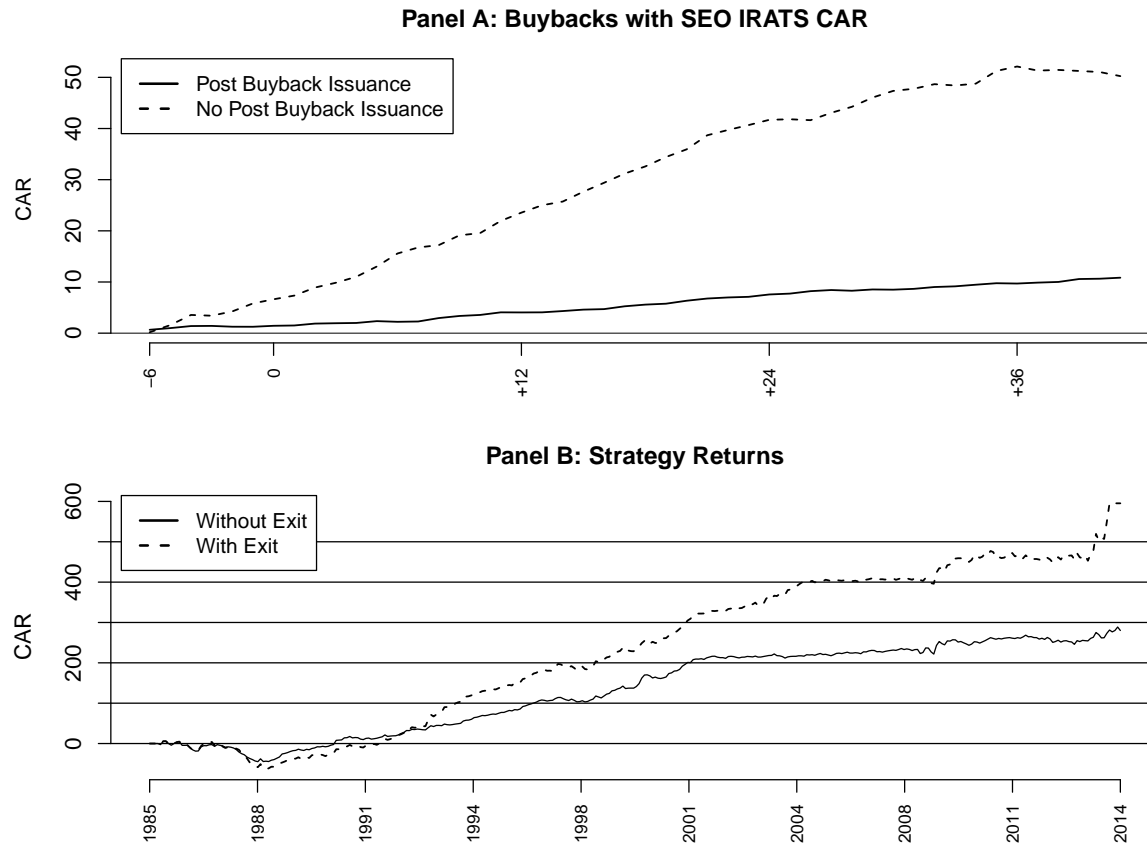


Fig. 5: Buybacks followed by equity issues within 48 months. Top Panel A: Five factor IRATS CAR for all buyback events that had (with hindsight) no subsequent SEO event within the 48 months post buyback announcement (solid line) versus those that did have (dashed line). Bottom Panel B: Abnormal (five-factor rolling hedged) returns of buybacks portfolio for only the 506 events for which there was a subsequent issue within 4 years. Dashed line is if we exit these positions the month after the subsequent SEO announcement.

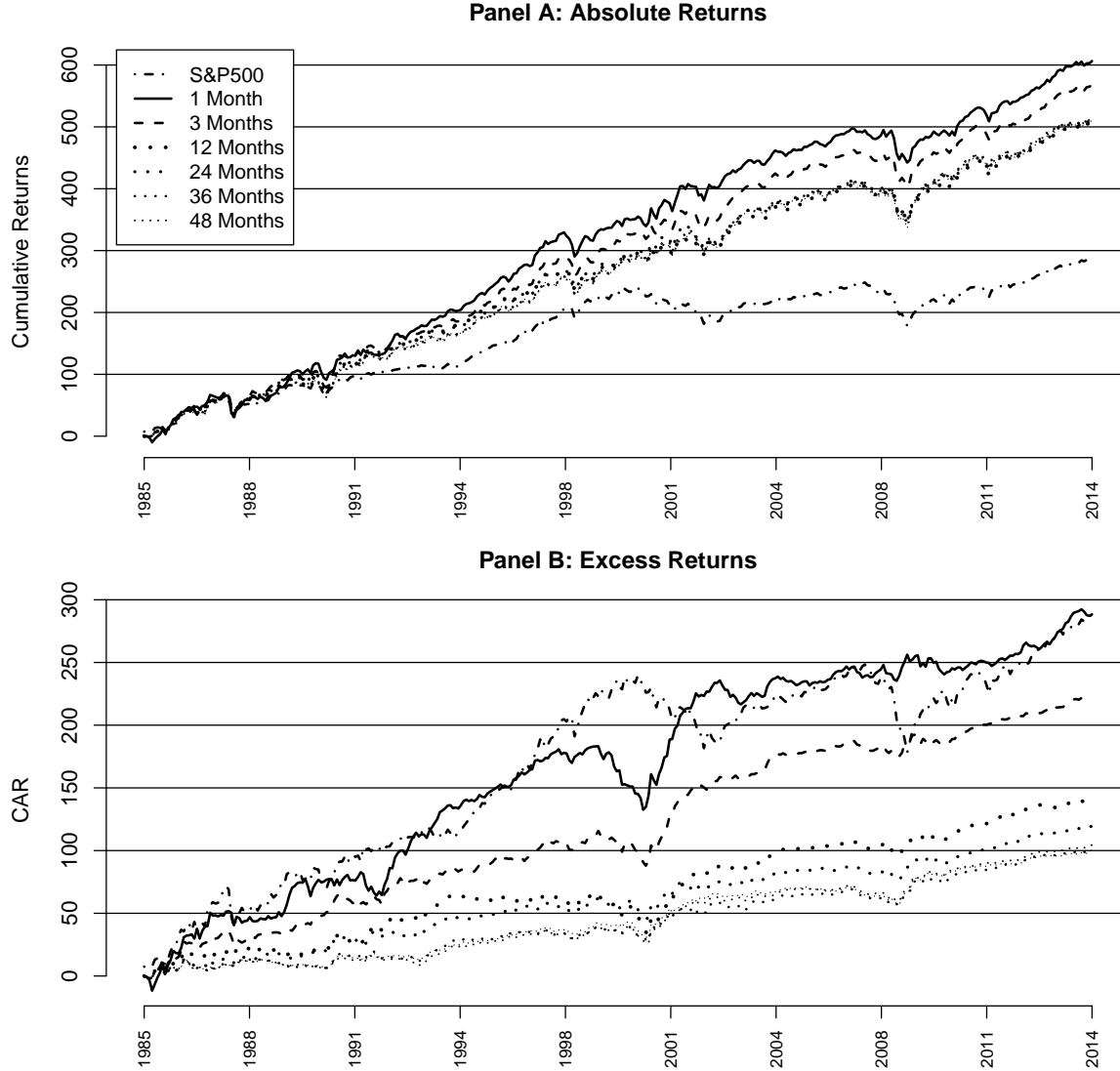


Fig. 6: Cumulative returns of portfolios of all buybacks for different holding periods. Panel A: Absolute returns; Panel B: five-factor Rolling Hedged Abnormal returns using a rolling window of 18 months, lagging 1 month. Dotted-dashed line (e.g., lowest one in Panel A) is the cumulative returns of the *S&P* Index, for comparison; solid line is with 1-month holding period, dashed line is with 3 months holding period; dotted lines are, from the most to the least dark ones, for 6, 12, 24, and 48 months holding periods. Note that the last few lines overlap to a large extent (especially in Panel A). We assume we enter each position 1 day after the corresponding event announcement.

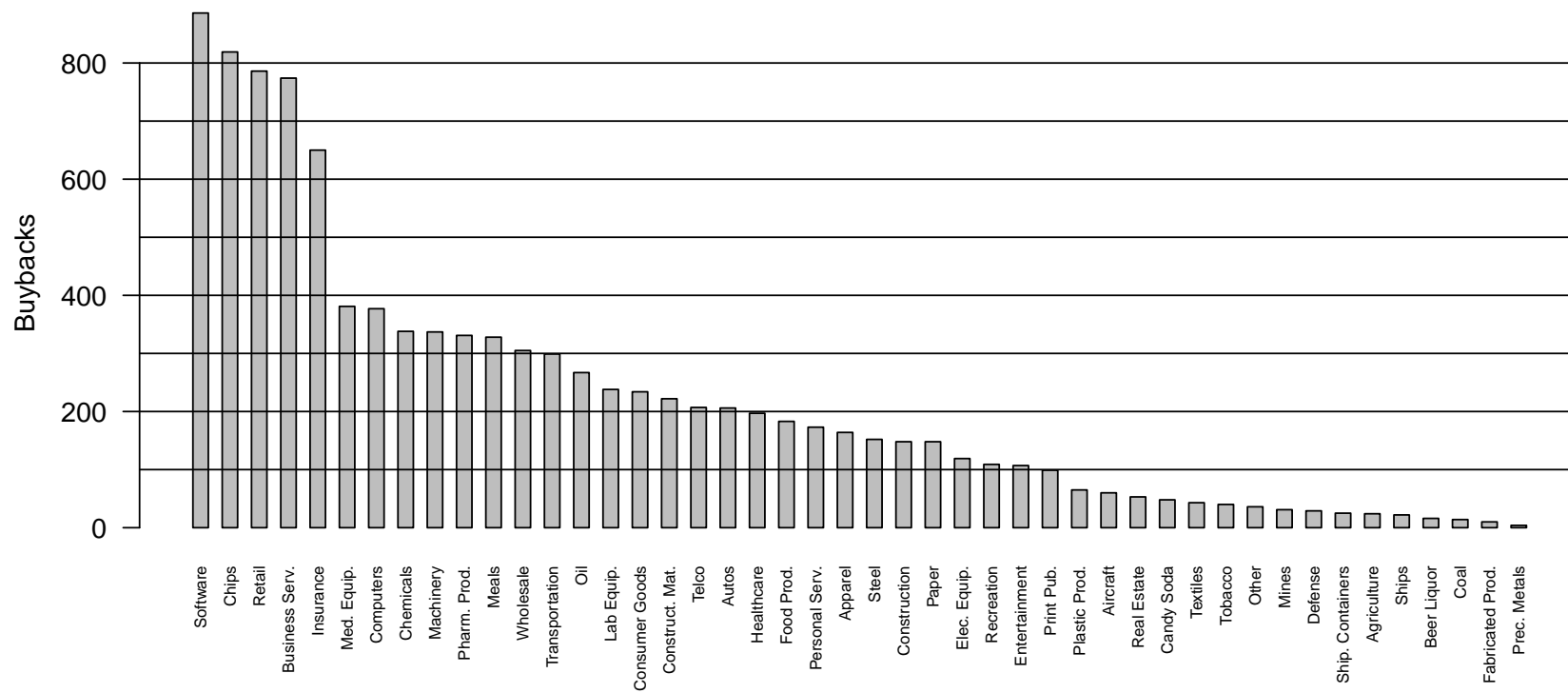


Fig. 7: Number of buyback announcements per industry.

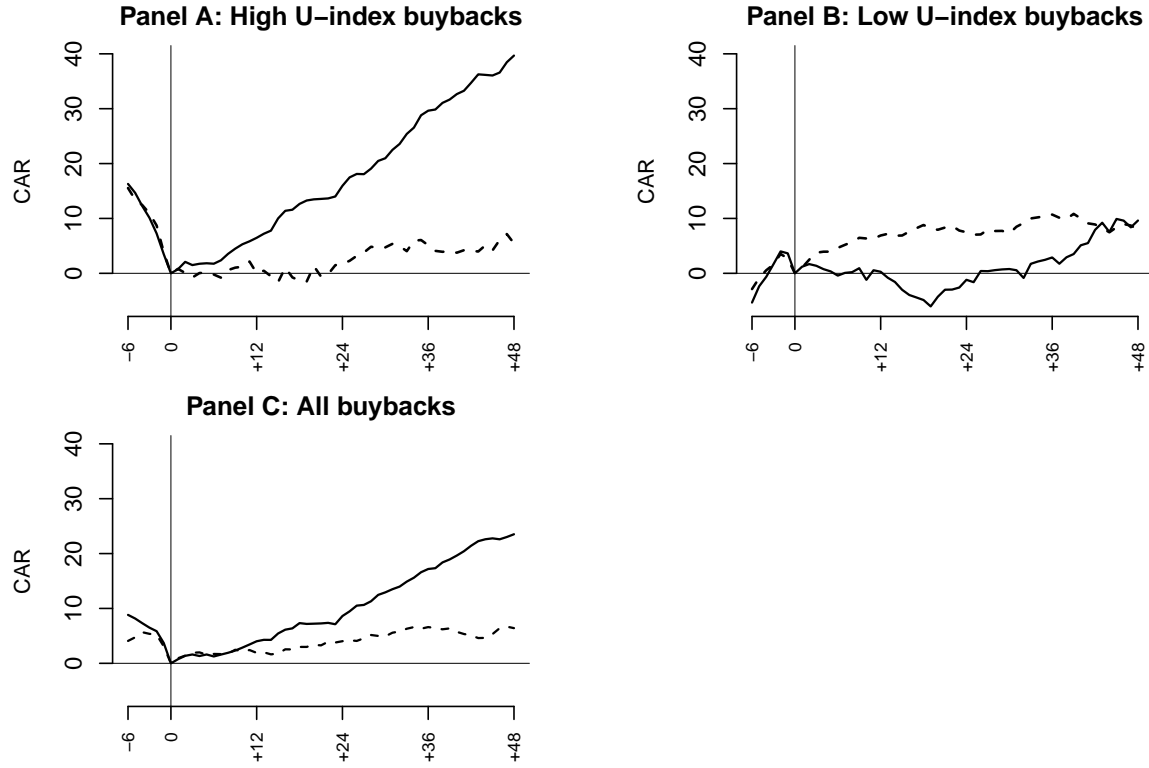


Fig. 8: Long-run five factors cumulative average abnormal returns (IRATS) of high (solid line) and low (dashed line) idiosyncratic buybacks. The x-axis indicates months from the date of the event announcement. Panel A shows only the high U-index companies, Panel B the low U-index ones, and bottom Panel C includes the whole sample.

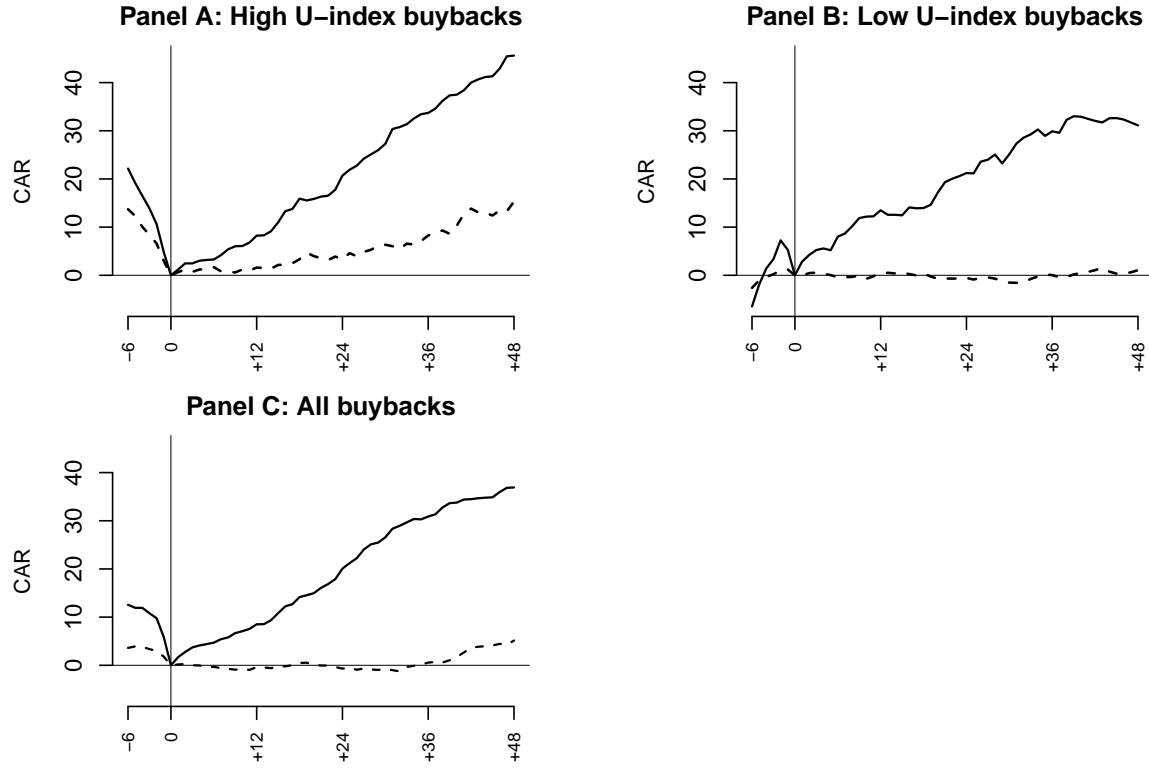


Fig. 9: Volatility and the U-index. Long-run five factors cumulative average abnormal returns (IRATS) of high (solid line) and low (dashed line) volatility buybacks. The x-axis indicates months from the date of the event announcement. Panel A shows only the high U-index companies, Panel B the low U-index ones, and bottom Panel C includes the whole sample.

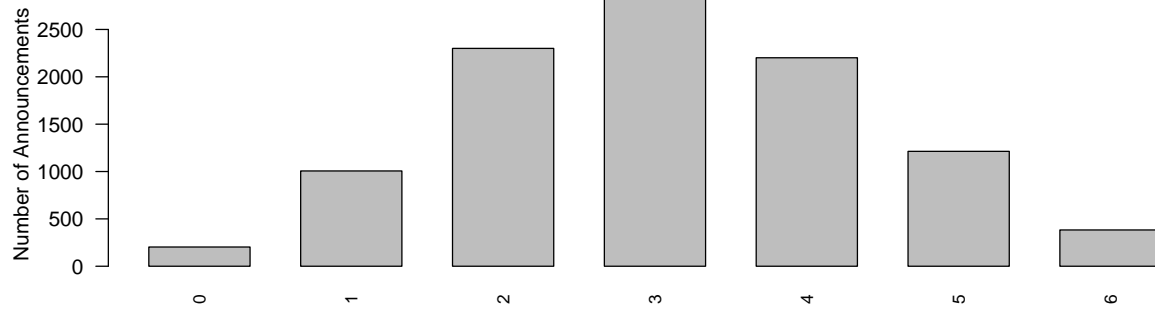


Fig. 10: EU-index. Distribution of the EU-index of all buyback events.

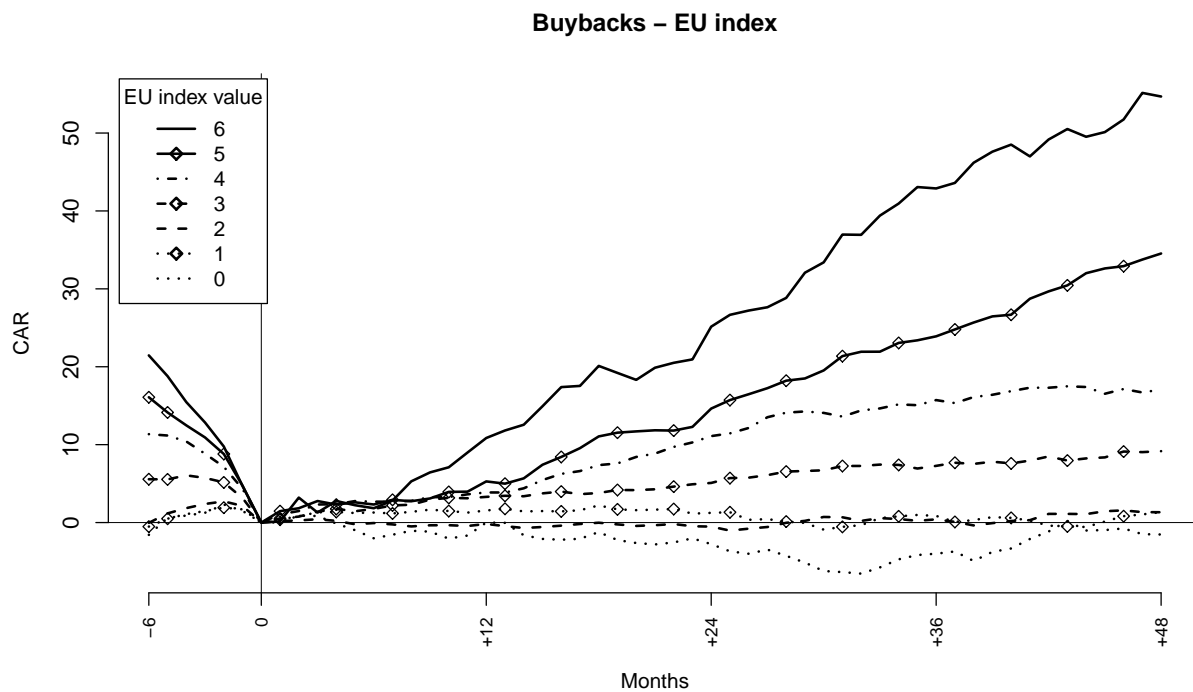


Fig. 11: Long-run IRATS five factors cumulative abnormal returns of buybacks depending on the EU-index. From the highest to the lowest lines: solid line is for EU-index 6, solid with diamonds for EU index 5, dotted-dashed for EU index 4, dashed with diamonds for EU index 3, dashed for EU index 2, dotted with diamonds for EU index 1, and finally the lowest dotted line is for EU index 0. The x-axis indicates months from the date of the event announcement.