The price impact of open market share repurchases

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This version: April 2011

Abstract

This paper examines the share price behavior surrounding initiation announcements of open market share repurchase programs, the price impact of repurchase trading, and the long-run abnormal stock performance following the announcements. The study use a detailed dataset on open market share repurchase programs by Swedish firms which have to disclose their repurchase transactions on a daily basis. The results show that initiation announcements of open market share repurchase programs exhibit a two-day abnormal return of approximately 2%. The price impact on the actual repurchase days is positively correlated with the daily repurchase volume, and is both statistically and economically significant during the first 3 repurchase days in a repurchase program. The long-run abnormal stock performance is positively associated with the fraction of shares bought in the program and is approximately 7% the first year following the initiation announcement. The results indicate that repurchase trading provides price support and that the market participants detect and perceive the repurchase announcement and the first repurchase days in a repurchase program as a signal of undervaluation. The long-run abnormal stock performance found in the study is consistent with the results found in prior studies.

JEL classification: G14; G35

Keywords: Share repurchases; Payout policy; Share price performance; Signaling; Information asymmetry

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1. Introduction

Share repurchases have become a common phenomenon worldwide in recent years. According to Vermaelen (2005) the global increase in repurchase activity seems to be a result of deregulation, tax changes, shareholder value maximization as a growing corporate objective, and the growth of employee stock ownership plans. Share repurchases have also become an important form of payout method of cash to shareholders since they are viewed by managers as more flexible than dividends. Survey results of Brav et al. (2005) report that managers use this flexibility to alter payout in response to the availability of good investment opportunities and accelerate or initiate share repurchases when their stock is perceived as undervalued.1 Studies of open market share repurchase programs in Hong-Kong (Brockman and Chung, 2001), Japan (Zhang, 2002), the US (Cook et al., 2004), and Canada (McNally et al., 2006) also find empirical support that firms exhibit market timing skills with their repurchase trades.

Even though share repurchases have been allowed in the US for decades it was not until recently that share repurchases were allowed in many European countries due to concerns about creditor protection, price manipulation, unequal treatment of shareholders, and insider trading by the firms. The regulatory framework that has been adopted to deal with these issues differs across countries which sometimes makes it difficult to interpret research results from one market to another. Sweden was the last country in the European Union (EU) to allow share repurchases when they removed restrictions on share repurchases in March 2000.2 A major difference between the regulatory framework in Sweden and many other countries, including the US, is that Swedish firms are required to disclose their repurchase transactions on a daily basis.3 This implies that the market is informed of any repurchase trading within 24 hours. Given that the market believes that firms exhibit timing abilities due to asymmetric information, one would expect that share repurchase trading is perceived by the market participants as a signal of undervaluation. When the market detects or learns about the repurchasing activity one would expect a positive and permanent price impact. Alternatively, a positive price impact can also be related to a liquidity effect where the price impact would likely be temporary.

1 Brav et al. (2005) report that 86.4% of all surveyed firms agree or strongly agree with the supposition that the market price of the stock is an important or very important factor to the firm’s repurchase decision.
2 The major concern with share repurchases in Sweden was first creditor protection, but later the major concern was the risk of price manipulation by the repurchasing firms.
3 Other countries in which regulation mandates daily disclosure of share repurchase transactions are i.e.; the UK, Hong-Kong, and Singapore. In the US share repurchase transactions must be disclosed quarterly.
There is a rich literature studying the price impact surrounding announcements of open market share repurchase programs in the US. In the US, share repurchase programs are authorized by the board of directors and hence do not need shareholder approval as in European countries. Announcements of open market share repurchase programs in the US seem to be associated with a positive abnormal return of around 3%. The most prevalent explanation for this finding is that managers activate open market share repurchase programs when the stock is perceived as undervalued. The announcement is therefore a signal of undervaluation of the firm’s stock which exhibits a positive abnormal return. Prior studies that have examined the announcement effect of open market share repurchase programs in Europe have found a much smaller price impact than that found in the US. However, these studies differ from the US studies since they examine the announcement effect surrounding announcements that the firms intend to ask for the shareholders’ approval to start a repurchase program at the next shareholders’ meeting. The smaller price impact is thus not surprising since all firms should request an authorization by the shareholders to be able to take advantage of buying undervalued shares whether or not the shares are undervalued at the time of the announcement (see Ikenberry et al., 1996). The price impact found in the European studies is therefore more a price effect of the option to be able to repurchase shares. A more similar announcement to the US authorization announcements is the announcement that the board of directors intends to activate a share repurchase program after the shareholders have authorized the board of directors to activate a share repurchase program. According to disclosure rules on the Stockholm Stock Exchange, the board of directors must announce when they have decided to initiate a share repurchase program. In contrast to the authorization announcements in the US and the intention announcements in Europe, the initiation announcements by the Swedish firms are always followed by actual repurchases. Consequently, the price impact of these initiation announcements is interesting to study and also compare with the announcement effects from US authorization announcements and “intention” announcements studied in prior European studies since the initiation announcement is a stronger signal that the firm will actually repurchase shares.

In this study I exploit a detailed dataset on open market share repurchase programs initiated over the period March 2000 through March 2010 by Swedish firms listed on the

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5 Lasfer (2000) find an announcement effect of 1.64% in the UK, 0.78% in France, and 0.63% in Italy. Rau and Vermaelen (2002) find an announcement in the UK of 1.14%.

6 The request to repurchase shares is generally always approved by the shareholders.
The purpose of the study is to examine the share price behavior surrounding initiation announcements of open market share repurchase programs, the price impact of repurchase trading, and the long-run abnormal stock performance following the announcements.

Investigating the price impact of open market share repurchases in Sweden is interesting for several reasons. First, Swedish disclosure rules enable market participants to be informed of any repurchase trading on a daily basis which could have an impact on the stock price if the investors perceive the information valuable. Second, the repurchase volume on the repurchase days is quite substantial. On average the repurchase volume represents 31% (median = 22%) of the total traded volume in the repurchasing firm’s stock on the repurchase days. This large demand-driven volume could lead to a price support on the repurchase days. Third, it is useful to investigate if there is evidence of a positive long-run abnormal stock performance subsequent to repurchase announcements in Sweden as documented in other countries (see e.g., Ikenberry et al., 1995, 2000; Mitchell and Stafford, 2000; Zhang, 2002, 2005; Chan et al., 2004; McNally and Smith, 2007; Peyer and Vermaelen, 2009; and Yook, 2010).

I find a significant negative abnormal return over the 20 trading days preceding the initiation announcement of the open market share repurchase program, and a statistically significant two-day abnormal return of 1.94% at the announcement. When I examine the announcement effect stratified by the stated reason for the repurchase program, I find a smaller two-day abnormal return (AR=0.86%) for repurchase programs motivated by an employee stock ownership plan (ESOP) compared to repurchase programs with other motives. The average abnormal return is significant and positive on the three first repurchase days in a repurchase program, with an abnormal return of approximately 0.7% on the first repurchase day. Since the market reaction is permanent the result indicates that the market perceives the actual repurchases as a signal of undervaluation. On average, repurchase days have a small, but statistically significant abnormal return of 0.12% with an equally-weighted stock return index as benchmark. The price impact on the repurchase days is positively correlated with the repurchase volume which suggests that price impact is also the result of a liquidity effect.

Using Ibbotson’s (1975) RATS methodology and the calendar-time portfolio approach with the Fama-French (1993) three-factor model and the Carhart (1997) four-factor model, I find a statistically and economically significant long-run abnormal return of 6-7% over the 12

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7 Open market share repurchases were first allowed in Sweden 10 March 2000.

8 The submission of buy limit orders by repurchasing firms may otherwise result in a temporary price impact.
months following the month of the initiation announcement. In the second year, I document no evidence of positive abnormal return, a finding which is inconsistent with Ikenberry et al. (1995, 2000), and Peyer and Vermaelen (2009). When I examine the long-run abnormal performance conditional on the fraction of shares bought in the program, I find that the long-run abnormal performance is positively associated with the fraction of shares bought in the program.

This study is organized into seven sections. Section 2 presents relevant previous research about the price impact of open market share repurchases. Section 3 describes the regulation of open market share repurchases in Europe and Sweden. Section 4 describes the data and sample. Section 5 explains the methodology while section 6 contains the empirical results. Concluding remarks are provided in section 7.

2. Previous research

There is a rich literature about the price impact of authorization announcements of open market share repurchase programs. Dann (1981), Vermaelen (1981), Comment and Jarell (1991), Stephens and Weisbach (1998), Ikenberry et al. (1995), Grullon and Michaely (2004), and Peyer and Vermaelen (2005) all find a significant abnormal price increase surrounding repurchase authorization announcements in the US of around 3%, indicating that repurchase announcements have a positive economic benefit for shareholders.9

Lasfer (2002) and Rau and Vermaelen (2002) examine the share price behavior surrounding announcements of intentions to repurchase shares by UK and other European firms. The intention announcement is an announcement that the board of directors has approved a repurchase program and will be seeking authorization of the program at the next shareholder meeting. In their studies they find small but statistically significant announcement returns of around 1%.

One of the most prevalent hypotheses to explain the positive announcement effect of open market share repurchase announcements is the signaling hypothesis. The signaling hypothesis assumes that there is asymmetric information between the managers and the investors. If the managers are able to detect undervaluation of the firm’s stock and they act in the interest of long-term investors, managers should repurchase shares when they perceive the share price below its true value. Open market share repurchase announcements should therefore be a

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9 The three-day excess return around open market share repurchase authorization announcements is around 3% in the US.
positive signal about the value of the firm. However, since the authorization announcement of an open market share repurchase program is not a firm commitment to repurchase shares, the signaling hypothesis may not be an adequate hypothesis to explain the positive announcement effect of open market share repurchase program authorizations unless managers care about their reputation and lying has a cost.

Ikenberry and Vermaelen (1996) argue that, because open market share repurchase programs are not firm commitments, repurchase authorizations effectively give managers an option to buy back shares when they view their stock as undervalued. This option is valuable even if the stock is not undervalued at the time of authorization, but only to the extent that managers are able to detect valuation errors.

There are only a few prior studies that examine the price impact of open market share repurchase executions since firms in the US are not required to disclose open market share repurchases on a daily basis. Brav et al. (2005) report that managers accelerate or initiate share repurchases when they believe the share price is below its true value. Brockman and Chung (2001), Zhang (2002), Cook et al. (2004), and McNally et al. (2006) also find evidence of timing ability by the firm’s managers. If the managers use their timing ability when they repurchase shares, then the actual repurchases are a credible signal of undervaluation and one can expect that the actual repurchases have a positive price impact. However, this signal is only of value if investors are able to identify when firms repurchase shares. Skjeltorp (2004), Zhang (2005) and McNally et al. (2006) investigate actual share repurchases in Norway, Hong-Kong and Canada respectively. They all find a positive price impact on the repurchase days and support for the hypothesis that actual share repurchases are signal of undervaluation that the market can detect.

Ikenberry et al. (1995) argue that if managers can detect undervaluation of the firm’s shares and therefore decide to buy back shares, the announcement of the repurchase program is a valuable signal to the less informed marketplace. If the capital market is semi-efficient, the new equilibrium price should immediately fully reflect the “true” value of the new information. However, studies such as Ikenberry et al. (1995, 2000), Chan et al. (2004), Zhang (2005), and Peyer and Vermaelen (2009) find long-run abnormal returns up to 48 months following repurchase announcements. Thus, the market seems to underreact to the information conveyed in repurchase announcements. Why the market reaction extends for such a long time is still puzzling. One explanation for the reported long-run excess returns is that they could be caused by chance and may be sample specific as argued by Kothari and Warner (1997), and Fama (1998).
3. Regulatory environment of open market share repurchases in Sweden and trading structure on the Stockholm Stock Exchange

3.1. Regulation of open market share repurchases in Europe and Sweden

Share repurchases in the European Union (EU) are regulated by articles 19 to 24 of the Second Company Law Directive 77/91/EEC of 13 December 1976. The aim of the directive is to ensure minimum equivalent protection for both shareholders and creditors in public limited companies. The directive states the minimum regulation in the member states and it is up to each member state to prohibit share repurchases or implement a stricter regulation. According to article 19 in the directive, a public limited company may acquire its own shares after an authorization given by the shareholders at a shareholders’ meeting. The maximum length of the authorization shall be determined by national law, but may not exceed 5 years. A company can either buy back its own shares to keep them as treasury stock or to reduce the company’s share capital. The share repurchase may not have the effect of reducing the net assets in the company’s annual accounts to a level below the sum of its share capital and non-distributable reserves.

In Sweden share repurchases were prohibited from 1895 until March 10, 2000 when changes in the Companies Act of 1975 made it possible for public limited companies to repurchase their own shares and keep them as treasury stock. The purpose of the prohibition was originally to protect the company’s creditors but later it was motivated by the risk of speculation or price support by the company. According to the Swedish Companies Act a public limited company (“publikt aktiebolag”), with its shares listed on a regulated stock exchange or another regulated market may acquire its own shares. A decision to repurchase shares must be made by the shareholders at a general shareholder meeting. However, the shareholder meeting can authorize the board of directors to make such a decision. The authorization to repurchase shares may not last longer than until the next annual general meeting and the maximum treasury stock the company is allowed to keep at any time is limited to 10% of the total number of shares in the company. Companies may buy back their

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10 Before March 10, 2000 it was possible for firms to buy back shares directly from the shareholders and thereafter cancel them in a relatively slow and cumbersome administrative procedure (redemption of shares).  
11 The Companies Act of 1975 (SFS 1975:1385) was replaced with a new Companies Act in 2005 (SFS 2005:551), however the regulation concerning share repurchase was basically kept the same.  
12 The repurchase decision is valid only if approved by shareholders holding at least two-thirds of the votes cast and the shares represented at the meeting. In general the shareholder meeting authorizes the board of directors to make decisions about share repurchases.
own stock on an authorized market or another regulated market within the European Economic Area, or through a tender offer directed to all shareholders.\textsuperscript{13}

In order to ensure the integrity of financial markets in the EU, and to enhance investor confidence in those markets, a new directive on insider trading and market manipulation was published in 2003 (Directive 2003/6/EC). Sweden implemented the directive into Swedish law on July 1, 2005.\textsuperscript{14} The prohibitions provided in the directive do not apply to trading in own shares if such trading is carried out in accordance with the Commission Regulation (EC) No 2273/2003 of December 22, 2003.\textsuperscript{15} However, it is important to note that share repurchases not carried out as in regulation 2273/2003, should not per se be deemed to constitute market abuse. In short the regulation states the following: In order to benefit from the exemption provided for in Article 8 of Directive 2003/6/EC, the sole purpose of the repurchase program must be to reduce the capital of the firm or to meet obligations arising from debt financial instruments exchangeable into equity instruments or employee share option programs. Prior to the start of trading, information about the objective of the program, the maximum number of shares to be acquired, and the duration of the program must be adequately disclosed to the public. The repurchasing company must publicly disclose details of all transactions no later than the end of the seventh daily market session following the date of the repurchase transactions. In so far as repurchase prices are concerned, the company may not purchase shares at a price higher than the higher of the price of the last independent trade and the highest current independent bid on the trading venues where the purchase is carried out. In so far as volume is concerned, the company may not purchase more than 25% of the average daily volume traded in the month preceding the month of the public disclosure of the repurchase program or when the program makes no reference to that volume, the average daily volume traded in the 20 trading days preceding the date of purchase.\textsuperscript{16}

In many countries corporate insiders such as officers, directors, and major shareholders are prohibited to trade in the firm’s stock when the informational advantage is expected to be particularly high. In Sweden firms are also defined as insiders and according to Swedish law,\textsuperscript{13} Companies may also repurchase their own stock on an authorized market or another regulated market outside the European Economic Area after approval from the Swedish Financial Supervisory Authority (FI).\textsuperscript{14} Market Abuse Penal Act (SFS 2005:377).\textsuperscript{15} A regulation is directly applicable, which means that it creates law which takes immediate effect, on the day of its publication, in all the member states without any further action on the part of the national authorities.\textsuperscript{16} In cases of extreme low liquidity on the relevant market, the firm may exceed the 25% limit if the firm informs the competent authority of the relevant market in advance, discloses the fact to the public and does not repurchase more than 50% of the average daily volume (Commission Regulation No 2273/2003, Article 5.3).
firms may not engage in trading in their own shares during the 30 days prior to the publishing of interim reports, the day of publication included.\footnote{The Act concerning Reporting Obligations for Certain Holdings of Financial Instruments (SFS 2000:1087).}

Companies repurchasing their own shares on the Stockholm Stock Exchange must comply with the stock exchange’s rules regarding share repurchases.\footnote{Rules regarding purchase and sale of a company’s own shares in the Rule book for issuers.} The rule book for issuers issued by NASDAQ OMX Stockholm states the following regarding share repurchases: the company’s resolution at a general shareholder meeting to purchase the company’s own shares and decisions by the board of directors to utilize possible authorizations to purchase the company’s own shares must be disclosed as soon as possible. The disclosure must contain information on:

- the period during which the decision to purchase the company’s own shares is to be effected or the period during which the authorization may be utilized,
- existing holdings of the company’s own shares and the maximum number of shares intended to be purchased,
- the highest and lowest repurchase price per share,
- the purpose of the repurchase program.

The company must report to the stock exchange all repurchase transactions as soon as possible and not later than 30 minutes before the stock exchange opens on the trading day immediately following the repurchase day. With the exception of block transactions, the company may not purchase more than 25% of the average daily turnover during the four calendar weeks immediately preceding the week of the repurchase.\footnote{A block transaction is defined as a single transaction of at least 5 million SEK for companies traded in the Large Cap segment and 2.5 million SEK for companies traded at the Mid and Small Cap segments.}

The company must only place orders or close transactions in the company’s own shares within the bid-ask spread applying on the stock exchange.

\section*{3.2 Trading structure on the Stockholm Stock Exchange}

Trading in shares listed on the Stockholm Stock Exchange (NASDAQ OMX Stockholm) is conducted in a computerized order-driven trading system. Traders submit orders in the trading system through exchange members. There are no designated market makers, however some smaller firms engage liquidity providers. Buy and sell orders entered into the trading system are automatically matched. Limit orders are first prioritized by price and then by time. If a trader requires immediate execution, the trader must submit a buy (sell) limit order that hits

\footnote{The Act concerning Reporting Obligations for Certain Holdings of Financial Instruments (SFS 2000:1087).}
the current best ask (bid) price. Traders can submit hidden limit orders, where only a portion of the order volume is displayed in the limit order book. However, the hidden portion has lower priority than the displayed limit orders with the same price. Exchange members can choose between trading on-exchange or outside the stock exchange (OTC). On-exchange, the Exchange member can either make trades in the computerized order-driven trading system or outside the order book as a manual trade. In both cases the trades must comply with the requirements of the Exchange. Manual trades that take place during the trading hours of the stock exchange must be reported as close to real time as possible, but no later than three minutes from the trading agreement. Manual trades that take place after trading hours must be reported prior to the opening of the stock exchange the following trading day.

The Stockholm Stock Exchange offers a high degree of transparency. Traders observe, in real-time, bid and ask prices with corresponding depth, concluded transactions, as well as the identities of exchange members behind executed transactions.

4. Data and sample
The initial sample includes all open market share repurchase programs with actual repurchases that were authorized during the period March 2000 through December 2009 by Swedish firms listed on the Stockholm Stock Exchange. In Sweden a share repurchase program must be authorized by the shareholders at a shareholder’s meeting, and information about the authorized share repurchase programs were collected from the meetings’ resolutions. Announcements by the board of directors to utilize repurchase authorizations were obtained from AffärsData and from the companies’ press release archives on their websites.20 Since some repurchase programs that were authorized in 2009 were initiated by the board of directors in 2010, the initiation announcements cover the period March 2000 through March 2010.

Information on the share repurchase transactions was collected from NASDAQ OMX Stockholm.21 The data includes the name of the repurchasing firm, the repurchase date, the total number of shares repurchased during the day distributed by class of share, and the average repurchase price. NASDAQ OMX Stockholm also provided data on daily trading volumes for on-exchange trades executed both inside and outside the computerized order-

20 According to NASDAQ OMX Stockholm’s guidelines (Rule book for issuers), decisions by the board of directors to utilize possible authorizations to purchase the company’s own shares must be publicly disclosed as soon as possible.
21 Information of repurchase transactions between March 10, 2000 and December 18, 2000 was collected from the Swedish Financial Supervisory Authority (Finansinspektionen) since NASDAQ OMX Stockholm did not keep track of the share repurchase transactions during this period.
driven trading system (automatic and manual trades respectively). The first repurchase transaction in the sample is on March 30, 2000 and the last transaction is on April 9, 2010.

The Thomson Reuters Datastream database was used to obtain price and total return data on individual shares as well as data on book values of equity. The total number of outstanding shares was provided by Euroclear Sweden and was also hand-collected from annual reports.22

Table 1 reports summary statistics for the open market share repurchase programs authorized over the period 2000 through 2009 of Swedish firms listed on the Stockholm Stock Exchange in which at least one share has been repurchased. The total number of authorized open market share repurchase programs with actual repurchases during the period was 335 in 125 different firms. It seems that the repurchase activity falls during recessions and rises during boom periods. The number of programs decreased each year from 2000 to 2005, and then increased and peaked in 2007 with 53 repurchase programs.

The fraction of the total number of shares that the shareholders authorized the company to repurchase is on average 8.8%. However, this figure is slightly flawed since approximately 83% of the repurchase authorizations are not authorizations for a maximum repurchase amount, but instead authorizations for a maximum fraction of treasury stock that the company is allowed to keep at any time.23 With these authorizations the companies may therefore in reality repurchase a larger fraction than the authorized fraction if the repurchased shares are cancelled during the repurchase program.

The shareholders generally authorize the board of directors to initiate a share repurchase program. The decision by the board of directors to utilize such a repurchase authorization must be publicly disclosed immediately and the announcement must include the maximum number of shares intended to be purchased. The sought fraction in Table 1 is the maximum fraction of the total number of shares in the company that the board of directors intends to repurchase in the repurchase program. Since 125 initiation announcements were not found in the AffärsData database or the press release archives on the companies’ websites, and one initiation announcement missed the sought fraction, the sought fraction is based on 209 initiation announcements.24 The sought fraction in the initiated share repurchase programs decreased during the sample period 2000 through 2009. In the 209 initiation announcements, the sought fraction is on average 6.1% with a median of 7.0%.

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22 Euroclear Sweden provided data on the total number of shares at the end of each year. The total number of shares within years was hand-collected from annual reports.

23 According to the Swedish Companies Act, the maximum treasury stock the company is allowed to keep at any time is limited to 10% of the total number of shares in the company (SFS 1975:1385 and SFS 2005:551).

24 In some cases the firms have failed to comply with the Exchange’s rules to publicly announce the initiation of share repurchase programs.
The bought fraction in Table 1 is the fraction of the total number of shares in the company that was actually repurchased in the repurchase program. The mean fraction of the total number of shares that were purchased in a repurchase program was 2.7%, while the median fraction repurchased was 1.8%. The maximum bought fraction in a share repurchase program was 10.9%, which was accomplished by one company (JM AB) that had a mandate from the shareholders’ meeting to keep up to 10% of the total number of shares as treasury shares. Since the firm cancelled some of the treasury shares during the program period, the firm was able to repurchase more 10% of the total number of shares in the program.

Table 2 reports the number of repurchase days in the open market share repurchase programs during the sample period. The median number of repurchase days in a repurchase program was 17, while the average was 31 repurchase days. In 44 repurchase programs there was only one repurchase day (not reported in table). The maximum number of repurchase days in a repurchase program was 158. For the 210 initiation announcements with known dates, the median number of trading days between the repurchase authorization at a shareholders’ meeting and the announcement by the board of directors to utilize such an authorization was 30, while the average number of trading days was 58. For all repurchase programs in the sample, the median number of trading days between the authorization and the first repurchase day was 38, while the average was 64 trading days. In general the first repurchase is executed only 2 trading days (median) after the initiation announcement of the repurchase program.

5. Methods for measuring the price impact of open market share repurchases

The main objective of this study is to measure the price impact of open market share repurchases. The price impact is examined short-term around the initiation announcement of the repurchase programs as well as around the actual share repurchases. Studying short-term price effects of different events is fairly straightforward, and most studies today use the event study methodology introduced in the seminal paper by Fama et al. (1969). Later studies by e.g. Brown and Warner (1980, 1985) and Patell (1976) consider implementation issues in the event-study methodology.25

In addition, the paper examines the long-run share performance after the initiation announcement of repurchase programs. Care must be taken in measuring long-run performance since bad-model errors in expected returns grow faster with the return horizon

than the volatility of returns, and according to Fama (1998) most long-term anomalies tend to become marginal or disappear when exposed to different models for expected returns or when different statistical approaches are used to measure them.

In the next sections I describe the methods used in the paper to measure short- and long term abnormal returns.

5.1 Measuring abnormal returns surrounding initiation announcements of open market share repurchase programs

In Sweden and Europe a repurchase program must be authorized by the shareholders at a shareholders’ meeting and generally the shareholders authorize the board of directors to initiate the share repurchase program. If the board of directors decides to utilize the authorization, information about the intended repurchase program must be disclosed as soon as possible. Since the authorization date is the same date as the date of the shareholders’ meeting, and information about the program is already known to the market by then, there is no new information about the repurchase program at the authorization date. The authorization event is therefore not appropriate to study in Europe since it is not an event unexpected by the market. Instead I study the initiation announcement by the board of directors which is a strong signal that the firm really intends to repurchase shares. The initiation announcement also discloses more precise information about the purpose of the program, the repurchasing period, and the number of shares sought, than the authorization of the program.

To investigate the price impact surrounding the initiation announcement of the repurchase program I apply a standard event study methodology with the market model as benchmark for calculating abnormal returns. The market model is

\[ R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t} \]  

where \( R_{i,t} \) is the total return on security \( i \) over day \( t \) and \( R_{m,t} \) is the return on the value-weighted OMXSPI over day \( t \). \( \alpha_i \) and \( \beta_i \) are the parameters of the market model, and \( \epsilon_{i,t} \) is the zero mean disturbance term. Returns are indexed in event time with the event date at \( \tau=0 \). The event date is the date of the initiation announcement by the board of directors. \( \tau=T_1+1 \) to \( \tau=T_2 \) represents the event window, and \( \tau=T_0+1 \) to \( \tau=T_1 \) represents the estimation window. The

26 The authorization is expected at the shareholders’ meeting and the notice of meeting details the resolutions.
27 All initiation announcements during the sample period have been followed by actual share repurchases.
28 In many cases the shareholders authorize the board of directors to repurchase the maximum legal limit of shares until the next annual general meeting, and for several different purposes.
length of the estimation window is 250 trading days and is defined as $L_1 = T_1 - T_0$. I examine the abnormal returns 20 trading days before and 20 trading days after the announcement event, thus the length of the event window is 41 trading days and is defined as $L_2 = T_2 - T_1$. Under general conditions ordinary least squares (OLS) is a consistent estimation procedure for the market model parameters. The OLS estimators of the market model are estimated for each event $j$ over the estimation window $L_1$.\footnote{To reduce the potential bias from non-synchronous trading I also estimate adjusted betas using the Scholes and Williams (1977) procedure, but find no change in the results.} Using the market model to measure the normal return, the abnormal return for event $j$ at event day $\tau$ in the event window is computed as

$$AR_{j,\tau} = R_{j,\tau} - \hat{\alpha}_j - \hat{\beta}_j R_{m,\tau} \quad \tau = T_1 + 1, \ldots, T_2$$

(2)

where $\hat{\alpha}_j$ and $\hat{\beta}_j$ are OLS values from the market model and estimated during the estimation period $L_1$ for each event $j$.

For each event in the sample the cumulative abnormal return is calculated from event day $\tau_1$ to $\tau_2$. The cumulative average abnormal return across all the events, $N$, in the sample is then

$$CAR(\tau_1, \tau_2) = \frac{1}{N} \sum_{j=1}^{N} \sum_{\tau=\tau_1}^{\tau_2} AR_{j,\tau}$$

(3)

The null hypothesis to be tested is that the cumulative average abnormal return during the event window is equal to zero. This makes sense since I want to examine whether the initiation announcement, on average, is associated with a change in shareholder value. I use the test statistic procedure proposed by Patell (1976) which allows the abnormal return to have a different standard deviation each day and considers any increase in variance due to prediction outside the estimation period. Under the null hypothesis, conditional on the event window market returns, the standard deviation of the abnormal return each event day $\tau$ for event $j$ is

$$\sigma(AR_{j,\tau}) = \sigma_{\varepsilon_j} \left(1 + \frac{1}{L_1} + \frac{\sum_{\tau=\tau_1}^{\tau_2} (R_{m,j,\tau} - \mu_{m,j})^2}{\sum_{\tau=\tau_1}^{\tau_2} (R_{m,j,\tau} - \mu_{m,j})^2} \right)^{1/2}$$

(4)

where $\sigma_{\varepsilon_j}$ is the standard deviation of the residual for event $j$ over the estimation period $L_1$ in the market model regression (1). $\mu_{m,j}$ is the average market return over the estimation period for event $j$. The abnormal return each event day is standardized by the estimated standard deviation of the abnormal return. By standardizing the abnormal returns I obtain identical
distributed abnormal return across events. The standardized abnormal return for each event
day \( \tau \) and event \( j \) is

\[
SAR_{j,\tau} = \frac{AR_{j,\tau}}{\sigma(AR_{j,\tau})} \tag{5}
\]

and the standardized cumulative abnormal return from \( \tau_1 \) to \( \tau_2 \) for event \( j \) is estimated as

\[
SCAR_j = \frac{\sum_{\tau=\tau_1}^{\tau_2} SAR_{j,\tau}}{\sqrt{(\tau_2 - \tau_1 + 1)}} \tag{6}
\]

The standardized cumulative abnormal return for each event \( j \) is distributed as a Student \( t \) statistic with \( L_1 - 2 \) degrees of freedom. To test if the cumulative average abnormal return (CAR) is zero I calculate the following test statistic

\[
z = \frac{\sum_{j=1}^{N} SCAR_j}{\left( \frac{\sum_{j=1}^{N} L_{1j} - 2}{\sum_{j=1}^{N} L_{1j} - 4} \right)^{1/2}} \tag{7}
\]

where the estimation window, \( L_1 \), for each event \( j \) is 250 trading days. Since the estimation window is large, the distribution of the test statistic tend to the unit normal \( N(0, 1) \).

The use of event study methodology with daily returns is subject to a number of potential problems of concern. First, the evidence suggests that distributions of daily returns for an individual security are fat-tailed relative to a normal distribution. However, Brown and Warner (1985) show that the non-normality of daily returns has no obvious impact on event study methodologies since the mean excess return in a cross-section of securities converges to normality as the number of sample securities increases.\(^{30}\) Second, non-synchronous trading may result in biased ordinary least squares (OLS) estimates of beta. I estimate beta parameters based on the methodology procedure suggested by Scholes and Williams (1977) to control for non-synchronous trading and find similar results as with ordinary least squares (OLS) estimates of market model parameters. Third, autocorrelation and cross-sectional dependence in the time-series of mean daily excess returns may be a concern, and adjustment of the variance estimate to account for these issues may be necessary. However, Brown and Warner

\(^{30}\) If the returns in the cross-section of securities are independent and identically distributed the distribution of the sample mean return will increasingly approximate a normal distribution according to the Central Limit Theorem.
(1985) find that only in special cases is it necessary to adjust the variance estimates to account for these issues.

In an event study it is important to identify the exact date of the event. Since, the initiation announcements of share repurchase must be publicly disclosed as soon as possible after the decision by the board of directors to utilize the authorization, the exact date of the event is easily identified. To accommodate for announcements after the stock exchange’s trading hours I use a two-day event window (0 to +1), when I analyze the market reaction to initiation announcements of share repurchase programs.

5.2 Measuring abnormal returns on share repurchase days

To test whether repurchase trading causes a price impact, I measure the abnormal return on the actual repurchase days. When I explicitly study the price impact surrounding the first repurchase day in a repurchase program, I estimate the abnormal returns with the market model specification described in section 5.1 as benchmark. The market model specification is however not suitable to estimate the abnormal return for all repurchase days in the sample since the estimation windows will overlap the events. I therefore use the market adjusted model as benchmark which does not require any pre-event estimations. The market adjusted model is

\[ AR_{i,t} = R_{i,t} - R_{m,t} \]  

(8)

where \( AR_{i,t} \) is the abnormal return on security \( i \) over calendar day \( t \), \( R_{i,t} \) is the total return on security \( i \) over calendar day \( t \), and \( R_{m,t} \) is the total return on an equal-weighted index of all shares listed on the Stockholm Stock Exchange over calendar day \( t \).\(^{31}\)

Abnormal returns are indexed with the sequence number of the repurchase day in each repurchase program with the first repurchase day in each repurchase program \( j \) at \( \tau = 1 \). The average abnormal return over repurchase day \( \tau \), across all repurchase programs is

\[ AR_{\tau} = \frac{\sum_{j=1}^{N} AR_{j,\tau}}{N} \]  

(9)

where \( AR_{j,\tau} \) is the abnormal return over repurchase day \( \tau \) in repurchase program \( j \), and \( N \) is the number of share repurchase programs.

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\(^{31}\) We also use the return on the value-weighted OMXSPI as \( R_m \) in the estimations and results.
The test statistic I use to evaluate the significance of the average abnormal return each repurchase day \( \tau \), is the ratio of the average abnormal return across repurchase programs, to its standard deviation

\[
t_{\tau} = \frac{AR_{\tau}}{\sigma(AR_{j,\tau})}
\]

where \( \sigma(AR_{j,\tau}) \) is the standard deviation of the abnormal returns on repurchase day \( \tau \) across repurchase programs.\(^{32}\) If the abnormal returns each repurchase day \( \tau \) are independent and identically distributed, and normal, the test statistic is distributed Student-\( t \) under the null hypothesis.\(^{33}\)

5.3 Measuring long-run abnormal performance following initiation announcements of open market share repurchase programs

To measure the long-run abnormal performance following initiation announcements of open market share repurchase programs, I use Ibbotson’s (1975) Returns Across Time and Securities (RATS) methodology and the calendar-time portfolio approach advocated by Fama (1998) and Mitchell and Stafford (2000).\(^{34}\)

In the RATS approach, security excess returns are regressed, each month in event time, on the three Fama-French (1993) factors and the additional momentum factor advocated by Carhart (1997). The estimated intercept represents the monthly average abnormal return for each event month \( \tau \) with the month of the initiation announcement indexed zero (\( \tau=0 \)). In the analysis I consider abnormal returns 6 months prior to the initiation announcement up to 24 months following the initiation announcement.\(^{35}\) The following cross-sectional regressions are run each event month:

\[
R_{i,t} - R_{f,t} = \alpha_t + \beta_t RMRF_t + s_t SMB_t + h_t HML_t + \epsilon_{i,t}
\]

(11)

\[
R_{i,t} - R_{f,t} = \alpha_t + \beta_t RMRF_t + s_t SMB_t + h_t HML_t + u_t UMD_t + \epsilon_{i,t}
\]

(12)

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\(^{32}\) To control for the potential risk of variance changes in the returns surrounding the repurchase transactions I use a \( t \)-statistic based on the cross-sectional standard deviation of the abnormal returns instead of a \( t \)-statistic based on the times-series standard deviation of the abnormal returns.

\(^{33}\) Since the repurchase days are spread out within the repurchase programs and over the years I do not make any adjustments for cross-sectional dependence in the abnormal returns. Brown and Warner (1985) also argue that if the degree of dependence is small, ignoring the dependence induces little bias in the variance estimates.

\(^{34}\) I do not use the buy-and-hold methodology because the imperfect expected returns from bad-models are compounded with long horizons and since the methodology suffers from cross-sectional dependence of the individual firms’ abnormal returns as argued by Fama (1998) and Mitchell and Stafford (2000).

\(^{35}\) Returns are truncated June 2010 and the post-event period is truncated if the firm initiates a subsequent repurchase program. Observations in the six event months prior to the initiation announcement are excluded if they overlap with event months in a firm’s prior repurchase program.
where \( R_{i,t} \) is the monthly total return on security \( i \) in the calendar month \( t \) that corresponds to the event month \( \tau \), with \( \tau = 0 \) being the month of the share repurchase initiation announcement. \( R_{t} \) is the return on the 30-day T-Bill and \( R_{m,t} \) is the return on the value-weighted OMXSPI in calendar month \( t \). \( HML_t, SMB_t \) and \( UMD_t \) are the returns on the book-to-market, size, and momentum factor, respectively in calendar month \( t \). The returns on the book-to-market and size factor are calculated as in Fama-French (1993). All firms listed on the Stockholm Stock Exchange are ranked on market capitalization at the end of December each year from 1999 to 2009. The median market capitalization is then used to split the firms into two groups, small (S) and big (B). I also rank all the firms listed on the Stockholm Stock Exchange on book-to-market equity values and split the firms into the bottom 30% (L), the middle 40% (M), and the top 30% (H). From the intersections of the two market capitalization groups and the three book-to-market equity groups, I construct six portfolios. The SMB factor is the difference, each month, between the simple average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the simple average of the returns on the three big-stock portfolios (B/L, B/M, and B/H). The HML factor is the difference, each month, between the simple average of the returns on the two high book-to-market equity portfolios (S/H and B/H) and the simple average of the returns on the two low book-to-market equity portfolios (S/L and B/L).

In the analysis I also consider momentum in returns as in Carhart (1997). UMD is the difference between the equal-weighted average return of firms with the highest 30% 11-month returns minus the equal-weighted average of firms with the lowest 30% 11-month returns.

I also calculate the cumulative abnormal return (CAR) over different time-event windows and use the CAR divided by the square root of the sum of squares of the monthly standard errors over the event-time period as a \( t \)-statistic. The advantage of the RATS methodology is that it accounts for any changes in riskiness of the equity over the event-window and the drawback of the method is that the estimators are not minimum variance because the disturbances \( \varepsilon_{i,t} \) are heteroscedastic caused by the differing risk parameters and \( \sigma^2(\varepsilon_{i,t}) \) that correspond to the different securities in the regression. To alleviate this issue I form portfolios

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36 With the exception that Fama and French (1993) rank the firms on size in June each year and I rank the firms on size in December each year.
37 According to Fama-French (1993) is the SMB factor meant to mimic the risk factor in returns related to firm size.
38 According to Fama-French (1993) is the HML factor meant to mimic the risk factor in returns related to book-to-market equity.
using the calendar-time portfolio approach advocated by Fama (1998), and Mitchell and Stafford (2000).  

In the calendar-time portfolio approach portfolios of event firms are formed each calendar month. Firms that have initiated an open market share repurchase program are included in the portfolio the calendar month after the announcement month, and excluded from the portfolio after a 12 or 24 month holding period. At the beginning of each calendar month, the portfolio is rebalanced so that the portfolio is equally weighted. Excess returns are regressed on the three Fama-French (1993) factors as well as on the four Carhart (1997) factors as follows:

\[
R_{p,t} - R_{f,t} = \alpha_p + \beta_p R_{MRF} + \beta_p R_{MRF} + s_p S_{MB} + h_p H_{ML} + \epsilon_{p,t} \quad (13)
\]

\[
R_{p,t} - R_{f,t} = \alpha_p + \beta_p R_{MRF} + s_p S_{MB} + h_p H_{ML} + u_p U_{MD} + \epsilon_{p,t} \quad (14)
\]

where \(R_{p,t}\) is the monthly return on the equally weighted portfolio of event firms in calendar month \(t\). The other variables are defined the same as above. By forming portfolios of event firms, any cross-sectional dependence of the individual event firm abnormal returns are accounted for in the portfolio variance at each point in calendar time. I also require at least 10 firms in the event portfolio each point in time to mitigate the heteroskedasticity problem from changing number of firms in the event portfolio through time.

6. Empirical results

The empirical results are separated into three parts. In the first part in section 6.1 I evaluate the price impact surrounding initiation announcements of share repurchase programs. In the second part, in section 6.2 I examine the price impact of the actual share repurchases using detailed data of repurchase transactions on the Stockholm Stock Exchange. In the third and last part, in section 6.3, I examine the long-run share price performance of firms that have initiated open market share repurchase programs.

6.1 Price impact of initiation announcements of open market share repurchase programs

Figure 1 illustrates the cumulative average abnormal return (CAR) around the initiation announcement of open market share repurchase programs. The cumulative abnormal return starts 20 trading days before the initiation announcement and continues until 20 trading days after the announcement. The daily abnormal return for each firm is the total daily return in excess of the return estimated by the market model. The parameters of the market model are

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39The calendar-time portfolio approach was originally used by Jaffe (1974) and Mandelker (1974).
calculated over days -270 to -21 relative to the announcement day. The sample comprises 126
initiation announcements with no other price affecting information on the same day or the
trading day prior to the announcement day over the period March 2000 through March 2010.\textsuperscript{40}

Figure 1 shows that announcements of open market share repurchase programs on average
are preceded by a period of negative abnormal performance and that there is a significant
positive price impact of the repurchase announcement with a possible overreaction. In the
post event period the excess return appears to disappear. This result is similar to the findings
reported by several prior studies examining repurchase announcements in other markets and
time periods, e.g.
Vermaelen (1981), Comment and Jarrell (1991), Ikenberry et al. (1995), and
Hatakeda and Isagawa (2004).

In Table 3 the cumulative average abnormal returns (CAR) with \( t \)-statistics are reported for
the different event windows around the share repurchase initiation announcement. For the full
sample there is a significantly negative cumulative average abnormal return during the 20
trading days prior to the initiation announcement of -1.83\% \( (t\)-statistic of -2.27) which
suggests that the initiation announcement is triggered by a period of share price
underperformance. The average two-day abnormal return around the initiation announcement
is 1.94\% (from day 0 to +1) and is statistically significant at the 1\% level \( (t\)-statistic of 7.61).
This is consistent with the three-day abnormal return of 2.39\% reported by
Peyer and Vermaelen (2009) for the US market over the period 1991 to 2001, and the two-day abnormal
return of 2.15\% reported by Hatakeda and Isagawa (2004) for the Japanese market over the
period 1995 to 1998. In the period following the repurchase announcement (from day +2 to
+20) the cumulative average abnormal return is not significantly different from zero \( (t\-
statistic of -0.67) for the whole sample.

In Table 3 I also split the sample by the fraction of outstanding shares that the firm
intends to repurchase in the initiation announcement of the open market share repurchase
program.\textsuperscript{41} The average two-day abnormal return for firms that intend to repurchase less than
5\% of the outstanding shares is 1.50\%, and for firms that intend to repurchase 5\% or more of
the outstanding shares, the average two-day market reaction is 2.28\%. This result is consistent
with the findings by Comment and Jarrell (1991) and Ikenberry et al. (1995), who also find
that larger repurchase programs are received more favorably by the market. In the post-

\textsuperscript{40} I exclude 80 announcements because they were on the same day or the day after an interim report. I also
exclude two announcements with other coincident confounding news and two announcements due to a short
return history for estimating market model parameters.

\textsuperscript{41} Most firms state the maximum number of shares the firm intends to repurchase in the initiation announcement
of the share repurchase program.
announcement period (from day +2 to +20) the cumulative average abnormal return is -3.24% and significantly negative for the smaller repurchase programs and not significantly different from zero for the larger programs.

Table 4 reports the cumulative average abnormal return (CAR) around the initiation announcement of open market share repurchase programs stratified by the reason for the repurchase programs stated in the announcement. I classify the reasons into the following five categories:

1. *Capital structure*: The firm intends to repurchase shares to adjust the capital structure or distribute excess cash.
2. *ESOP*: The repurchase is made in conjunction with an employee stock ownership plan.
3. *Acquisitions*: The firm may use the repurchased shares in acquisitions.
4. *Key ratios*: The repurchase is made to improve the firm’s key ratios or offset dilution.
5. *Undervalued*: The share is a good investment.

Multiple reasons are often cited in the repurchase announcements and I therefore report the frequency with which one particular reason is stated together with any of the other four reasons. For example, in 83 announcements “Capital structure” was stated as a reason for the repurchase program, however only 48 announcements state “Capital structure” as the sole reason for the repurchase program.

Interestingly, share repurchase programs motivated by an employee stock ownership plan (ESOP) experience a smaller market reaction around the initiation announcement of the repurchase program than programs with other stated reasons. The excess return around the initiation announcement of a share repurchase program motivated by an employee stock ownership plan is 0.86% and is consistent with the option-funding hypothesis in Kahle (2002) which predicts that the announcement return of repurchase programs initiated to fund employee stock option exercises should not be as positive as if the repurchase were due to undervaluation or as a method to mitigate agency costs. Share repurchase programs motivated by ESOPs also experience a significantly negative post-announcement return with a cumulative average abnormal return of -3.27%.

To further analyze the price impact around the initiation announcement of open market share repurchase programs I regress the two-day abnormal return over days 0 to 1 relative to the announcement on various firm- and repurchase program characteristics that previous
studies have found to be significantly related to the initial market reaction to repurchase program announcements. I run the following cross sectional regression with the two-day abnormal return as the dependent variable:

\[
\text{CAR}_i = \alpha + \beta_1 \text{MCAP}_i + \beta_2 \text{BM}_i + \beta_3 \text{SOUTHGT}_i + \beta_4 \text{PRECAR}_i + \beta_5 \text{ESOP}_i + \epsilon_i
\]  

(15)

where \(\text{CAR}_i\) is the two-day cumulative abnormal return over days 0 to 1 relative to repurchase announcement \(i\). \(\text{MCAP}_i\) is the natural log market capitalization and \(\text{BM}_i\) is the book-to-market equity value, of the firm with the repurchase announcement \(i\), at the end of the prior year. \(\text{SOUTHGT}_i\) is the stated maximum fraction of the firm’s total number of shares that the firm intends to repurchase or keep as treasury shares in repurchase announcement \(i\). \(\text{PRECAR}_i\) is the cumulative abnormal return from trading day -20 to trading day -1 relative to announcement \(i\). \(\text{ESOP}_i\) is a dummy variable coded one if at least one motivation for the repurchase program in the announcement \(i\) is that the repurchased shares are for an Employee Stock Ownership Plan (ESOP), and zero otherwise. Table 5 shows the results from the regression where the standard errors of the coefficients have been adjusted for heteroscedasticity.

The coefficient for firm size (MCAP) is significantly negative which implies that the initial market reaction to the announcement of a share repurchase programs decreases with firm size. If firm size is a proxy for informational asymmetry the result is consistent with the signaling hypothesis in which the repurchase announcement serves as a signal from the more informed managers that the firm is undervalued. If the informational asymmetry is higher for smaller firms, then the market reaction to repurchase announcements made by smaller firms should be more favorable than for larger firms.\(^{42}\)

The book-to-market equity value (BM) is commonly used as a proxy for undervaluation. Firms with relatively high book-to-market equity values are then considered undervalued and therefore more likely to have undervaluation as their primary motivation for share repurchases. I therefore expect to find a positive relationship between the initial market reaction to share repurchase announcements and the book-to-market equity value. However, in the regression, the coefficient for the book-to-market equity variable (BM) is not significantly different from zero. This result is consistent with the findings in Ikenberry et al.

\(^{42}\) Smaller firms are less followed by analysts and media and therefore subject to higher information asymmetries than larger firms.
(1995) that find no indication that the book-to-market ratio has any impact on the market reaction to repurchase announcements.

The stated fraction of the firm’s total number of shares that the firm intends to repurchase in the initiation announcement (SOWUGHT) does not explain the initial market reaction to the announcement of a share repurchase program. This is not surprising since 48% of the initiation announcements in the sample are for the maximum allowed repurchase size of 10% and therefore there is little variation in the SOWUGHT variable to account for any variation in the abnormal return.

In the analysis of the cumulative average abnormal return around the initiation announcement of share repurchase programs (Table 3) I found that the cumulative average abnormal return was significantly negative in the pre-announcement period (trading day -20 to -1 relative to the announcement). To control for any mean-reversion effect arising from the negative abnormal return in the pre-announcement period I include a variable for the cumulative abnormal return over days -20 to -1 relative to the announcement (PRECAR). The coefficient for the PRECAR variable is significantly negative which implies that there is a negative relationship between the market reaction to the repurchase announcement and the pre-announcement cumulative abnormal return.43

Kahle (2002) argues that if companies repurchase shares to fund employee stock option exercises, then in an efficient market, the repurchase announcement return should not be as positive as if the repurchases were due to undervaluation (the option-funding hypothesis). In the regression I therefore include a dummy variable coded one if any of the stated reasons in the initiation announcement of the share repurchase program is for an Employee Stock Ownership Plan (ESOP). The coefficient for the ESOP variable in the regression is significantly negative and therefore consistent with Kahle’s (2002) option-funding hypothesis.

6.2 Price impact of actual share repurchases

In this section I analyze the short-term price effect of actual share repurchases in open market share repurchase programs. If repurchasing firms have market timing ability and repurchase shares when the shares are temporarily undervalued, then other traders will find it valuable to identify repurchase trades. I should therefore observe a permanent positive price impact on

43 Comment and Jarrell (1991), Ikenberry et al. (1995), and Hataka and Isagawa (2004) also find a negative relationship between the abnormal return in the pre-announcement period and the announcement effect.
repurchase days when other market participants detect that a company repurchases shares.\footnote{Firms that repurchase shares on the Stockholm Stock Exchange must publicly disclose their repurchase transactions as soon as possible and not later than 30 minutes before the opening of the stock exchange the following trading day. Repurchase volumes each repurchase day are also often quite substantial. Market participants are therefore able to identify repurchase trades with ease.} Alternatively, the submission of buy limit orders by repurchasing firms may result in a temporary price impact.

The initial sample of actual share repurchases covers 9,624 repurchase events over the period March 2000 through April 2009 in 312 share repurchase programs initiated by 121 Swedish firms listed on the Stockholm Stock Exchange. I begin by examining the price performance around the first repurchase day in share repurchase programs and apply a similar event study methodology to the one described in section 5.1. Figure 2 illustrates the cumulative average abnormal return from 10 trading days before to 10 trading days after the first repurchase in 245 open market share repurchase programs.\footnote{From the initial sample I exclude repurchase programs in which the first repurchase transaction in the program is on the same day or the day after an interim report. I also exclude five repurchase programs with too short a history to estimate the parameters in the market model.}

The pre-event excess return seems stable which indicates that firms on average do not time the beginning of their repurchase trades to a period of prior underperformance. On the first repurchase day and the following three days there is a strong positive price impact. After a reversal in the abnormal returns later in the post-event period, the prices seem to stabilize on a higher level than in the pre-event period. These results are consistent with a signaling hypothesis of undervaluation, but also with a hypothesis of a liquidity driven price impact since there is a small degree of reversal in the post-event period.

In Table 6 I report the cumulative average abnormal return and their \( t \)-statistics for the different event windows. The sample is also stratified by the stated reason for the share repurchase program in the repurchase initiation announcement. For the full sample the pre-event abnormal return from day \(-10\) to day \(-1\) relative to the first repurchase day is not significantly different from zero. The average abnormal return over days 0 to +1 is 0.74\% and significantly positive with a \( t \)-statistic of 3.98. Over the post-event period the average abnormal return is not significantly different from zero. Since I find a permanent and significantly positive price impact our findings are consistent with the undervaluation signaling hypothesis in which the first repurchase transaction in an open market share repurchase program signals that the shares are undervalued. The price impact is however not as large as the positive price impact from initiation announcements of open market share repurchase programs that I found in section 6.1.
When I split the sample by the stated motivation of the share repurchase program I find that the price impact on the first repurchase day is positive for all programs whatever the stated motivation for the program in the initiation announcement. However, the abnormal return is only significantly positive for repurchase programs that are motivated by capital structure adjustments or excess cash distributions. For these programs the two-day abnormal return over day 0 to +1 is on average 0.89% with a t-statistic of 4.07.

If the first repurchase trade in a repurchase program is a valuable signal of undervaluation I would expect subsequent repurchase days in repurchase programs to have less signaling value. In Table 7 I report the average abnormal return for each of the first ten repurchase days in each repurchase program. I also report the average abnormal return for all repurchase days in the sample. I use the market adjusted model to estimate the abnormal return and use the equal- or value-weighted market return as benchmark.46

The average abnormal return for all repurchase days in the sample is 0.12% with the equal-weighed market return index as benchmark. Worthwhile noting is that repurchasing firms almost repurchase one third (31.8%) of the total traded volume each repurchase day. The persistent submission of buy limit orders from the repurchasing firms would likely support the share price temporarily.

Table 7 also shows that the first repurchase day in a repurchase program has the greatest price impact which indicates as predicted that the first repurchase in a repurchase program has the most valuable signal. The average repurchase fraction is however relatively higher (42.0%) on the first repurchase day than on the other reported repurchase days, thus the larger price impact on the first repurchase day may be due to a liquidity effect.

To analyze the abnormal returns on the actual repurchase days more in detail I run the following firm fixed effects regression

\[ AR_{i,j} = \alpha_i + \beta_1 \text{REPFRAC}_{i,j} + \beta_2 \text{FIRST}_{i,j} + \beta_3 \text{TENDAYS}_{i,j} + \epsilon_{i,j} \]  

where \( AR_{i,j} \) is the abnormal return for firm \( i \) on repurchase day \( j \). The abnormal return is calculated using the market adjusted model with the equal-weighted return of all shares on the Stockholm Stock Exchange and the value-weighted OMXSPI, as benchmarks respectively. \( \text{REPFRAC}_{i,j} \) is the fraction of the total number of traded shares that firm \( i \) repurchase on day \( j \). \( \text{FIRST}_{i,j} \) is a dummy variable coded one if the repurchase day \( j \) is the first repurchase day in

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46 I have five more “first repurchase day” observations in Table 7 than I have in Table 6 since five observations are dropped in Table 6 due to a too short return history for calculating market model normal returns. The market adjusted model used in Table 6 to calculate normal returns do not require any historical returns.
the repurchase program initiated by firm \( i \), zero otherwise. \( TENDAYS_i \) is a dummy variable coded one if there are 10 or more trading days between the repurchase day \( j \) and the prior repurchase day in the repurchase program initiated by firm \( i \).

In Table 8 I report the results from the firm fixed effects regression. The coefficient for the repurchase size variable \( REPFRAC \) is positive and statistically significant at the 5% level which indicates a positive correlation between the repurchase fraction and the abnormal return. As I noted earlier in the univariate analysis I found that the first repurchase in a repurchase program on average is greeted with the largest abnormal return. I therefore include a dummy variable \( FIRST \) coded one if the repurchase event is the first in a repurchase program. The coefficient for the \( FIRST \) variable is positive and highly significant even after I control for the repurchase fraction. Finally I also test if the price impact is higher for the first repurchase event after a period of at least 10 non-repurchasing days in a repurchase program by including the dummy variable \( TENDAYS \). However, even if the coefficient is positive it is not statistically different from zero at any conventional levels.

6.3 Long-run share price performance of repurchasing firms

Figure 3 illustrates the monthly cumulative average abnormal return 6 months prior to and up to 24 months following the initiation announcements of open market share repurchase programs. The figure shows that firms that announce the initiation of an open market share repurchase program tend to perform abnormally well on average during the announcement month and the first year following the announcement.\(^{47}\) During the second year following the initiation announcement the abnormal performance seems to subside.

In Table 9 I report the abnormal returns for each month during the first year following the initiation announcement and the cumulative average abnormal return (CAR) for six time periods.\(^{48}\) The abnormal returns each event month are calculated using Ibbotson’s (1975) returns across time and securities (RATS) methodology. I report the abnormal returns applying both the Fama-French (1993) three-factor model and the Carhart (1997) four-factor model in the RATS model for a sample of 231 initiation announcements of open market share repurchase programs over the period March 2000 through March 2010.

\(^{47}\) The monthly abnormal returns in the figure are calculated using Ibbotson’s (1975) RATS methodology and applying the Carhart (1997) four-factor model.

\(^{48}\) Since historical returns are truncated June 2010 and the post-event period is truncated if the firm initiates a subsequent repurchase program, the number of observations decreases each event month following the initiation announcement.
Share price performance in the half-year prior to the initiation announcement is slightly positive, with a cumulative abnormal return of 1.78% relative to the Carhart (1997) model specification. This indicates that firms on average do not time the initiation announcement of open market share repurchases to a prior long-term period of share price underperformance found in e.g. Ikenberry et al (2000) and Yook (2010). In the month of the initiation announcement (event month 0) the average abnormal return is approximately 2.1% and statistically significant at the 1% level. The average abnormal return in the month of the initiation announcement of a repurchase program is thus similar to the two-day abnormal return of 1.94% around the initiation announcement found in section 6.1. In the first year following the initiation announcement (event months +1, +12) the cumulative average abnormal return is approximately 7% and statistically significant at the 1% level. This result is similar to the 12 month cumulative abnormal return of 7.27% found by Ikenberry et al. (2000) in a sample of 1,060 Canadian repurchase programs between 1989 and 1997, but higher than the first year cumulative abnormal return of 2.67% found by Peyer and Vermaelen (2009) in the US market over the period 1991-2001.49 Interestingly, when I partition the first year into a first and second half, I find that the major part of the abnormal performance is concentrated during months 7 to 12 following the initiation announcement. In the same time period the fraction of firms that actually repurchase shares declines. This pattern is consistent with the market timing hypothesis which suggests that managers repurchase shares in response to undervaluation. The results are also similar to Ikenberry et al. (2000) who find that abnormal performance decreases in periods where firms were active buyers. However, in contrast to Ikenberry et al. (1995, 2000), and Peyer and Vermaelen (2009) I find no further abnormal return following the first year after the initiation announcement.50

To eliminate any possible dependence between observations within calendar months, Ibbotson (1975) selected at random one event per calendar month. As a robustness check I also follow this procedure and randomly select only one observation per calendar month. The results are omitted for the sake of brevity, but are qualitatively similar to the cumulative average abnormal returns (CAR) reported in Table 9.

As an alternative to Ibbotson’s (1975) RATS methodology, to estimate long-run abnormal performance, I also apply a calendar-time portfolio approach advocated by Fama (1998), and

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49 Ikenberry et al. (2000) and Peyer and Vermaelen (2009) found these results using Ibbotson’s (1975) RATS methodology and applying the Fama-French (1993) three-factor model.
50 Since I do not permit event months following repurchase programs to overlap with event months in subsequent repurchase programs the number of observations in the event months following the initiation announcement decreases. Due to the relatively small sample I therefore only examine the abnormal performance up to 24 months following the initiation announcement.
Mitchell and Stafford (2000). The results of the calendar-time portfolio approach are reported in Table 10 for a sample of 231 initiation announcements of open market share repurchase programs over the period May 2000 through June 2010. In the calendar-time portfolio approach a portfolio is formed each calendar month consisting of firms that had an initiation announcement of a share repurchase program in a certain period relative to the given calendar month. Monthly average abnormal returns of the event portfolio are measured both relative to the three-factor Fama-French (1993) model, and the four-factor Carhart (1997) model. Table 10 reports results of the regression of equally-weighted repurchase portfolio returns for three holding periods; event months 1-12, event months 1-24, and event months 13-24, relative to the initiation announcement month (month 0).

The monthly average abnormal return for the one year holding period following the initiation announcement is 0.53\% (\textit{t}-statistic of 2.19) with the Fama-French (1993) model specification, and 0.52\% (\textit{t}-statistic of 2.27) with the four-factor Carhart (1997) model specification. These results translate to an annual abnormal return of approximately 6\% that match the first year cumulative average abnormal return of 7\% obtained using Ibbotson’s (1975) RATS methodology in Table 9. For holding periods up to two years following the initiation announcement the monthly average abnormal return decreases to 0.41\% (\textit{t}-statistic of 1.98) with the Carhart (1997) model specification. The abnormal return performance thus seems to decline during the second year following initiation announcements of open market share repurchase programs. When I focus on portfolios of firms that are included 13 months following the initiation announcement and dropped 12 months later I find no abnormal return in these portfolios. This result also matches the insignificant cumulative average abnormal return during the second year obtained using Ibbotson’s (1975) RATS methodology. Thus it seems as the positive abnormal performance following initiation announcements of open market share repurchase programs persist, regardless of methodology employed, the first year following the repurchase announcement.

Table 11 reports the long-run abnormal performance surrounding initiation announcements of share repurchase programs conditional on fraction of total number of shares bought in the programs. I separate the repurchase programs into two groups. Repurchase programs in which less than 2\% of the total number of shares have been bought, and programs in which more than 2\% of the total number of shares have been bought. The abnormal returns are estimated with the calendar-time portfolio approach for the 6 months prior to the initiation

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51 Our first calendar-month is May 2000 since at least 10 firms are required in the portfolio to reduce the idiosyncratic risk of the portfolio.
announcement and the 12 months following the announcement.\textsuperscript{52} In the 6-month time period prior to the initiation announcement there is no significant abnormal return for programs with a repurchased fraction of more than 2% of the total number of shares. However, programs with a repurchased fraction of less than 2% of the total number of shares are preceded with an average monthly abnormal return of 1.01% (\textit{t}-statistic of 1.91). One explanation for these results could be that firms are willing to repurchase large amounts of shares only if the stock has not overperformed in the months preceding the initiation announcement, and that the reason for many of the smaller repurchase programs is to provide shares for incentive plans which is more likely if the stock has had a good performance over the months preceding the repurchase program.\textsuperscript{53}

Focusing on abnormal returns over the 12 months following the initiation announcement, there is also a difference between the two groups. For repurchase programs with a repurchased fraction less than 2% of the total number of shares, the abnormal return performance is not significantly different from zero, whereas for repurchase programs with a repurchased fraction of more than 2% of the total number of shares, the average monthly return is 0.75% and statistically significant at the 5% level (\textit{t}-statistic of 2.42). This average monthly abnormal return corresponds to an abnormal return of 9% on an annual basis.

Overall the results from the long-run performance analysis indicate that long-run abnormal return is positively associated with the fraction of shares bought in the program.

7. Conclusions

Share repurchases are a relatively new phenomenon in Europe and little is still known about the effects open market share repurchases have on the firms’ stock price in a European regulatory setting that differs to a large extent from the regulatory environment in e.g. the US.

The purpose of this paper is to examine the stock price behavior surrounding the initiation announcements of the repurchase programs, the price impact of the repurchase trading, and the long-run abnormal stock performance following the initiation announcements. The study use a detailed dataset on initiated open market share repurchase programs from March 2000 to March 2010 by Swedish firms listed on the Stockholm Stock Exchange.

Open market share repurchases in Sweden are interesting to study since the repurchase transactions are disclosed on a daily basis. Market participants are therefore able to instantly

\textsuperscript{52} As a robustness check I also estimate the abnormal returns with Ibbotson’s (1975) RATS methodology with qualitatively the same results.

\textsuperscript{53} I also separately analyze the long-run abnormal performance for the programs motivated by stock option programs and find a significant abnormal return in the 6 months period preceding the initiation announcement.
trade on any perceived asymmetric information they find valuable from the repurchase transactions. The repurchasing firms’ repurchase volumes on the repurchase days are also quite substantial relative to the total trading volume in the stock that may lead to a price support of the firms’ shares.

The results show that initiation announcements of open market share repurchase programs by the board of directors, are associated with a two-day abnormal return of 1.94%, similar to the announcement effect found in prior US studies (e.g. Comment and Jarell, 1991; Stephens and Weisbach, 1998; Ikenberry et al., 1995; Grullon and Michaely, 2004; and Peyer and Vermaelen, 2005). The positive abnormal return indicates that initiation announcements of open market share repurchase are perceived by the market participants as signal of undervaluation. Interestingly, the announcement effect is lower for repurchase programs motivated by stock option plans, which is consistent with the hypothesis that programs motivated by stock option plans are not driven by perceived undervaluation of the firms’ shares.

The price impact on the actual repurchase days is positively correlated with the daily repurchase volume and is both statistically and economically significant during the first 3 repurchase days in a repurchase program. These results indicate that repurchase trading provides price support and that the market detects and perceives the first repurchase days in a repurchase program as a signal of undervaluation.

Finally, using Ibbotson’s (1975) RATS methodology and the calendar-time portfolio approach I find a positive 12 month abnormal stock performance of 6-7% subsequent to the initiation announcement that is positively associated with the fraction of shares bought in the program.
References

Table 1
Statistics of activated open market share repurchase programs authorized 2000 to 2009

<table>
<thead>
<tr>
<th>Year</th>
<th>No of authorized rep. programs</th>
<th>Authorized fraction Mean</th>
<th>Median</th>
<th>Sought fraction Mean</th>
<th>Median</th>
<th>Bought fraction Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>43</td>
<td>9.2</td>
<td>10.0</td>
<td>8.2</td>
<td>10.0</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>2001</td>
<td>34</td>
<td>9.1</td>
<td>10.0</td>
<td>7.3</td>
<td>10.0</td>
<td>2.9</td>
<td>2.2</td>
</tr>
<tr>
<td>2002</td>
<td>40</td>
<td>9.6</td>
<td>10.0</td>
<td>7.1</td>
<td>10.0</td>
<td>2.7</td>
<td>1.7</td>
</tr>
<tr>
<td>2003</td>
<td>29</td>
<td>9.2</td>
<td>10.0</td>
<td>6.7</td>
<td>6.3</td>
<td>2.1</td>
<td>1.5</td>
</tr>
<tr>
<td>2004</td>
<td>25</td>
<td>8.8</td>
<td>10.0</td>
<td>6.2</td>
<td>5.0</td>
<td>2.1</td>
<td>1.0</td>
</tr>
<tr>
<td>2005</td>
<td>15</td>
<td>9.1</td>
<td>10.0</td>
<td>5.9</td>
<td>6.8</td>
<td>1.9</td>
<td>0.9</td>
</tr>
<tr>
<td>2006</td>
<td>26</td>
<td>9.1</td>
<td>10.0</td>
<td>4.7</td>
<td>4.3</td>
<td>3.6</td>
<td>2.9</td>
</tr>
<tr>
<td>2007</td>
<td>53</td>
<td>8.3</td>
<td>10.0</td>
<td>5.2</td>
<td>4.5</td>
<td>2.2</td>
<td>1.7</td>
</tr>
<tr>
<td>2008</td>
<td>48</td>
<td>8.3</td>
<td>10.0</td>
<td>5.5</td>
<td>4.8</td>
<td>2.0</td>
<td>1.2</td>
</tr>
<tr>
<td>2009</td>
<td>22</td>
<td>7.7</td>
<td>10.0</td>
<td>5.0</td>
<td>3.7</td>
<td>1.7</td>
<td>0.9</td>
</tr>
<tr>
<td>All years</td>
<td>335</td>
<td>8.8</td>
<td>10.0</td>
<td>6.1</td>
<td>7.0</td>
<td>2.7</td>
<td>1.8</td>
</tr>
</tbody>
</table>

The table shows summary statistics of open market share repurchase programs by Swedish firms listed on the Stockholm Stock Exchange, in which at least one share has been repurchased. The year of the repurchase program is the year the program was authorized by the shareholders at a shareholders’ meeting. The authorized fraction is the fraction of the total number of shares in the company that the shareholders authorized the company to repurchase or keep as treasury shares. The sought fraction is the maximum fraction of the total number of shares in the company that the board of directors intended to repurchase or keep as treasury shares in the initiation announcement of the share repurchase program. The initiation announcement is the announcement by the board of directors to utilize the repurchase authorization. Bought fraction is the fraction of the total number of shares in the company that was actually repurchased in the repurchase program. Due to missing data the sought fraction is based on a total of 209 initiation announcements. Fraction numbers in the table are in percent.

Table 2
Summary statistics of the number of repurchase days in activated open market share repurchase programs and trading days between events within repurchase programs authorized 2000 to 2009

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Mean</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of repurchase days in repurchase program</td>
<td>31</td>
<td>17</td>
<td>1</td>
<td>158</td>
</tr>
<tr>
<td>Trading days between authorization and initiation announcement</td>
<td>58</td>
<td>30</td>
<td>0</td>
<td>240</td>
</tr>
<tr>
<td>Trading days between authorization and first repurchase</td>
<td>64</td>
<td>38</td>
<td>0</td>
<td>241</td>
</tr>
<tr>
<td>Trading days between initiation announcement and first repurchase</td>
<td>13</td>
<td>2</td>
<td>-3</td>
<td>200</td>
</tr>
</tbody>
</table>

The table reports the number of repurchase days in open market share repurchase programs authorized over the period 2000 to 2009 by Swedish firms listed on the Stockholm Stock Exchange. The table also shows statistics of the number of trading days between the repurchase authorization and the initiation announcement, the trading days between the repurchase authorization and the first repurchase day, and the trading days between the initiation announcement and the first repurchase day in the repurchase program. The initiation announcement is the announcement by the board of directors to utilize the repurchase authorization. Due to missing data the sought fraction is based on a total of 210 initiation announcements.
Figure 1
Illustration of the cumulative average abnormal return (CAR) around the initiation announcement of open market share repurchase programs

The figure illustrates the average cumulative abnormal return (CAR) in percent surrounding the initiation announcement of open market share repurchase programs by Swedish firms listed on the Stockholm Stock Exchange. The sample includes 126 initiation announcements with no other price affecting information on the same day or the trading day prior to the announcement over the period March 2000 through March 2010. The CAR is the accumulated average abnormal return starting 20 trading days prior to the initiation announcement of the repurchase program and ending 20 trading days after the announcement. The abnormal returns are measured with the market model as benchmark. The parameters of the market model are calculated over days -270 to -21 relative to the initiation announcement.

Table 3
Abnormal returns surrounding the initiation announcement of open market share repurchase programs

<table>
<thead>
<tr>
<th></th>
<th>Trading days relative to announcement day</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-20 to -1</td>
<td>0 to +1</td>
<td>+2 to +20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAR</td>
<td>t-statistic</td>
<td>CAR</td>
<td>t-statistic</td>
<td>CAR</td>
</tr>
<tr>
<td>Full sample</td>
<td></td>
<td>-1.83**</td>
<td>-2.27</td>
<td>1.94***</td>
<td>7.61</td>
<td>-0.53</td>
</tr>
<tr>
<td>Fraction sought</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5%</td>
<td></td>
<td>-1.47</td>
<td>-1.23</td>
<td>1.50***</td>
<td>3.96</td>
<td>-3.24***</td>
</tr>
<tr>
<td>5 to 10%</td>
<td></td>
<td>-2.10*</td>
<td>-1.92</td>
<td>2.28***</td>
<td>6.69</td>
<td>1.50</td>
</tr>
</tbody>
</table>

The table reports cumulative abnormal returns (CAR) in percent surrounding the initiation announcement of open market share repurchase programs by Swedish firms listed on the Stockholm Stock Exchange. The sample includes 126 initiation announcements with no other price affecting information on the same day or the trading day prior to the announcement over the period March 2000 through March 2010. The abnormal returns are measured with the market model as benchmark. The parameters of the market model are calculated over days -270 to -21 relative to the initiation announcement. *, ** and *** indicate two-tailed significance levels of 10%, 5%, and 1%, respectively.
Table 4
Frequency distribution and announcement returns of open market share repurchase programs stratified by the stated reason for the repurchase program

<table>
<thead>
<tr>
<th>Reason stated in the share repurchase initiation announcement</th>
<th>Capital structure</th>
<th>ESOP</th>
<th>Acquisitions</th>
<th>Key ratios</th>
<th>Undervalued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of reasons per announcement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>48</td>
<td>25</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>5</td>
<td>15</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
<td>42</td>
<td>33</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>CAR (-20, -1)</td>
<td>-2.57***</td>
<td>-2.24</td>
<td>-2.15</td>
<td>0.94</td>
<td>-1.89</td>
</tr>
<tr>
<td></td>
<td>(-2.49)</td>
<td>(-1.68)</td>
<td>(-1.34)</td>
<td>(0.44)</td>
<td>(-0.57)</td>
</tr>
<tr>
<td>CAR (0, +1)</td>
<td>2.60***</td>
<td>0.86**</td>
<td>2.50***</td>
<td>1.97***</td>
<td>3.09**</td>
</tr>
<tr>
<td></td>
<td>(7.96)</td>
<td>(2.04)</td>
<td>(4.92)</td>
<td>(2.90)</td>
<td>(2.95)</td>
</tr>
<tr>
<td>CAR (+2, +20)</td>
<td>0.18</td>
<td>-3.27**</td>
<td>-1.52</td>
<td>3.13</td>
<td>2.23</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td>(-2.52)</td>
<td>(-0.97)</td>
<td>(1.49)</td>
<td>(0.69)</td>
</tr>
</tbody>
</table>

The table reports the frequency distribution and announcement returns of open market share repurchase programs stratified by the stated reason for the repurchase program stated in the initiation announcement. One announcement can refer to several reasons. The sample includes 126 initiation announcements with no other price affecting information on the same day or the trading day prior to the announcement over the period March 2000 through March 2010. The reasons for the repurchase programs are classified into the following categories:

**Capital structure:** The announcement states that the firm intends to repurchase shares to adjust the capital structure or distribute excess cash.

**ESOP:** The repurchase is made in conjunction with an employee stock ownership plan or in conjunction with outstanding convertibles.

**Acquisitions:** The announcement states that the firm may use the repurchased shares in acquisitions.

**Key ratios:** The announcement states that the repurchase is made to improve the firm’s key ratios or off-set dilution.

**Undervalued:** The announcement states that the share is a good investment.

The abnormal returns are measured with the market model as benchmark. The parameters of the market model are calculated over days -270 to -21 relative to the initiation announcement. CARs are reported for various event windows surrounding the initiation announcement (t-statistics in parentheses). ** and *** denote two-tailed significance levels of 5% and 1%, respectively.
Table 5
Regression results of the initial market reaction to open market share repurchase program announcements

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>CAR (0, +1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.1335***</td>
</tr>
<tr>
<td>MCAP</td>
<td>-0.0050***</td>
</tr>
<tr>
<td>BM</td>
<td>-0.0011</td>
</tr>
<tr>
<td>SOUGHT</td>
<td>0.0154</td>
</tr>
<tr>
<td>PRECAR</td>
<td>-0.0718**</td>
</tr>
<tr>
<td>ESOP</td>
<td>-0.0119</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.10</td>
</tr>
<tr>
<td>Number of obs</td>
<td>126</td>
</tr>
</tbody>
</table>

The table reports regression results from the following regression:

$$CAR_i = \alpha + \beta_1 MCAP_i + \beta_2 BM_i + \beta_3 SOUGHT_i + \beta_4 PRECAR_i + \beta_5 ESOP_i + \epsilon_i$$

where $CAR_i$ is the two-day cumulative abnormal return over days 0 to 1 relative to announcement $i$. $MCAP_i$ is the natural log market capitalization and $BM_i$ is the book-to-market equity value, of the firm with the initiation announcement $i$, at the end of the prior year. $SOUGHT_i$ is the stated maximum fraction of the firm’s total number of shares that the firm intends to repurchase or keep as treasury shares in initiation announcement $i$. $PRECAR_i$ is the cumulative abnormal return from trading day -20 to trading day -1 relative to the initiation announcement $i$. $ESOP_i$ is a dummy variable coded one if at least one motivation for the repurchase program in the initiation announcement $i$ is that the repurchased shares are for an Employee Stock Ownership Plan (ESOP), and zero otherwise. The standard errors of the coefficients have been adjusted for heteroscedasticity using White’s (1980) procedure. *, ** and *** indicate two-tailed significance levels of 10%, 5%, and 1%, respectively.

Figure 2
Cumulative average abnormal return (CAR) surrounding the first repurchase day in open market share repurchase programs

![Graph showing cumulative average abnormal return (CAR) surrounding the first repurchase day in open market share repurchase programs](image-url)
The figure shows the average cumulative abnormal return (CAR) surrounding the first repurchase day in 245 open market share repurchase programs initiated over the period March 2000 through March 2009 by Swedish firms listed on the Stockholm Stock Exchange. The CAR is the accumulated average abnormal return starting 10 trading days prior to first repurchase day and ending 10 trading days after the first repurchase day. The abnormal returns are measured with the market model as benchmark. The parameters of the market model are calculated over days -270 to -21 relative to the first repurchase day. Observations the same day or the day after an interim report are excluded from the sample.

Table 6
Abnormal return surrounding the first repurchase day in open market share repurchase programs

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Trading days relative to first repurchase day in repurchase program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Full sample</td>
<td>245</td>
</tr>
<tr>
<td>Capital structure</td>
<td>177</td>
</tr>
<tr>
<td>ESOP</td>
<td>74</td>
</tr>
<tr>
<td>Acquisitions</td>
<td>69</td>
</tr>
<tr>
<td>Key ratios</td>
<td>31</td>
</tr>
<tr>
<td>Undervalued</td>
<td>14</td>
</tr>
</tbody>
</table>

The table reports cumulative abnormal returns (CAR) in percent surrounding the first repurchase day in 245 open market share repurchase programs initiated over the period March 2000 through March 2009. Abnormal returns are reported for the full sample and stratified by motivation of the share repurchase program by the firm. The definitions of the motivations are found in table 4. The abnormal returns are measured with the market model as benchmark. The parameters of the market model are calculated over days -270 to -21 relative to the first repurchase day. Observations the same day or the day after an interim report are excluded from the sample. *, ** and *** indicate two-tailed significance levels of 10%, 5%, and 1%, respectively.

Table 7
Abnormal return on repurchase days

<table>
<thead>
<tr>
<th>Repurchase day</th>
<th>n</th>
<th>AR</th>
<th>t-statistic</th>
<th>AR</th>
<th>t-statistic</th>
<th>Rep. fraction</th>
<th>tot. trad. vol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250</td>
<td>0.70***</td>
<td>4.20</td>
<td>0.64***</td>
<td>3.79</td>
<td>42.0%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>259</td>
<td>0.38***</td>
<td>2.74</td>
<td>0.40***</td>
<td>2.85</td>
<td>36.0%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>238</td>
<td>0.40***</td>
<td>3.15</td>
<td>0.45***</td>
<td>3.31</td>
<td>34.7%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>230</td>
<td>-0.04</td>
<td>-0.26</td>
<td>0.01</td>
<td>0.06</td>
<td>33.0%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>225</td>
<td>0.07</td>
<td>0.53</td>
<td>0.11</td>
<td>0.68</td>
<td>33.1%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>214</td>
<td>0.33***</td>
<td>2.08</td>
<td>0.26</td>
<td>1.60</td>
<td>31.9%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>206</td>
<td>-0.21</td>
<td>-1.41</td>
<td>-0.21</td>
<td>-1.30</td>
<td>31.8%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>199</td>
<td>0.21</td>
<td>1.42</td>
<td>0.22</td>
<td>1.47</td>
<td>30.3%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>200</td>
<td>0.29***</td>
<td>1.97</td>
<td>0.39***</td>
<td>2.30</td>
<td>32.9%</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>189</td>
<td>-0.01</td>
<td>-0.08</td>
<td>-0.03</td>
<td>-0.18</td>
<td>30.8%</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>9375</td>
<td>0.12***</td>
<td>5.72</td>
<td>0.15***</td>
<td>6.43</td>
<td>31.8%</td>
<td></td>
</tr>
</tbody>
</table>

The table shows the average abnormal returns (AR) in percent on repurchase days over the period March 2000 through April 2009 in 311 repurchase programs initiated by 120 firms. The abnormal return in the EW Benchmark column is the total stock return minus the equal-weighted return of all shares listed on the Stockholm Stock Exchange. During repurchase days. The abnormal return in the VW Benchmark column is the total stock return minus the return on the value-weighted OMXSPI representing all shares listed on the Stockholm Stock Exchange. The table also reports the average repurchase fraction of the total daily trading volume in the share. Repurchase events the same day or the day after an interim report are excluded from the sample as well as repurchase events September 11-12, 2001. ** and *** denote two-tailed significance levels of 5% and 1%, respectively.
### Table 8
**Firm fixed effects regression on abnormal return (AR) on repurchase days**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>AR (EW benchmark)</th>
<th>AR (VW benchmark)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-statistic</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.0001</td>
<td>0.31</td>
</tr>
<tr>
<td>REPFRAC</td>
<td>0.0026***</td>
<td>1.92</td>
</tr>
<tr>
<td>FIRST</td>
<td>0.0071***</td>
<td>3.99</td>
</tr>
<tr>
<td>TENDAYS</td>
<td>0.0028</td>
<td>1.56</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of firms</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Number of obs</td>
<td>9375</td>
<td></td>
</tr>
</tbody>
</table>

The table reports regression results from the following firm fixed effects regression:

$$AR_{i,j} = \alpha_i + \beta_1 REPFRAC_{i,j} + \beta_2 FIRST_{i,j} + \beta_3 TENDAYS_{i,j} + \epsilon_{i,j}$$

where $AR_{i,j}$ is the abnormal return for firm $i$ on repurchase day $j$. The abnormal return is calculated using the market adjusted model with the equal-weighted return of all shares on the Stockholm Stock Exchange (EW benchmark) and the value-weighted OMXSPI (VW benchmark), as benchmarks respectively. $REPFRAC_{i,j}$ is the fraction of the total number of traded shares that firm $i$ repurchase on day $j$. $FIRST_{i,j}$ is a dummy variable coded one if the repurchase day $j$ is the first repurchase day in the repurchase program initiated by firm $i$, zero otherwise. $TENDAYS_{i}$ is a dummy variable coded one if there are 10 or more trading days between the repurchase day $j$ and the prior repurchase day in the repurchase program initiated by firm $i$. The sample includes repurchase days over the period March 2000 through April 2009 in 311 repurchase programs initiated by 120 firms. Repurchase events the same day or the day after an interim report are excluded from the sample as well as repurchase events September 11-12, 2001. Estimation is done with firm fixed effects and standard errors adjusted for group-wise heteroscedasticity. *, ** and *** indicate two-tailed significance levels of 10%, 5%, and 1%, respectively.

### Figure 3
**Monthly cumulative average abnormal return (CAR) surrounding open market share repurchase initiation announcements**

![Graph](image.png)
The figure plots the monthly cumulative average abnormal return (CAR) 6 months prior to and up to 24 months following initiation announcements of open market share repurchase programs over the period March 2000 through March 2010. Abnormal returns are calculated each event month using Ibbotson’s (1975) returns across time and securities (RATS) methodology and applying the Carhart (1997) four-factor model.

### Table 9
Long-run performance following initiation announcements of open market share repurchase programs estimated with Ibbotson’s (1975) RATS methodology

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$AR$</td>
<td>$t$-statistic</td>
</tr>
<tr>
<td>0</td>
<td>231</td>
<td>70.6%</td>
<td>2.15***</td>
<td>3.65</td>
</tr>
<tr>
<td>+1</td>
<td>229</td>
<td>66.8%</td>
<td>-0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>+2</td>
<td>224</td>
<td>46.4%</td>
<td>0.72</td>
<td>0.52</td>
</tr>
<tr>
<td>+3</td>
<td>222</td>
<td>37.8%</td>
<td>0.52</td>
<td>0.91</td>
</tr>
<tr>
<td>+4</td>
<td>218</td>
<td>33.9%</td>
<td>0.47</td>
<td>0.84</td>
</tr>
<tr>
<td>+5</td>
<td>207</td>
<td>30.4%</td>
<td>-0.52</td>
<td>-0.80</td>
</tr>
<tr>
<td>+6</td>
<td>204</td>
<td>28.4%</td>
<td>0.87</td>
<td>1.29</td>
</tr>
<tr>
<td>+7</td>
<td>200</td>
<td>23.0%</td>
<td>1.12**</td>
<td>1.65</td>
</tr>
<tr>
<td>+8</td>
<td>187</td>
<td>13.9%</td>
<td>1.44**</td>
<td>1.93</td>
</tr>
<tr>
<td>+9</td>
<td>180</td>
<td>14.4%</td>
<td>0.89</td>
<td>1.26</td>
</tr>
<tr>
<td>+10</td>
<td>174</td>
<td>13.2%</td>
<td>1.60**</td>
<td>2.61</td>
</tr>
<tr>
<td>+11</td>
<td>162</td>
<td>8.6%</td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>+12</td>
<td>121</td>
<td>0.8%</td>
<td>0.67</td>
<td>0.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event months</th>
<th>CAR</th>
<th>$t$-statistic</th>
<th>CAR</th>
<th>$t$-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-6, -1)</td>
<td>2.35</td>
<td>1.77</td>
<td>1.78</td>
<td>1.33</td>
</tr>
<tr>
<td>(+1, +6)</td>
<td>1.51</td>
<td>1.03</td>
<td>1.39</td>
<td>0.93</td>
</tr>
<tr>
<td>(+7, +12)</td>
<td>5.78***</td>
<td>3.36</td>
<td>6.04***</td>
<td>3.50</td>
</tr>
<tr>
<td>(+1, +12)</td>
<td>7.29***</td>
<td>3.23</td>
<td>7.43***</td>
<td>3.26</td>
</tr>
<tr>
<td>(+1, +24)</td>
<td>8.12**</td>
<td>1.86</td>
<td>9.21**</td>
<td>2.03</td>
</tr>
<tr>
<td>(+13, +24)</td>
<td>0.83</td>
<td>0.22</td>
<td>1.78</td>
<td>0.45</td>
</tr>
</tbody>
</table>

The table reports monthly abnormal returns (AR) and cumulative abnormal returns (CAR) in percent following initiation announcements of open market share repurchase programs over the period March 2000 through March 2010. Abnormal returns are calculated each event month using Ibbotson’s (1975) returns across time and securities (RATS) methodology and applying the Fama-French (1993) three-factor model (i), and the Carhart (1997) four-factor model (ii).

(i) $R_{jt} - R_{ft} = \alpha_t + \beta_{1}RMRF_{t} + \beta_{2}SMB_{t} + \beta_{3}HML_{t} + \epsilon_{ij}$

(ii) $R_{jt} - R_{ft} = \alpha_t + \beta_{1}RMRF_{t} + \beta_{2}SMB_{t} + \beta_{3}HML_{t} + \beta_{4}UMD_{t} + \epsilon_{ij}$

where $R_{jt}$ is the monthly total return on security $i$ in the calendar month $t$ that corresponds to the event month $\tau$, with $\tau=0$ being the month of the share repurchase initiation announcement. $R_{ft}$ is the return on the 30-day T-Bill and $R_{m,t}$ is the return on the value-weighted OMXSPI in calendar month $t$. $SMB_{t}$, $HML_{t}$ and $UMD_{t}$ are the returns on the size, book-to-market, and momentum factor, respectively in calendar month $t$. The returns on the size and book-to-market factors are calculated in Fama-French (1993) using all shares listed on the Stockholm Stock Exchange, but with size ranking at the end of December each year. The return on the momentum factor is calculated as in Carhart (1997) using all shares listed on the Stockholm Stock Exchange. Using the Ibbotson’s (1975) RATS method, $\alpha_t$ is the abnormal return (AR) in event month $t$. CAR is the abnormal returns cumulated over different event-time periods. The $t$-statistic of the CAR is the CAR divided with the square root of the sum of squares of the monthly standard errors during the event-time period. The table also report the number ($n$) of sample firms each event month and the fraction of sample firms that repurchase shares each event month. *, ** and *** indicate two-tailed significance levels of 10%, 5%, and 1%, respectively.
Table 10
Long-run performance following initiation announcements of share repurchase programs estimated with the calendar-time portfolio approach

<table>
<thead>
<tr>
<th></th>
<th>Holding period</th>
<th></th>
<th>Holding period</th>
<th></th>
<th>Holding period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>months 1-12</td>
<td></td>
<td>months 1-24</td>
<td></td>
<td>months 13-24</td>
</tr>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-statistic</td>
<td>Coefficient</td>
<td>t-statistic</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Intercept ($\alpha_p$)</td>
<td>0.53**</td>
<td>2.09</td>
<td>0.44**</td>
<td>1.95</td>
<td>0.07</td>
</tr>
<tr>
<td>RMRF</td>
<td>0.88***</td>
<td>13.54</td>
<td>0.90***</td>
<td>16.95</td>
<td>1.00***</td>
</tr>
<tr>
<td>SMB</td>
<td>0.29***</td>
<td>3.84</td>
<td>0.37***</td>
<td>6.13</td>
<td>0.57***</td>
</tr>
<tr>
<td>HML</td>
<td>0.41***</td>
<td>4.83</td>
<td>0.42***</td>
<td>6.10</td>
<td>0.42***</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.78</td>
<td></td>
<td>0.82</td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>Number of obs</td>
<td>108</td>
<td></td>
<td>121</td>
<td></td>
<td>92</td>
</tr>
</tbody>
</table>

Panel A: Fama-French (1993)

<table>
<thead>
<tr>
<th></th>
<th>Holding period</th>
<th></th>
<th>Holding period</th>
<th></th>
<th>Holding period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>months 1-12</td>
<td></td>
<td>months 1-24</td>
<td></td>
<td>months 13-24</td>
</tr>
<tr>
<td>Intercept ($\alpha_p$)</td>
<td>0.52**</td>
<td>2.27</td>
<td>0.41**</td>
<td>1.98</td>
<td>0.06</td>
</tr>
<tr>
<td>RMRF</td>
<td>0.97***</td>
<td>12.55</td>
<td>0.97***</td>
<td>15.45</td>
<td>1.01***</td>
</tr>
<tr>
<td>SMB</td>
<td>0.35***</td>
<td>4.31</td>
<td>0.42***</td>
<td>6.26</td>
<td>0.57***</td>
</tr>
<tr>
<td>HML</td>
<td>0.38***</td>
<td>4.22</td>
<td>0.39***</td>
<td>5.39</td>
<td>0.42***</td>
</tr>
<tr>
<td>UMD</td>
<td>0.11***</td>
<td>2.69</td>
<td>0.09**</td>
<td>2.39</td>
<td>0.15</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.79</td>
<td></td>
<td>0.83</td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>Number of obs</td>
<td>108</td>
<td></td>
<td>121</td>
<td></td>
<td>92</td>
</tr>
</tbody>
</table>

Panel B: Carhart (1997)

The table reports monthly average abnormal returns in percent of equal-weighted calendar-time portfolios over the period May 2000 through June 2010. Using the calendar-time portfolio approach, excess returns of the event portfolio are measured relative to the three-factor Fama-French (1993) model (i), and the four-factor Carhart (1997) model (ii),

(i) $R_{p,t} - R_{f,t} = \alpha_p + \beta_p R_{MF,t} + s_p SMB_t + h_p HML_t + e_{p,t}$

(ii) $R_{p,t} - R_{f,t} = \alpha_p + \beta_p R_{MF,t} + s_p SMB_t + h_p HML_t + u_p UMD_t + \epsilon_{p,t}$

where $R_{p,t}$ is the monthly total return on the equal-weighted portfolio of event firms in the calendar month $t$. $R_{f,t}$ is the return on the 30-day T-Bill and $R_{MF,t}$ is the return on the value-weighted OMXSPI in calendar month $t$. SMB, HML, and UMD, are the returns on the size, book-to-market, and momentum factor, respectively in month $t$. The returns on the size and book-to-market factors are calculated as in Fama-French (1993) using all shares listed on the Stockholm Stock Exchange, but with size ranking at the end of December each year. The return on the momentum factor is calculated as in Carhart (1997) using all shares listed on the Stockholm Stock Exchange. The intercept, $\alpha_p$, measures the average monthly abnormal return on portfolios of event firms in percent. Equal-weighted portfolios of firms that have initiated an open market share repurchase program within the previous 12 or 24 months are formed each calendar month. We also form equal-weighted portfolios of firms in which firms are included 13 months following the initiation announcement and dropped 12 months later (holding period 13-24). Panel A shows the results with the three-factor Fama-French (1993) model as benchmark, and Panel B shows the results with the four-factor Carhart (1997) model as benchmark. Only calendar months with a minimum of 10 firms in the portfolio are included in the regression (5 firms over months 13-24). The standard errors of the coefficients have been adjusted for heteroscedasticity using White’s (1980) procedure. ** and *** indicate two-tailed significance levels of 5% and 1%, respectively.
Table 11  
Long-run performance surrounding announcements of share repurchase programs conditional on fraction of total number of shares bought in program

<table>
<thead>
<tr>
<th>Holding period months -6 to -1</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Bought up to 2% of total number of shares</td>
<td>Intercept ($\alpha_p$)</td>
<td>1.01*</td>
<td>1.91</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>RMRF</td>
<td>1.14***</td>
<td>14.75</td>
<td>0.92***</td>
</tr>
<tr>
<td></td>
<td>SMB</td>
<td>0.32*</td>
<td>1.92</td>
<td>0.26***</td>
</tr>
<tr>
<td></td>
<td>HML</td>
<td>0.25**</td>
<td>2.60</td>
<td>0.37***</td>
</tr>
<tr>
<td></td>
<td>UMD</td>
<td>0.17***</td>
<td>2.94</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>$R^2$</td>
<td>0.74</td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Number of obs</td>
<td>60</td>
<td></td>
<td>102</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Holding period months 1 to 12</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel B: Bought more than 2% of total number of shares</td>
<td>Intercept ($\alpha_p$)</td>
<td>0.13</td>
<td>0.34</td>
<td>0.75**</td>
</tr>
<tr>
<td></td>
<td>RMRF</td>
<td>0.96***</td>
<td>11.03</td>
<td>1.08***</td>
</tr>
<tr>
<td></td>
<td>SMB</td>
<td>0.40***</td>
<td>3.50</td>
<td>0.53***</td>
</tr>
<tr>
<td></td>
<td>HML</td>
<td>0.50***</td>
<td>6.36</td>
<td>0.40***</td>
</tr>
<tr>
<td></td>
<td>UMD</td>
<td>0.04</td>
<td>0.34</td>
<td>0.16**</td>
</tr>
<tr>
<td></td>
<td>$R^2$</td>
<td>0.70</td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Number of obs</td>
<td>46</td>
<td></td>
<td>90</td>
</tr>
</tbody>
</table>

The table reports monthly average abnormal returns in percent of equal-weighted calendar-time portfolios over the period May 2000 through June 2010. Portfolios are formed in calendar time and conditional on the fraction of outstanding shares bought in the program. Using the calendar-time portfolio approach, excess returns of the event portfolio are measured relative to the four-factor Carhart (1997) model,

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_p \text{RMRF}_{t} + \gamma_p \text{SMB}_{t} + \delta_p \text{HML}_{t} + \lambda_p \text{UMD}_{t} + \epsilon_{p,t}$$

where $R_{p,t}$ is the monthly total return on the equal-weighted portfolio of event firms in the calendar month $t$. $R_{f,t}$ is the return on the 30-day T-Bill and $R_{p,t}$ is the return on the value-weighted OMXSPI in calendar month $t$. SMB, HML, and UMD are the returns on the size, book-to-market, and momentum factor, respectively in month $t$. The returns on the size and book-to-market factors are calculated as in Fama-French (1993) using all shares listed on the Stockholm Stock Exchange, but with size ranking at the end of December each year. The return on the momentum factor is calculated as in Carhart (1997) using all shares listed on the Stockholm Stock Exchange. The intercept, $\alpha_p$, measures the average monthly abnormal return on portfolios of event firms in percent. Only calendar months with a minimum of 5 firms in the portfolio are included in the regression. The standard errors of the coefficients have been adjusted for heteroscedasticity using White’s (1980) procedure. ** and *** indicate two-tailed significance levels of 5% and 1%, respectively.