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POST-EARNINGS ANNOUNCEMENT DRIFTS ON THE BALTIC STOCK EXCHANGES

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Abstract

The thesis examines the phenomena of post-earnings announcement drifts (PEAD) on the NASDAQ OMX Baltic stock exchanges during 10 years from 2000 to 2009 by using regression analysis and a portfolio-based trading strategy approach. The portfolio strategy is based on forming quintile portfolios using two metrics: initial abnormal return (IAR) and initial abnormal volume (IAV). Trading is financed through borrowed funds, accounts for transaction costs and can be fully replicated in real life. The best performing individual IAR-based portfolio and the combined trading strategy could earn up to 254% and 112% significant annual cumulative abnormal returns, respectively; however, after accounting for transaction and borrowing costs, possibilities to profit on PEAD nearly disappear. Even though both regression analysis and the portfolio strategy provide evidence supporting existence of PEAD on the Baltic stock markets, the results are not robust enough to formally reject the Efficient Market Hypothesis as one cannot profit from the PEAD.

Keywords: Announcement effects, Baltic stock exchanges, IAR, IAV, initial abnormal return, initial abnormal volume, PEAD, Scholes-Williams beta, trading rule

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1 Introduction

When studying stock markets and creating models which try to explain movements in stock prices, many researchers assume efficient markets. However, in the real world, stock markets' efficiency is hardly observed, which has encouraged researchers to uncover strategies to exploit inefficiencies. One type of inefficiency of markets occurs when the new information is incorporated into the stock prices too slowly. As, clearly, the most important regular announcements of a company are the monthly, quarterly and annual earnings reports, analyzing those is potentially highly rewarding, on both intellectual and material grounds.

The first study exploring the issue of earnings announcement effects was the study by Ball and Brown (1968) who discovered that share prices on average drift upwards after earnings have been announced if a company had shown unexpectedly good results (vice versa for the case of unexpectedly low earnings). Afterwards this apparent market inefficiency was confirmed by many other studies numerically, e.g. Foster, Olsen and Shevlin (1984) found 25% and Bernard and Thomas (1989) found 18% of annual abnormal return, for exploiting certain announcement effect strategies. Some academics, e.g. Fama, were trying to explain the issue as a result of applying inadequate methodology or incorrect risk adjustments, but their work did not yield successful results. Not being able to find any explanation from the theory of efficient markets, the phenomenon was called an anomaly and later many studies have tried to investigate the issue with tools of behavioural finance, for example Hong and Stein (1997) attributed the anomaly to irrationality of investors. Moreover, many researchers such as Johnson and Schwartz Jr. (2000) investigate the effect of market frictions on post-earnings announcement drifts, and find that these are strongest where transaction costs are high.

Apparently, Baltic stock exchanges can hardly be described as efficient (see for example Avdejev & Kveksas, 2007 or Dikanskis & Kiselovs, 2006); thus, one would expect slow information inclusion into prices, which means that the post-earnings announcement effects are likely to be present in the Baltics as well, which is the focus of this paper. To go deeper into the issue, we have narrowed down our research to studying the post-earnings announcement drifts (PEAD) and opportunities for profitable exploitation of those in the Baltic stock markets, namely NASDAQ OMX Stock Exchanges in Tallinn (Estonia), Riga (Latvia) and Vilnius (Lithuania). Essentially no research[1] has been made in the recent years

[1] To the best knowledge of the authors, in recent years only Stasiulis (2009) has researched announcement effects on the Baltic stock markets; however, his study did not focus specifically on PEAD.

which would focus on determining the existence and level of PEAD on the Baltic stock exchanges; thus, we aim to fill the gap in the field by conducting a study answering the following research question: *Are post-earnings announcement drifts present on the NASDAQ OMX Baltic Stock Exchanges and what is the payoff for a profit-maximizing investor from exploiting them?*

The data set of the study includes all companies that were listed in the Baltics in December 2009 from 2000 to 2009, the longest time-frame possible. From the methodological perspective the study represents an event study, where we first estimate the normal return of a stock, which is based on the market model, and then see whether substantial deviations from the expected return occur during trading days following the announcement day until the next earnings release, in which case PEAD are present.

To differentiate among companies in order to form strategic portfolios, most of the previous studies were using standardized unexpected earnings (SUE)[2] as a proxy for the level of unexpected earnings. However, if analyst estimates are hardly available for a particular market, which is the case for the Baltics, these strategies cannot be applied. Instead, we use the concept of Initial Abnormal Return (IAR), also used by Börjesson (2007), for the purpose of determining the level of surprise content of the announcement, which is arguably even better measure, as it captures all the reported information and future expectations, not only the pure number of earnings.

In contrast to previous studies[3], interactions and causalities between stock returns and trading volume around the earnings announcements are investigated to deeper extent to determine PEAD-based profit strategies, using methodology similar to Börjesson. Additionally, the study accounts for main market frictions for evaluating the feasibility of profit strategies from exploiting PEAD. Most importantly, as futures are not traded and short-selling is prohibited on the Baltic stock exchanges, it is not possible to create self-financing market neutral portfolios; thus, authors employ another trading strategy which is based on borrowing the necessary funds.

The work provides weak evidence of the existence of post-earnings announcement drifts on the Baltic stock exchanges. It finds that initial abnormal return is a strong predictor of the magnitude of PEAD, while initial abnormal volume adds only marginal value. The study reveals that 18 strategies earned significant positive abnormal returns during 2001-2009,

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[2] SUE is defined as the difference between reported and expected earnings divided by the standard error of estimate of trend regression.

[3] Only Frazzini and Lamont (2006), and Börjesson (2007) have done it to authors' best knowledge.

while the most profitable of them generated average yearly cumulative abnormal return of 254%. However, when accounting for borrowing and transaction costs, possibilities to profit on PEAD nearly disappear. Moreover, when analysing the nominal returns of the strategies yielding significant positive abnormal returns after accounting for trading costs, it can be observed that cumulative nominal returns for them are in many cases negative; thus, making the PEAD-based trading strategy hardly applicable in the real life. In conclusion, the thesis cannot formally reject the Efficient Markets Hypothesis, because profiting on past information is not seen as viable.

The paper contributes strongly to the existing literature in the field as well as to the knowledge of the investment community. Firstly, it provides weak evidence of the existence of PEAD on the Baltic stock exchanges. Secondly, it investigates how the stock price, trading volume and interaction between them can be used in predicting the direction and magnitude of PEAD on the Baltic exchanges. As there have been only very few previous attempts to do so in other markets, the study has international relevance in context of post-earnings announcement effects. Thirdly, it shows and discusses potential profiting strategies on PEAD and estimates the potential pay-offs and associated risks for the investor when he/she decides to employ any strategy; thus, being valuable in monetary terms.

The paper will proceed as follows. Section 2 provides a review of relevant literature. Section 3 presents the methodology applied. Section 4 presents the data used in the study, while section 5 describes and analyses the empirical results. Finally, conclusions are drawn and suggestions for further studies are provided.

2 Literature review

One of the underlying concepts of behaviour of stock markets, the market efficiency, tells that stock prices at each particular moment should incorporate all information available to market participants at that point in time (Fama, 1970)[4]. Implicitly, it means that in case new information becomes available, stock prices should immediately react and reach the new

[4] Fama (1970) presents concept of Efficient Markets Hypothesis and distingueshes three forms of market efficiency: weak, semi-strong and strong. The weak form states that investors are not able to earn abnormal returns via knowing past stock prices. The semi-strong form says that no abnormal returns can be realized when basing investment decisions on all publicly available information including past stock prices. Strong form tells that investors cannot profit even by utilizing insider information. Further on in this study, while referring to market efficiency, authors mean semi-strong form of efficiency by Fama's classification, because this should be the most relevant form for an ordinary investor who does not have access to insider information.

equilibrium level, because any amount of new information carries some value; thus, it should change the true stock price of the company and, consequently, the valuation of the firm.

There are different types of information that can influence stock prices, which in broad terms can be divided into two categories. The first includes information and news which are common to all companies, mostly about macroeconomic environment (Mitchell & Mulherin, 1994). The second category consists of company-specific news. For example, announcements about changes in the management, leverage, dividend payout, mergers, acquisitions, sales agreement, earnings reports, etc – all of them convey information and affect the value of the company in one way or another and influence company's share price performance (Balakrishnan et al, 2008). Therefore, as in efficient markets a price of a stock, in theory, always reflects the true and fair value of a particular company, the change in the stock price should happen immediately after the announcement and further price changes should be independent of this information.

However, it has been widely documented that such situation is a rarely the case in the real life, in other words, the news are often not incorporated into prices immediately. As a consequence, numerous studies have been conducted which have investigated the effect of various announcements on stock prices. Out of those, a substantial group of papers is concentrating on the stock price reaction triggered by announcement of companies' quarterly earnings (see for example Ball and Brown (1968), Foster, Olsen and Shelvin (1984)).

Ball and Brown (1968) were the first to discover the earnings announcement effects. In their study of market reactions to forecasting errors they found that unexpectedly high (low) reported earnings are followed by positive (negative) abnormal returns. The study is based on a sample of 261 US stocks during 1946 to 1966. The authors used the difference in reported earnings and earnings forecasts that were released one year before the announcement to form portfolios of stocks. Annual earnings figures were used in the study and market model was applied to estimate normal returns of securities. Evidence of a long-term pre-earnings announcement drift, which starts one year prior to the release of the accounting numbers, is found. Stock price drifts in the short run, in the month of the announcement and during six months after the announcement, are found to be of less magnitude than those during the year before the announcement. The explanation provided by Ball and Brown says that the stock prices are converging to their current fair values during the year as market participants receive information that would allow them to estimate the earnings figures, and the release of the annual earnings figures actually contains little unknown information, leading only to minor price adjustments.

After the pioneering study of Ball and Brown, the issue of abnormal returns around earnings announcement dates became a popular topic of study among academics. There were numerous papers reporting post-announcement drifts for observations with unanticipated good or bad news (for example, see survey papers of Ball (1978) and Joy and Jones (1979)). These and subsequent studies in the field were aiming at extending the knowledge about the way how information contained in the earnings announcements is priced. An important achievement in the field was introduction of standardized unexpected earnings (SUE) as a measure for the unexpected earnings component in price shifts around the earnings announcements. The metric was first used by Latane and Jones (1977) and was extensively applied since then.

Foster, Olsen and Shelvin (1984) (FOS) provided additional evidence on the systematic drifts in prices after earnings announcements. Using a sample of 2053 companies during 1974-1981 they find that the cumulative abnormal returns on portfolios with more positive SUE measure continue to drift upwards after the earnings information was made publicly available (and vice versa for portfolios with more negative SUE). The authors find that going long in the portfolio consisting of highest decile SUE stocks would yield an abnormal return of 2.32% over the 60-days post-announcement period. Having run regressions on the determinants of abnormal returns the authors find that 61% of variation is explained by firm size. However, even though FOS report significant drifts during a 60-day period subsequent to earnings information release, the result was significant only for a subset of models tested. This finding was one of the first to indicate that the detection of post-earnings-announcement drifts is sensitive to the model specification applied.

Since the discovery of Ball and Brown, one of the main issues addressed by academics when trying to explain the sources of PEAD is mispricing of risk that comes from inadequately specified models, since majority of the models used for estimating the expected price changes are in essence CAPM-based. Trying to overcome the issue, many authors were trying to improve the model for estimating returns. Chen, Roll and Ross (1986) showed that risk coming from changes in term structure, default risk premiums and industrial output are priced, which supports the relevance of arbitrage-pricing theory-based models. They also report weak evidence of priced inflation risks. Ball, Kothari and Watts (1988) and later Ball and Kothari (1991) proposed hypothesis that CAPM omits possible increase in return variances and betas around the earnings announcement window that could lead to higher expected returns during these periods. By allowing betas to change daily, Ball and Kothari (1991) find that abnormal returns still remain after controlling for risk increases and they are largest for firms of smaller size. Going away from CAPM model, Fama and French (1993) show that average stock returns are better explained by three factors: market risk, book-to-market and company size. However, the short-term momentum anomaly documented by Jagadeesh and Titman (1993) remained unexplained. To overcome this problem, Carhart (1997) includes one-year momentum risk factor into Fama and French three factor model. Bartov et al (2000) extend the line of possibly not priced risk factors finding that there is negative correlation between PEAD and the share of institutional holdings, where institutional holdings are used as a proxy for investor sophistication. They also report that after controlling for the amount of institutional holdings, traditional proxies for transaction costs and firm size have little extra explanatory power.

Followed by a series of papers trying to uncover the source of price drifts, Bernard and Thomas (1989) had a fresh look at the issue of post-earnings-announcement drifts. They examine two possible sources of abnormal returns: delay in price response to new information and incompleteness or misspecification of CAPM. Using SUE as a measure for unexpected earnings and applying a long-short strategy of being long in the highest and short in the lowest decile SUE portfolio they find no evidence of misspecification of CAPM. The authors find no economically significant changes in betas from CAPM model around the announcement dates. They also found that none of the five factors from the APT model suggested by Chen, Roll and Ross (1986) individually nor all the factors taken together were significantly correlated with the return of the SUE strategy. From that Bernard and Thomas (1989) conclude that the results are rather a result of delayed price response than of misspecified model. In the subsequent article (Bernard and Thomas, 1990) the authors find that there is a serial correlation of earnings which is likely to be overseen by market participants.

In most of the studies mentioned above, SUE was used to compute abnormal returns. However, there have been attempts to develop new metrics that could better approximate the unexpected information conveyed by earnings announcements. One of such studies is a recent research of Brandt et al (2008), which provided additional evidence on the post-earnings abnormal returns anomaly. Using the earnings announcement return (EAR) as a measure for portfolio construction, the authors find systematic under-reaction on information becoming available around the earnings announcement date.

Concerning the Baltic countries, to the best knowledge of the authors, only Kiete and Uloza (2005) and Stasiulis (2009) has researched announcement effects on the Baltic stock markets. However, their studies did not focus on PEAD in conventional sense, but rather concentrated on investigating short-term price movements around earnings announcements. Kiete and Uloza studied announcement effects in 20 days window around earnings announcements (from -10 to +10 days) in Latvia and Lithuania over the period of 2000-2004. They found that the semi-strong form of market efficiency did not hold for the Latvian stock market, whereas it did hold for the Lithuanian stock market. However, the Lithuanian stock market was not strong form efficient and significant abnormal returns could have been earned before the earnings announcements. More up to date study was done by Stasiulis, who investigated the topic in all three Baltic countries in period of 2004-2008 using event window of 10 days around earnings announcement, that is from day t= -5 until day t=5, if announcement day is t=0. Looking at the return on the announcement day, he divides the new information into 3 categories - good, neutral and bad news – and constructs portfolios based on the classification. Regarding PEAD, he only looks at 1-day and 3-day holding period strategies and finds that out of Baltic countries, only Latvia has statistically significant returns for holding stocks for 3 days after the earnings announcement, as well as significant positive abnormal return for holding the stocks on the 4th day after the earnings announcement. However, he concludes that the significant returns are too low to be exploited when accounting for transaction costs.

Perhaps the most relevant study concerning our paper is the one conducted by Börjesson (2007), because our methodology to a large extent is similar to his[5]. He investigates the presence of post-earnings announcement drifts on the Swedish stock market in years 1997-2007. The surprise content of the earnings (and any other information included in the report) is proxied by the price change on the announcement day and different portfolios are performed based on the metric. Afterwards the performance of various portfolios is observed throughout the period of 60 days after earnings announcement. The strategy of going long in stocks with highest abnormal returns and short in stock with lowest abnormal returns on the announcement day is found to yield up to 11.25% of abnormal return per year. However, in addition to studying PEAD purely with stock returns data, Börjesson also studies another variable to sort stocks into portfolios – volume on the day of the announcement. He finds that the strategy of going long in stocks with the highest abnormal volumes and short in stock with the lowest abnormal volumes on the announcement day returned up to 8.16% of abnormal return per year over the studied period. Moreover, he investigated the interactions

[5] Will be discussed in more detail in methodology section.

between the two metrics and found mixed results, with portfolios yielding positive annualized abnormal returns of up to 23.52%.

The trading volume of securities in general has deserved a lot of attention from the researchers of financial markets; however, the research concerning the relation between earnings announcements and volume are scarce. According to Karpoff (1987), there is wide-ranging evidence that trading volume and stock returns are generally positively correlated; in other words, stock prices are likely to gain on high volume and decrease on low volume[6]. Although there are many theories to explain the relationship, most of them centre on short-sale constraints. The main line of reasoning is the following: higher volume in general is associated with greater differences of opinion about the value of the stock; however, if there are short-sale constraints, which is normally the case[7], the differences of opinion lead to overpricing of the stock. The latter happens, because investors who have optimistic beliefs bid up the prices; however, pessimists are unable to balance them, because they are restricted from short-selling, which would create additional supply, and subsequently, decrease the price. Thus, short-sale constraints lead to situations where the prices tend to move above the equilibrium value, which can be thought of as the mean valuation given the available information (Miller, 1977; Harrisson & Kreps, 1978; Scheinkman & Xiong, 2003). Putting it into the context of the earnings announcements, Kandel and Pearson (1995) among others argue empirically that investors interpret new information differently; thus, divergence of opinions around the earnings announcements leads to the increase in volume. Similar strand of study argues that high volume is caused by lots of irrational or noise traders in the market, but due to the presence of short-sale constraints high volume pushes prices higher (Baker & Stein, 2004; Hong & Yu, 2004).

A study of special relevance for our paper was conducted recently by Frazzini and Lamont (2006), which investigates the link between earning announcements effects and trading volume. They base their study on a strategy of buying all the stocks which are expected to announce earnings in a given month and selling short all other stocks. The study uses data from US stock markets for period of 1972-2004. Firstly, they confirm empirically that earnings announcements are on average associated with positive returns and their strategy yields 7% annualized abnormal return. However, more importantly, they show that high volume around earnings announcements for a given stock in the past periods is strongly

[6] See Karpoff (1987) for the list of studies.

[7] Compared to share purchase transaction, short-selling is normally associated with higher transaction costs, which puts constraints on the usage short-selling.

correlated with higher premium of the share price during earnings announcement. So, they find that strategy exploiting positive correlation between high volume and price change around earnings announcements yields an annualized abnormal return of 18%. Thus, their study supports theories arguing for positive correlation between share price and trading volume.

However, the intriguing results obtained by different authors about the possible strategies of exploiting PEAD might be inapplicable to real-life trading. Bernard and Thomas (1989) note that cumulative abnormal returns on long-short trading strategies are limited and roughly represent "round-trip transaction costs for the small individual investor". A recent study by Chordia et al (2006) finds that transaction costs represent 66-100% of profits from long-short SUE strategies. They show that albeit the highest abnormal returns are observed for the most illiquid stocks, trading them is associated with high transaction costs both in the form of bid-ask spreads and the high influence on the prices even by averagely large investors.

3 Methodology

Firstly it should be noticed that the study utilizes abnormal market reactions in terms of return and volume and tries to use them for gaining abnormal profits for some of the announcing stocks. Even though the methodology is linked to the earnings announcements as the event dates, it does not necessarily mean that solely the earnings results matter for the purpose of the study. Earnings announcement are just the most common announcements and include very important indicators concerning the company performance. Additionally, they are reported relatively regularly. Essentially, the methodology does not require only some specific type of information to influence the price – the only thing which is of our concern is that the announcement conveyed some information to the market and the market reacted to it. A trading strategy is then formed to profit from the lag in the reaction of the market to this information, which is the post-earnings announcement drift. Thus, it should be considered that we are not claiming that earnings are the only factor driving the drifts; rather, all information included in the earnings report drives it.

For the purpose of answering our research question we will use event study methodology, trying to follow recommendations by MacKinlay (1997). On the fundamental level, the methodology is similar to that of Börjesson (2007); however, there are some substantial differences. The timeline of the study can be observed on Figure 1. The event day is the day when the earnings are announced on the NASDAQ OMX Baltic stock exchanges. If the announcement is made after the trading day has ended, the following trading day will be taken as the event day. Time on the event day equals zero. For further discussion, it should be clarified that ‘day’ in this report refers to trading day, if not otherwise stated, that is 5 (trading) days corresponds to one calendar week.

3.1 Estimating the normal return

In order to estimate the normal return of a stock, we use market model, which is commonly applied methodology for that purpose (MacKinley, 1997). For any stock i, the basic market model is the following:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \qquad E(\varepsilon_{it}) = 0 \qquad var(\varepsilon_{it}) = \sigma^2 \tag{3.1}$$

where R_{it} and R_{mt} are the period-t returns on stock i and the market portfolio, respectively, and ε_{it} is the disturbance term with mean 0. α_i, β_i, σ^2 are the parameters of the market model, estimated using OLS regression. The estimation period starts one day after the previous earnings announcement and lasts until the day before the event day. Normally, the estimation period is equal to around 60 days (see Figure 1), corresponding to the period starting at $t \approx -60$ and ending at $t = -1$.

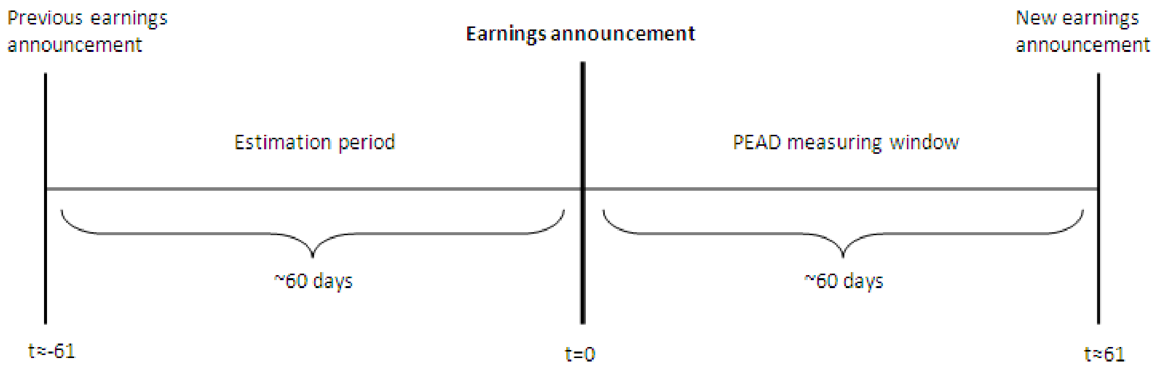

Figure 1. Timeline of the event study. *Source: created by authors*.

Since inclusion of the previous earnings announcement date in the estimation window might distort the results, the length of the possible maximum estimation window varies across observations. In this study the maximum amount of the data on price changes after the preceding announcement is used to estimate the market model. This implies that IAR is calculated starting with the second earnings announcement of each stock. According to Krivin et al (2003), the length of the estimation period should not influence the results too much and a varying length of estimation window allows making more correct estimates of the normal performance of a stock. In the previous studies (e.g. Börjesson (2007)) estimation periods of fixed length were used, therefore leading to possible inaccurate estimation of the expected return model since the estimation window could capture the previous earnings announcement day.

The alternative to market model for estimation of the normal return would be to use Fama and French 3-factor model (Fama & French, 1993), or 4-factor model suggested by Carhart (1997). However, due to the fact that Baltic stock markets are rather small, estimating 3-factor model factors HML and SMB would be rather questionable. For the same reason we do not adjust the market model to capture possible variation of beta across industries, as most of the industries would consist of only a few companies; thus, hampering the validity.

3.1.1 Scholes-Williams Method of Estimation of Betas and Alphas

On the Baltic markets many stocks have rather low liquidity. However, when trading is potentially infrequent, ordinary least squares (OLS) estimators are biased and inconsistent. As argued by Scholes and Williams (1977), in case of infrequent trading of securities, OLS estimators tend to produce upward biased alphas and downward biased betas[8]. In order to correct for the bias, it is proper to use Scholes-Williams betas and alphas[9]. For calculating those, three OLS regressions have to be run:

(3.2) $$R_{it} = \alpha_{1i} + \beta_{1i}R_{mt} + \varepsilon_{1t}$$

(3.3) $$R_{it} = \alpha_{2i} + \beta_{2i}R_{mt-1} + \varepsilon_{2t}$$

(3.4) $$R_{it} = \alpha_{3i} + \beta_{3i}R_{mt+1} + \varepsilon_{3t}$$

where R_{mt}, R_{mt-1} and R_{mt+1} are returns on the market portfolio for days t, t-1, and t+1, respectively.

Then the Scholes-Williams beta can be calculated as follows:

(3.5) $$\hat{\beta}_{SWi} = \frac{(\hat{\beta}_{1i}+\hat{\beta}_{2i}+\hat{\beta}_{3i})}{(1+2\hat{\rho}_m)}$$

where $\hat{\rho}_m$ stands for the estimated serial correlation of market returns of order one from t=-T to t=-1 and T denotes the length of the estimation period.

The Scholes-Williams alpha, consequently, is obtained as follows:

(3.6) $$\hat{\alpha}_{SWi} = \frac{1}{T-2}\sum_{t=-T+1}^{-2} R_{it} - \frac{1}{T-2}\hat{\beta}_{SWi}\sum_{t=-T+1}^{-2} R_{mt}$$

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[8] See Scholes and Williams (1977) for mathematical derivation.

[9] Another way to reduce the bias from thin trading is to use Dimson correction. However, it has been argued that Scholes-Williams method yields more correct results (Fowler & Rorke, 1983), therefore it is used in this paper.

Later Scholes-Williams alphas and betas are used for the calculation of abnormal returns in the market model as described in the following section.

3.1.2 Initial Abnormal Return

Initial Abnormal Return (IAR)[10] is the excess return of the stock on the announcement day compared to the expected normal return. That is:

$$IAR_{it} = NR_{it} - E(R_{it}) \qquad t=0 \tag{3.7}$$

where NR_{it} is the nominal return of stock i on day t (event day in this case), and $E(R_{it})$ is the expected return of the stock i on the event day estimated by the market model, that is:

$$E(R_{it}) = \hat{\alpha}_{SWi} + \hat{\beta}_{SWi} R_{mt} \tag{3.8}$$

3.1.3 Abnormal Return

Abnormal Return (AR) is the excess return of the stock over the PEAD measuring window compared to the expected normal return, that is:

$$AR_{i,[t,N]} = \prod_{t=1}^{N}(1 + NR_{it}) - \prod_{t=1}^{N}(1 + E(R_{it})) \tag{3.9}$$

where N is the length of the PEAD measuring window. The length of the PEAD measuring window is equal to the length of the period between the current and the subsequent earnings announcements, but is never longer than 120 days, which roughly corresponds to two calendar quarters. The maximum length criterion is included since it can be the case that a company can have a lengthy period when it does not publish any announcements, thus leading to PEAD measuring window of more than half a year and occasionally even more than a year. In case of an extremely long PEAD measuring window it is highly likely that the share price will no longer be driven by under-reaction of the market participants to the announcement. In order to better understand the duration of the PEAD, AR-s with a maximum length of the measuring window of 5, 20 and 60 days are also calculated. At the same time the length of the holding period cannot be longer than the period until the next earnings announcement in order to avoid capturing the IAR and PEAD associated with it. For instance, when referring to 60 day strategies, the stocks are held until the next earnings announcement, but not more than 60 days.

In portfolio formation part Cumulative Abnormal Return (CAR) metric is utilized, which refers to average accumulated AR over one year, that is:

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[10] As the study uses many abbreviations in order to simplify the text, list of abbreviations used can be found in Appendix 1, Table 3.

(3.10) $$CAR_N = \frac{1}{9}\sum_{i=1}^{M} AR_{i,N}$$

where M is the total number of earnings announcements in particular portfolio and 9 stands for the number of years used for the trading strategy[11]. For clarification, not dividing the sum of AR-s with 9 would yield the gross return of a particular trading strategy over 9 years of implementation.

3.1.4 Initial Abnormal Volume

In order to analyse earnings announcements from the perspective of trading activity, we follow Frazzini and Lamont (2006), who developed the concept of the Initial Abnormal Volume (IAV), while taking into account the characteristics of the Baltic stock exchanges. The purpose of the IAV metric is to show us how high the trading activity was on the announcement day compared to normal periods and general market activity on the particular day and, thus, allows us to analyse the abnormal return also from the perspective of relative level of the trading activity.

For this, we first calculate the Scaled Volume (SV), which is defined as the ratio of stocks i volume today to the average volume over the past 21 trading days[12]:

(3.11) $$SV_{i,t} = \frac{VOLUME_{i,t}}{\frac{1}{21}\sum_{s=1}^{21} VOLUME_{i,t-s}}$$

This shows the level of trading volume for stock i on the announcement day compared to its normal level of volume. Relatively shorter period (compared to market model) for estimating the normal volume is chosen due to the fact that trading volume is often non-stationary; thus, shorter period allows to capture the current level of normal volume. At the same time, the period should not be too short, because this could lead to a situation where extreme values have too high weight. 21 trading days approximately corresponds to one calendar month; thus, it should be sufficiently long to capture the true average volume for infrequently traded stocks while still accounting for stationarity. It should be noted that Börjesson, while applying the IAV metric, also used 21 trading days. The SV is not calculated for the stocks which experienced zero volume during 21 days prior to the announcement.

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[11] Argumentation behind using 9 years instead of 10 years is given in the description of the trading strategy.
[12] Volume in this paper refers to stock turnover in monetary terms, that is number of shares traded multiplied by the respective share price.

Secondly, we calculate the IAV, which is defined as the SV of a stock minus the market SV on the announcement day:

(3.12) $$IAV_{i,t} = SV_{i,t} - SV_{market,t} = SV_{i,t} - \frac{VOLUME_{market,t}}{\frac{1}{21}\sum_{s=1}^{21} VOLUME_{market,t-s}}$$

This is done to capture the effect of the general level of market activity on the given day. For example, if on some day a lot of trading takes place on the market, it is highly likely that the particular stock is also traded more and if one would not adjust for the level of market volume, the IAV metric could be biased upwards. However, if we deduct the SV of the market which must be higher as well due to higher market volume, we correct for that bias. Similar to the SV, the IAV metric is not calculated if the stock was not traded 21 days before the earnings announcement, thus automatically excluding the most infrequently traded stocks which might be difficult to exit for the investor due to lack of liquidity. Moreover, when forming all portfolios, stock announcements for which the IAV is not calculated are disregarded for the same reason.

Frazzini and Lamont (2006) define the IAV as the SV minus the weighted average SV for the whole sample of stocks on the announcement day, that is $IAV_{i,t} = SV_{i,t} - \frac{1}{S}\sum_{i=1}^{S} SV_{i,t}$. Nevertheless, this cannot be directly applied in the Baltics because there are relatively many stocks which have very low trading activity, and consequently take extreme values for SV-s. If the SV is very large for the company on the day when it is announcing, it truly reflects substantially higher volume; however, if it has extreme value on the day when some other stock is announcing, such formula strongly biases the IAV metric downwards for the announcing stock. The version of the IAV presented in this paper is influenced by the relatively infrequent trading of many stocks on Baltic stock exchanges to a much lesser extent, thus adjusting for the bias.

3.1.5 Nominal Return

Nominal return (NR) is the total return of the stock over the PEAD measuring window, i.e. shows the actual performance of stock price, not compared to any predicted value. The mathematical expression for the metric is:

(3.13) $$NR_{i,[t,N]} = \prod_{t=1}^{N}(1 + NR_{it}) - 1$$

where N is the length of the PEAD measuring window. Similar to CAR, the length of the PEAD measuring window is no longer than 120 days. The CNR-s with the length of the

PEAD measuring window of 5, 20 and 60 days are also calculated. Even though the CNR cannot be used for determining existence of PEAD, it shows the 'real-life' profitability which could be achieved by buying the announcing stock.

Similarly to CAR, the CNR metric is calculated for the NRs, which refers to average accumulated realized return per year by utilizing the portfolio trading strategy:

(3.14)

$$CNR_N = \frac{1}{9}\sum_{i=1}^{M} NR_{i,N}$$

where M is the total number of earnings announcements in the sample and 9 stands for the number of years used for the trading strategy.

3.1.6 Compared-to-market return

Compared-to-market return (MAR) is the excess return of the stock over the PEAD measuring window compared to the return of the market index, i.e.:

(3.15)

$$MAR_{i,[t,N]} = \prod_{t=1}^{N}(1 + NR_{it}) - \prod_{t=1}^{N}(1 + MR_t)$$

where N is the length of the PEAD measuring window and the MR is the return on the index of the respective country (Estonia, Latvia or Lithuania, depending where the stock is listed). One can also think of MAR as the AR where the values of α and β are imposed to be 0 and 1 respectively. Similar to the AR and the NR, MAR is calculated for the maximum length of the PEAD measuring window of 5, 20, 60 and 120 days.

In the same manner as CAR and the CNR, cumulative compared-to-market return (CMAR) is calculated as:

(3.16)

$$CMAR_N = \frac{1}{9}\sum_{i=1}^{M} MAR_{i,N}$$

where M is the total number of earnings announcements in the sample and 9 stands for the number of years used for the trading strategy.

3.2 Regression analysis

In order to make first inferences about the predictability of the sign and magnitude of PEAD using data of the IAR and the IAV, as well as to justify the trading strategy that will be presented later, regression analysis using OLS estimation method was conducted. For that we used the measure of daily abnormal return (DAR). DAR is defined as the geometric average daily abnormal return over the PEAD measuring window. That is:

(3.17) $$DAR_{i,[t,N]} = \sqrt[N]{1 + AR_{i,[t,N]}} - 1$$

Thus, DAR shows the general level and magnitude of PEAD; however, it does not say anything about the development of abnormal returns over time. The reason why DAR is used in regressions instead of the AR is that the length of the PEAD measuring window is varying. This happens primarily because companies do not report earnings that regularly and the time period between two quarterly announcements can be substantially different from 60 days. For instance, there is a tendency that 4^{th} quarter/annual earnings reports arrive later than 2^{nd} quarter results, relatively to the end of the respective quarter. Another cause is the fact that sometimes companies report monthly earnings as well. Thus, the lengths of PEAD measuring windows are different and not comparable, which is why adjusting them to the same basis is needed for the analysis.

Firstly, a general relationship between the IAR and DAR is examined. For that reason *first type of regression specification* (regression (1)) was run, where the form of the regression for the specification is:

(3.18) $DAR_i = \beta_0 + \beta_1 IAR_i + \varepsilon_i$

It is reasonable to believe that the Baltic stock market experienced significant improvements in efficiency over the sample period. Thus, to discover whether there was a significant difference in incorporation of information from the earnings announcements over time, regressions (2)-(10) were run with the *second type of regression specification* being:

(3.19) $DAR_i = \beta_0 + \beta_1 IAR_i + \beta_2 Dummy(YEAR)_i + \beta_3 Dummy(YEAR)_i{*}IAR_i + \varepsilon_i$

In this specification the sample is split into two parts and *YEAR* refers to the splitting point. Dummy variable for *YEAR* equals to one in case the observation refers to a year after *YEAR* and zero otherwise. Meanwhile dummy variable for *YEAR* multiplied by the IAR is an interaction term. Thus, a coefficient on the IAR represents the effect from the initial abnormal return before and including *YEAR*, dummy on *YEAR* shows the change in the intercept after *YEAR* and the interaction term shows the change in the effect from the IAR after *YEAR*. Such a regression specification is in a way identical to running two regressions of model specification (1) on the date before and after *YEAR*. However, by using the second type of regression specification (regressions (2)-(10)) we are able to determine the significance of the difference in the coefficients on the IAR, which can be seen by checking significance of the coefficient on the interaction term.

Apart from the effect coming from the IAR, the paper also studies the effects from the IAV, therefore appropriate regression specifications have to be used. In order to see whether there is any effect coming solely from the IAV, *third type of regression specification* (regression (11)) was used:

(3.20) $DAR_i = \beta_0 + \beta_1 IAV_i + \beta_3 Dummy(Negative\ IAR)_i * IAV_i + \varepsilon_i$

It has been documented in the literature that the initial abnormal volume might be correlated with the magnitude of PEAD. Therefore, in case positive DAR is expected, the effect of the IAV should be with plus sign and in case of negative expected DAR – with minus sign. Thus, in order to capture the effect of increase/decrease in magnitude of PEAD, interaction term of the dummy variable for negative IAR with the IAV has to be introduced. The IAR was chosen for creation of the dummy variable since it has already proven to be a significant predictor of abnormal return in previous studies and the larger was the IAR, the larger abnormal return was expected. As a result, the coefficient on the IAV shows the effect coming from increase in the initial abnormal volume in case of non-negative IAR. The coefficient on the interaction term is the change in the effect coming from the IAV in case the IAR is negative. Analogues to model specifications in regressions (2)-(10), this specification allows seeing whether there was significant difference between the effect of the IAV in case of negative and non-negative IAR. Consequently, it also shows whether the IAV did actually influence the magnitude of the effect, or the effect was with the same sign for all values of the IAR.

Finally, a joint effect of the IAR and the IAV was examined. For the purpose of conducting the analysis, *fourth type of regression specification* (regression (12)) was created:

(3.21) $DAR_i = \beta_0 + \beta_1 IAR_i + \beta_2 IAV_i + \beta_3 Dummy(Negative\ IAR)_i * IAV_i + \varepsilon_i$

In this model the effect of the IAR, similar to previous model specifications, has the same sign over the whole sample, the coefficient on the IAV shows the effect of initial abnormal volume in case the IAR is non-negative while the coefficient on the interaction term shows the change in the effect of the IAV in case of negative IAR.

3.3 Portfolio formation and trading strategy

Finally, the analysis of the existence of PEAD and possible profiting strategies from exploiting it is based on various portfolios of stocks. In order to assign the announcing company into one of the portfolios, the IAR and IAV metrics over the last 365 days are calculated for all the announcements and ranked. From there, it is possible to assign borderline values for each quintile of the IAR and IAV[13]. Afterwards portfolios of stocks are formed according to the IAR and IAV rankings – stocks are divided into quintiles, with the lowest quintile containing 20% of all announcement observations exhibiting the lowest IAR and IAV respectively, and vice versa for the highest one. Eventually, this leaves us with ten portfolios: five for the IAR metric and five for the IAV metric. Additionally to that, 25 portfolios ranked simultaneously by IAR and IAV are formed, i.e. a portfolio consisting of stock-announcement observations having both IAR and IAV values from the top quintile, a portfolio consisting of stocks having the IAR of top quintile and the IAV of second quintile, etc, essentially creating a 5x5 IAR-IAV percentile matrix. For convenience the portfolios are labelled by the metric used to obtain them and a number from 1 to 5 (e.g. IAR5 for a single-metric strategy and IAR5xIAV1 for a simultaneous IAR and IAV strategy), where 1 stands for the portfolio containing the lowest 20% of observations on the respective metric over the previous year, 2 refers to the portfolio containing observations over the previous year falling between 20th and 40th percentile, etc. Tables 1 and 2 visualize the portfolio formation principle.

Table 1. Visual representation of portfolio formation principle for the IAR and the IAV separately. *Source: created by authors.*

IAR 1 (IAV 1)	**IAR 2 (IAV 2)**	**IAR 3 (IAV 3)**	**IAR 4 (IAV 4)**	**IAR 5 (IAV 5)**
Observations with the lowest 20% of IAR (IAV) over 1 year preceding the current earnings announcement	…	…	…	Observations with the highest 20% of IAR (IAV) over 1 year preceding the current earnings announcement

Table 2. Visual representation of portfolio formation principle for the IAR and the IAV simultaneously. *Source: created by authors.*

	IAR 1	**IAR 2**	**IAR 3**	**IAR 4**	**IAR 5**
IAV 1	Observations with the lowest 20% of IAR and IAV over 1 year preceding the current earnings announcement	…	…	…	…
IAV 2	…	…	…	…	…
IAV 3	…	…	…	…	…
IAV 4	…	…	…	…	…
IAV 5	…	…	…	…	Observations with the highest 20% of IAR and IAV over 1 year preceding the current earnings announcement

Then in order to make a decision about buying or not buying the announcing stock, its IAR or (and) IAV is compared to the threshold values of the portfolios. A "buy" decision for respective portfolio will be made in case the IAR or (and) IAV of the stock falls in between

[13] For this reason even though the data is available for ten years, the trading strategy can be applied only for nine years, as there are no reference values of IAR and IAV for the first year.

the percentile thresholds of the portfolio. Written mathematically, the "buying rule" of the respective portfolios is as follows for separate IAR or IAV strategy

(3.22)

$$Buy\ if\ IAR\ (IAV)_i > Percentile_{r_1\ (v_1)}(IAR\ (IAV)\ )_{t=0}^{t=-365}\ and\ IAR\ (IAV)_i \leq Percentile_{r_2\ (v_2)}(IAR\ (IAV)\ )_{t=0}^{t=-365}$$

and is as follows for the simultaneous IAR and IAV strategy

$$(3.23)\quad Buy\ if \begin{cases} IAR_i > Percentile_{r_1}(IAR)_{t=0}^{t=-365}\ and\ IAR_i \leq Percentile_{r_2}(IAR)_{t=0}^{t=-365} \\ IAV_i > Percentile_{v_1}(IAV)_{t=0}^{t=-365}\ and\ IAV_i \leq Percentile_{v_2}(IAV)_{t=0}^{t=-365} \end{cases}$$

where *i* denotes the current announcement and r_1, r_2, v_1, v_2 denote the values for percentiles for the IAR and the IAV for the preceding year respectively. For the portfolios where r_1, or (and) v_1 is equal to zero, the value (values) of the lower percentile threshold is (are) also included in the decision rule. It is also assumed that an investor is rational, therefore he does not acquire stocks with extreme predicted values of α even when the "buying rule" suggests him to do so[14]. Essentially, the "buying rule" is improved compared to methodology suggested by Börjesson (2007). He uses the values of the IAR and the IAV of the previous earnings announcement period to form portfolios. However, as it has already been mentioned previously, since in the Baltic companies used to report their earnings in very wide time spans and also occasionally reported monthly earnings, definition of announcement periods becomes ambiguous. Moreover, taking the values of IAR and IAV for the last 365 days allows both to capture the most recent information available to the investor, as well as to level out the impact of possible 'extreme-IAR' or 'extreme-IAV' quarters, when the respective metrics might have deviated substantially from the long-term averages for most of the companies in the market.

The portfolio strategy implies that the investor does not use his own money to finance the trading strategy; instead every time a stock has to be bought he borrows a fixed sum of money, e.g. 1000 EUR[15]. The money is returned as soon as the stock is sold, which is on the last day before the next earnings announcement. It is also assumed that the investor is risk-averse and does not reinvest the profits gained from using the strategy. Thus, the investor

[14] Altogether four such cases were present in the sample.
[15] It should be noted that a sum of 1000 EUR is used only for indicative purposes. If the investor would have used 1000 EUR (or equivalent amount of DEM before 2002) for exploiting the strategy, he would have faced currency risk, which is not accounted for in the paper.

uses only borrowed funds for trading and invests a fixed sum of money every time he buys a stock. For the purpose of calculation of the returns, borrowing costs are assumed to be 10% annually for all Baltic markets and round-trip transaction costs are assumed to be 4%. The borrowing cost of 10% is the current approximate average borrowing cost for loan and leverage transactions one can find from a Baltic securities broker (LHV, 2010). We believe that the number can be applied to the whole sample period since if an investor can borrow at such cost in the times of financial distress, he should have been able to borrow at the same (or lower) rate in better market conditions as well; thus, we use conservative approach when assessing potential profitability of the strategies. Round trip transaction cost of 4% approximates the average bid-ask spread in the Baltic stock exchanges calculated on the sample data and the average commission fee (NASDAQ OMX Baltic, 2009a; LHV, 2010). However, the assumptions behind the borrowing and the transaction costs cannot be taken for granted as in real-life application they differ from investor to investor; therefore the returns are also calculated for borrowing costs of 7% and 13% and transaction costs of 2% and 6% to act as sensitivity analysis. Profitability of the trading strategy of any portfolio is calculated by summing up all holding period abnormal returns over 9 years (given the respective portfolios "buying rule") and then taking an annual average of the result by dividing the obtained figure by 9, thus obtaining CAR metric. Portfolio returns are also calculated for the NR and MAR metrics in the similar way, obtaining the CNR and CMAR metrics. It should be noted that the conventional way of annualizing returns by taking the geometric average is inappropriate for this paper since the profits gained from the strategy are not reinvested. Moreover, in case of abnormal returns the total abnormal return over 9 years can be lower than -100%, therefore it cannot be annualized by taking geometric average.

To be able to see how PEAD effects are evolving through time, portfolios for all metrics are calculated for the maximum holding period of 5, 20, 60 and 120 days.

In order to assess the significance of the trading strategy, the returns of the strategy are also calculated assuming zero borrowing and transaction cost, i.e. showing the 'pure effect'. We assume that the investor pursuing the strategy is interested in the final outcome of each transaction; therefore, it is appropriate to use a conventional t-test for determining the level of significance of the returns of each portfolio[16].

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[16] The significance of each portfolio's return is calculated as follows: $t = \frac{\frac{1}{N}\sum_{i=1}^{N} AR_i}{\sigma/\sqrt{N}} \sim N(0,1)$, where N is the number of announcements on which a stock was bought in the portfolio and σ is the estimated standard deviation of AR (MAR) in the portfolio. Essentially, the test shows whether the average AR (MAR) in the portfolio was different from zero.

The strategy of going long in the stocks with expected positive abnormal returns and short in stocks which are expected to have negative abnormal return would be optimal in this situation as it would allow to eliminate market risk and to capture the possible theoretical abnormal returns with no investment. However, since short-selling is not allowed on the Baltic stock markets, such trading strategy cannot be implemented in real life; thus, analysing the profitability of the trading strategy is based on going long in stocks which fall into portfolios with positive abnormal return.

4 Data description

The geographical scope of our study includes three neighbouring Baltic countries: Estonia, Latvia and Lithuania. In each of the countries there is only one stock exchange operating, that is NASDAQ OMX Tallinn, NASDAQ OMX Riga, and NASDAQ OMX Vilnius, respectively. All of the exchanges belong to the NASDAQ OMX Group. This has resulted in having harmonized trading rules and market practices across the exchanges (NASDAQ OMX Baltic, 2009b). For this reason, the data for the purpose of conducting the study was collected from the web pages of NASDAQ OMX Baltic stock exchanges (NASDAQ OMX Baltic, 2009a) as the primary source. Moreover, all the countries are also members of European Union, the respective currencies are pegged to Euro and their economies share otherwise similar characteristics. Taking everything into account and adding the fact that any individual exchange has only a few dozen of companies listed, it is reasonable to merge the three markets into one bigger exchange, that is, NASDAQ OMX Baltic. This includes 90 stocks which were listed at the time of collecting the data and gives possibility for portfolio formation, which is a necessary component of the study.

The data is collected for the period from 1st of January 2000 until mid-December 2009, which corresponds to the time scope used in the study. The beginning of the year 2000 is the earliest date for which it is possible to obtain the necessary data. The data was collected in the middle of December 2009 when all earnings announcements for 2009 should have been made already. Thus, we are using the longest time frame possible.

According to Griffin et al. (2008), only three percent of companies' earnings announcement dates in Bloomberg database are correct for emerging markets. Great majority of the papers in the field use aggregated data sources; however, in our paper very high importance is put to having utmost accurate data, and we consider data validity as one of the clear merits of the study. For that purpose, all the data was "hand collected" from the official websites of the NASDAQ OMX Baltic stock exchanges. This includes stock specific data of daily closing prices, daily trading volumes and most importantly monthly, quarterly and annual unaudited earnings announcement dates and times. The stock returns are adjusted for all corporate actions and dividend payouts.

The study includes all currently listed companies on the Baltic stock exchanges, which means that the whole current population is used. However, the companies which have been trading during the period of the study but were not listed in December 2009 are automatically excluded, because not all necessary information could be obtained for those companies. Thus, the study suffers from survivorship bias which cannot be eliminated. At the moment of collecting the data, there were 90 stocks listed in the Baltics.

As a proxy for market return, official indices for respective countries' stock exchanges are obtained from NASDAQ OMX Baltic exchanges. These indices include all listed stocks on the market, are adjusted for dividends and weighted by market capitalization on daily basis (NASDAQ OMX Baltic, 2007).

The total number of observations of earnings announcement dates used in the study is 2668, and that comprises of all monthly, quarterly and annual reports submitted to the Baltic stock exchanges by the listed companies during the study period for which one can calculate IAR. Figure 2 summarizes the number of stocks and earnings announcement observations used throughout the study's timeframe.

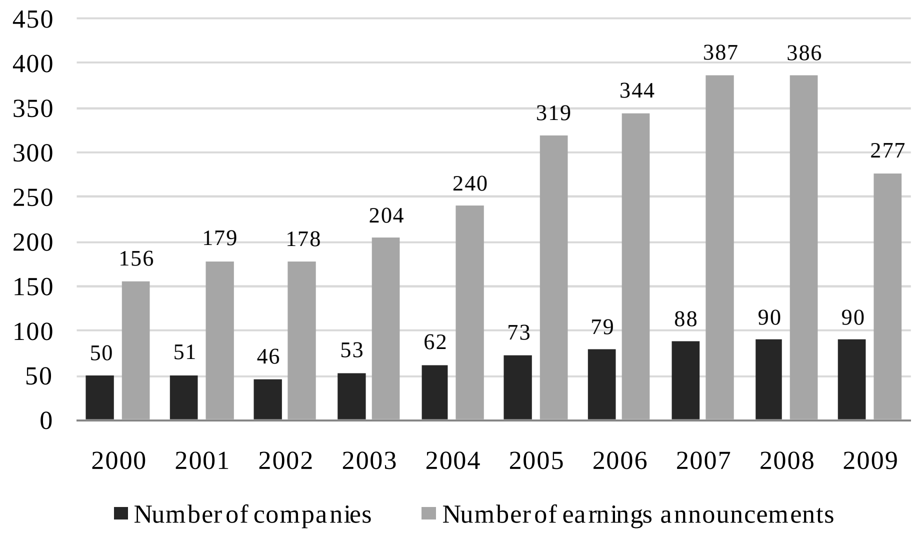

Figure 2. Number of stocks and earnings announcements over the time frame of the study.
Source: created by authors using NASDAQ OMX Baltic (2009a) database.

5 Empirical Results and Analysis

This section firstly presents descriptive statistics and then discusses and analyses the empirical findings based on regression study and portfolio formation strategies, respectively.

5.1 Descriptive statistics

Tables for summary statistics for the variables that were used in the regression analysis can be found in Appendix 2. As it can be seen from table 4[17], on average, currently listed Baltic companies experienced abnormal return of -0.14% per day during the 2000-2009, whereas the respective median value was -0.02%. The values slightly deviate from the theoretical average AR, which is 0%, indicating that there were more cases of negative abnormal returns in the sample with several of those being of large magnitude. Meanwhile, abnormal returns on the days of earnings announcements centred around 0 with the mean value being 0.43%. Thus, there were more cases when there were positive price changes as compared to estimated performance of the stocks on the announcement days. However, such a difference between mean and median values can be regarded small if compared to the discrepancy of the initial abnormal returns in the sample – the largest observed IAR was 79.62% while the smallest being -27.7%. Mean and median values of the AR and the IAR remained relatively stable during the whole period under review.

Regarding abnormal volumes on the days of the earnings announcements, on average there was a considerable increase in scaled volume as compared to the market with the mean IAV being 1.8863. However, mostly initial abnormal volume was negative, which is reflected by the median IAV of -0.1696. Thus, in most of the cases scaled volume of announcing companies was below the market scaled volume, but in the remaining cases scaled volume of some of the announcing companies was significantly larger than the figure for the market.

5.2 Regression analysis[18]

Results of the regression analysis are presented and discussed in this sub-section. The results of the regression specifications 1 and 2 are presented first, followed by results for regression specifications 3 and 4.

[17] Table 5 is not used for summarizing DAR and IAR since it shows the figures for observations where IAV metric could be calculated, which is less than the total number of observations in the sample.
[18] Tables with regression outputs are presented in Appendix 3.

5.2.1 Daily abnormal return dependent on initial abnormal return

The first regression shows that for a company listed on one of the Baltic stock markets, the higher was the initial abnormal return on the announcement day, the higher should have been the daily abnormal return over the post-announcement period in years 2001-2009. In numerical terms, if the IAR was higher by 1%, the stock price was expected to have on average extra daily return of 0.0103% until the next earnings announcement other things being equal[19]. The coefficient is significant at 1% level and adjusted R^2 of the regression is 0.55%. One should have expected R^2 to have low value for this as well as the following regression specifications, since a metric mainly based on a single-day return cannot possibly fully explain share price changes over the subsequent period up to 120 days. Thus, the first finding of the study is that in general there is a positive relationship between the IAR and the abnormal return on the Baltic markets, which goes well in line with literature on the field.

The result has two important implications. Firstly, if higher IAR leads to higher AR, it must mean that there is some constant under-reaction to news, which is later cancelled out through positive abnormal return. In other words, if the earnings are better than expected, the share price is likely to see a jump. However, the regression results indicate that the increase is not sufficient to achieve the new fair value of the company, which is why there will be positive PEAD, which will cover the gap and allow reaching new higher value of the stock after some time. Thus, the first regression provides some evidence for the presence of the post-earnings announcement drifts on the Baltic stock exchanges. Secondly, as the IAR helps to determine the magnitude of abnormal returns, it basically helps to predict stock movements; thus, the finding provides some proof that Baltic markets lack efficiency and gives motivation to look for profitable trading strategies from exploiting PEAD.

Meanwhile, the primary reason for running the regressions (2)-(10) is to see whether the relation between the IAR and the magnitude of abnormal returns has changed over the past 10 years. We do this by comparing IAR coefficients throughout the sample period via dividing it into two parts – until and after the year – by shifting the “break-point year” in each regression.

In fact, the second type of regression specification reveals truly interesting results. In regression (4), the coefficient on IAR interaction term with year (*IAR_D_YEAR*) is equal to -0.0262 and is significant at 10% level, which means that there is significant difference between IAR coefficients until and after year 2002. Combining it with the fact that the

[19] Regression analysis was conducted with the maximum length of the PEAD measuring window of 120 days.

coefficient on the IAR is 0.0346 (significant at 1% level), one can conclude that before and including year 2002 1% increase in the IAR led to higher expected daily abnormal return by 0.0346%; however, after year 2002, if the IAR was higher by 1%, the increase in expected daily abnormal return was only 0.0084%[20], holding other variables constant.

Regression (5) yields very similar results in numerical terms; however, the regression itself now has the break-point year of 2003. Moreover, the coefficient on the interaction term of the IAR and the year-dependent dummy is significant at 5% level. Shortly, regression (5) tells that there is significant difference in the coefficient on the IAR between years up to and including 2003 and the period after that. Numerically, the slope was flatter by 0.0251% per percentage point increase in the IAR in the latter case.

In general, if the coefficient on the IAR is higher, it means that there is more severe under-reaction towards earnings announcements on average. However, if there is under-reaction on the announcement day, the stock price must continue moving at the same direction to correct for that, creating profiting opportunity. Putting it all together, it can be said that before 2003 and 2004 there was more severe under-reaction to earnings releases as compared to periods after that. At the same time it means that if one disregards transaction costs, investors could have profited more from utilization of under-reaction before 2004, if the strategy exists, as the expected return from one percentage point increase in the IAR was higher.

Interestingly, analogous findings are not the case after year 2003, as in the regressions (6)-(9) the interaction term between the IAR and yearly dummy is not statistically significant. This means that there were differences only when comparing periods until and after 2003 and 2004, respectively. Thus, a percentage point increase in the IAR before that led to higher expected abnormal return than it did after 2003 or 2004. Such a result implies that the level of under-reaction decreased on the Baltic stock exchanges and, at the same time, markets started incorporating new information into the prices faster. Thus, it can be said that the Baltic stock markets became more efficient in pricing and incorporating new information when comparing the beginning and end of the decade.

There could be different reasons for that. For instance, one line of thought would be to argue that investors became more knowledgeable in time, which led to more intelligent trading. However, the problem with this argument is that it would imply gradual increase in efficiency over time. Nevertheless, when looking at the results, they suggest that the shift was

[20] In order to know IAR for years 2003-2009 one needs to add interaction term to IAR in regression (4), that is $IAR_{2003\text{-}2009} = IAR_{2002} + IAR\_D\_YEAR_{2002} = 0.0346 – 0.0262 = 0.0084$.

faster. It can be speculated that a major reason for the increase in market efficiency was that the Baltic countries joined the European Union in 2004. Consequently, there were changes in regulatory environment on the state level to comply with the EU legal framework as well as huge increase in foreign funds inflow (Kärkkäinen, 2008). To be exact, more knowledgeable investors' and the European Union accession arguments are not mutually exclusive, on the contrary, the latter could have brought lots of additional talent investing into the Baltic markets; thus, increasing the level of investors knowledge and sophistication. All in all, there is some evidence that joining the European Union has positively affected the efficiency of the Baltic stock exchanges, at least from the perspective of post-earnings announcement drifts.

Interestingly, regression (10) shows that the coefficient on the IAR in 2009 is significantly different (at 10% level) from the period which consists of all other years in the study period. What is more, the interaction term between the IAR and the yearly dummy has negative sign and is in absolute terms bigger than the coefficient on the IAR. Putting it together, it shows that in year 2009, if the IAR was higher by 1%, the expected DAR was actually lower by 0.0046%. This is rather surprising result, because in all other periods there was always positive relationship between the IAR and expected daily abnormal return. This indicates that there could have been over-reaction to stock prices on the announcement days in 2009, which was later corrected by small reversing drift. However, it is a well-established fact that during times of economic turmoil stock markets become much more "nervous". 2009 was the year when stocks world-wide (including the Baltics) traded at their lowest levels in past several years and the markets were extremely volatile (Yahoo! Finance, 2010; NASDAQ OMX Baltic, 2009a). Thus, it can be expected that in such environment over-reaction is often the case, which provides a logical explanation to the regression results. However, given the predicted magnitude and the significance level of the interaction term, we believe that there is only weak evidence that over-reaction to earnings announcements in the Baltics was common in 2009.

5.2.2 Daily abnormal return dependent on initial abnormal return and volume

Third and fourth regression specifications are run in order to see whether trading volume on the announcement day could be helpful in predicting the magnitude of PEAD. In regression (11) the coefficient on the IAV is 0.00003 and is significant at 1% level. At the same time the coefficient on the interaction term of negative IAR with the IAV is not significant. Combined, this suggests that stocks which have non-negative IAR (so, are expected to have non-negative PEAD), other things equal, are expected to have higher DAR if the volume on the announcement day was higher than usual as compared to historical volume of the stock and the historical and current volume of the market. Meanwhile, the stocks with negative IAR are not expected to experience significant change in volume as compared to stocks with non-negative IAR. Due to the reason that the IAV is a metric which involves stock- as well as market-specific volume, the completely correct interpretation of it is not straightforward. However, as an approximation, the regression shows that if the trading volume of the stock with positive IAR is twice as big as it is usually, it is expected to have 0.003% higher DAR[21], leaving all other independent variables constant. This means that higher volume increases the PEAD effect which is predicted from using only the IAR metric. If the IAR metric suggests that the stock is expected to show higher DAR, higher volume means that the DAR is higher than predicted by the IAR alone.

Since regression (11) provides some evidence that the IAV might also be an important metric for determining DAR, further analysis is conducted. Regression (12) is run in order test how the two metrics, initial abnormal return and volume can be used together in predicting average daily abnormal return over the post-announcement period. Similar to regression (1), the coefficient on the IAR is positive and significant with the value being 0.0095. Meanwhile, the coefficients on the IAV and the interaction term are no longer significant. This is a controversial result if compared to regression (11). However, since the IAV has proved to be a significant determinant of the magnitude of the IAR in one of the regressions, we include it as an additional metric for portfolio formation, that is, we will study the interaction between IAR and IAV metrics with combined portfolio strategies.

5.3 Portfolio analysis

In regression analysis it was discovered that there is relationship between abnormal returns for the period following earnings announcement and respective initial abnormal returns and volumes. In this section, we firstly investigate whether post-earnings announcement drifts are present on the Baltic stock exchanges according to results obtained from forming actual portfolios based on individual IAR as well as combined strategies of IAR and IAV[22]. Secondly, we examine whether profitable exploitation of the PEAD is possible, taking into account the costs associated with transactions.

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[21] For the approximation authors utilize the fact that the theoretical average SV of a stock as well as of the market is equal to 1. So it follows that the SV of the stock is expected to be 2 in case of twice the usual trading volume and this would yield the increase in the IAV by 1.

[22] Further in the study, due to many holding periods large number of possible portfolio strategies, short denotions will be used for clarity. For instance, IAR2(60) will refer to strategy of buying all stocks falling into

5.3.1 Presence and characteristics of post-earnings announcement drifts

Table 8 and 9 in appendix 4 report the average AR-s[23] and CAR-s for all IAR and IARxIAV strategies for holding periods of 5, 20, 60 and 120 days[24]. Out of 20 individual IAR strategies, 12 show statistically significant average AR-s. Concerning the combined strategies, out of 100 portfolios, statistically significant average AR-s are obtained in 39 times.

First conclusions can be drawn when looking at the sign of AR-s and distribution of the statistically significant portfolios on the "strategy matrix". It is observed that the third/middle quintile of IAR is part of significant portfolios in only 3 cases, all yielding positive average AR. At the same time all other positive average AR-s result from IAR4 or IAR5 individual or combined strategies. Except for one strategy, IAR5xIAV2(5), all other negative results fall into area of IAR1 and IAR2 individual or combined strategies. These results illustrate that positive average AR-s are generated within stocks which show positive IAR on the announcement day (the "good news"), corresponding to IAR 4th and 5th quintile. The negative average AR-s result almost exclusively from strategies which buy stocks from 1st and 2nd quintile of IAR, corresponding to negative movement on the announcement day (the "bad news"). What is more, the middle IAR area, the stocks which had small reaction on the announcement day ("no news"), shows almost no existence of significant abnormal returns. Additionally, without accounting for statistical significance, all portfolios created out of IAR1 and IAR2 individual or combined strategies resulted in negative average AR-s, while nearly all strategies which included stocks from IAR 4th and 5th quintile generated positive average AR-s. Taking it all together, following the earnings announcement, the stocks on the Baltic markets on average drift towards the direction of the initial reaction, measured in abnormal terms. In other words, if a company announces good news, its share price is expected to outperform the normal scenario; however, when reporting bad news, the stock will likely underperform relative to its expected normal return. Therefore, the results provide enough evidence to claim that post-earnings announcement drifts are present on the Baltic

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IAR2 portfolio and holding them until the next earnings announcement of the company or maximum of 60 days. Thus, the number in the parathesis is the maximum length of the holding period. Similar notaion will be used for combined strategies.

[23] "Average AR" refers to average abnormal return of all the stocks which were included in the portfolio and is also the metric which is tested for significance.

[24] In the same tables nominal returns and compared-to-market returns for the respective strategies are reported as well. Although irrelevant for this section, comparison will be drawn further in the paper.

stock exchanges, subject to model validity, which answers the first part of our research question.

The average abnormal returns for IAR1(5) and IAR2(5) strategies are equal to -1.13% and -1.37%, respectively, and are both significant at 1% level. This means that on average the stocks which performed worst on the announcement day continued drifting negatively for at least another 5 days following the earnings release. The results also show that negative significant average AR was the case for IAR1 and IAR2 portfolios for all holding periods and the AR-s are constantly decreasing (going more negative) in time. IAR1(120) and IAR2(120) strategies yield average AR-s of -11.99% and -17.88%, respectively. Moreover, average AR-s are positive and significant at 1% level for IAR4(20,60,120) strategy, being 3.54%, 4.69% and 4.59%, respectively, and IAR5(20) strategy yields significant average AR of 2.60%. When looking at the development of the statistically significant PEAD over holding periods, it can be seen that the drift is consistently increasing in time. However, when looking also at IAR3 and IAR5 strategies, which yielded mostly insignificant average AR-s, in both cases average AR for 60 and 120 days holding period is lower than for 20 days, which suggests that there was a reversal of the drift. Taking everything into account, it means that when assessing at four points in time – one week, month, quarter and half a year – there is some evidence that PEAD are in general increasing over holding period; however, clear conclusions cannot be drawn (see Figure 3 in Appendix 4). Moreover, it is found that significant short-term PEAD occurs only for negative IAR. Concerning the only possible comparison, Stasiulis (2009) found negative significant 3-day average AR for Lithuania and found no significant 3-day average AR for Estonia or Latvia. However, conclusive comparison cannot be drawn because of the different holding periods and the fact that he looks at each country separately.

An interesting phenomenon can be observed regarding the abnormal returns. Namely, AR for IAR2 strategy is lower than for IAR1, regardless the holding period. This means that on average companies which report moderately bad news experience relatively larger negative drift, compared to companies which announce even worse results, which is an unexpected finding. Similar result is also obtained for 20-days IAR4 and IAR5 strategies, where the latter has lower return than the former. One potential reason for such outcome could be that over the sample period, the mean IAR for lowest quintile is 8 times more negative than for the second lowest quintile, because there are lots of observations which have very large negative IAR, for example -15%. It can be speculated that such movements often happen due to low liquidity and are not true representation of market assessment towards the news; however, if the stock falls on the announcement day a lot, the drift naturally has much less if any more space towards the target level, which explains smaller average magnitude of PEAD.

Interestingly, the results show that the magnitude of the drift is around 3 times higher following negative earnings announcements compared to positive ones, depending on the exact holding period and portfolio strategy. Possible reason for this could be that if the short-selling is prohibited on the market, negative abnormal returns cannot be exploited, because extra selling pressure cannot be created; thus, leading to potential market inefficiencies.

Concerning the interactions between IAR and IAV, they are not clear cut; however, some observations are still valid. Firstly, across all holding periods' strategies of IAR1xIAV3 and IAR1xIAV4 yield significant negative AR-s. Moreover, all interaction portfolios between IAR2 and IAR1,2,3,4 result in significant negative outcomes for average AT-s, except for 5-days strategy. In other words, results show that the core of the negative abnormal returns is concentrated more towards middle level volumes, that is IAV quintiles 2,3 and 4. On the contrary, profitable trading strategies tend to be concentrated more towards the side quintiles, which makes this the area where one should be looking for profit exploitation. In general, IAV metric does not show systematic improvements in magnitudes of drifts; however, it recognizes many portfolios which have even higher significant average AR-s compared to individual strategy of constructing portfolios only based on IAR metric.

Perhaps the most interesting result out of the combined strategy is that IAR5xIAV2 for 5-days shows significant average AR of -1.68%. The other nearby strategies, although not significant, do not show very positive AR-s either. This means that trading strategy based on very high IAR and low IAV value does not create positive abnormal returns in the short-term, such as 5 days. Most likely the reason is that short-term reversals occur as a response to large price increase triggered by positive earnings announcement. However, it is still interesting that no other significant reversals are observed anywhere else, including the individual IAR strategies.

PEAD is often categorized as anomaly and with such phenomena it is never easy to provide explicit reasons for their existence. Therefore, one can only speculate regarding possible causes. The general view in the literature is that PEAD appear due to irrational behaviour of investors, e.g. leading to market being too slow at information incorporation (see for example Hong and Stein, 1999). One argument could be that although investors collectively act to the new information in correct way, they usually under-react on the announcement day. One reasonable argument would be that investors are too much short-term oriented. In that case, they usually instantly assess the news into positive and negative, based on key numbers such as profit and sales. However, after starting to digest the information later on, they realize that the future outlook of the company has also changed. Another logical argument derives from intuitive behaviour of investors who are hoping for better terms of trade. For example if a company announces unexpectedly bad results, there will be most likely a drop in the share price, caused by sell-off by current stockholders of the company. However, many investors most likely do not sell on the same day because they will be hoping for better terms of trade, in other words, they hope that the share price will increase a bit in few days, and then they can sell it on better terms. The same line of reasoning is applicable when a company announces positive results. Many investors, probably, are reluctant to buy the stock during or in the end of the announcement day, because they find it too expensive, and hope that the price will decrease in few days, which would provide a better level for opening a long position in the stock; thus, postponing the transaction and excess buying pressure, leading to share price increase later.

5.3.2 Profitable exploitation of PEAD

Short-selling on the Baltic stock exchanges is not allowed; thus, one cannot possibly take market neutral positions and profit from decrease in share price. As it is found out, the negative AR-s have in general larger PEAD magnitude compared to positive ones, which makes it increasingly difficult to find a profitable investment strategy exploiting the existence of PEAD on the Baltic markets while providing positive abnormal returns to the investors. Moreover, the investments into long positions cannot be financed through short-selling. Thus, we are using a portfolio strategy, which assumes certain borrowing and round-trip transaction costs. Tables 10-22 provide outputs to all possible trading strategies with sensitivity analysis concerning transaction and borrowing costs incorporated into the tables due to the fact that various local and international investors can possibly attract funds and make transactions on different terms.

As the negative CAR-s cannot be possibly exploited, the analysis will further continue based on positive ones. However, in order to be sure that the strategy is profitable the important condition is that it must have positive significant average AR, in other words, we are looking only at strategies which experienced significant positive PEAD. Otherwise the outcome could have occurred just through chance. Moreover, as the CAR of a strategy is the outcome of individual AR-s, it means that if average AR is significantly different from zero and we are including all the stocks in the portfolio, the CAR must be significant as well.

The total number of strategies which generate significant positive CAR-s before any costs is 18[25]. All of them remain profitable when we account for borrowing costs of 7% and roundtrip transaction costs of 2%. However, when looking at our baseline scenario of 4% roundtrip transaction costs and 10% annual interest rate for borrowing, 8 strategies out of initial 18 remain profitable, which all are actually combined strategies of IAR and IAV metric, implying that IAV might have positive effect when selecting portfolios. For comparison, only one strategy out of all insignificant portfolios has positive CAR after accounting for transaction costs. Out of the 8 selected portfolios, by far the most profitable strategies are IAR4xIAV1(60,120), which generate CAR of 46.35% and 48.73%, respectively, for each holding period. CAR-s for all remaining strategies[26] are below 7.43%.

Cumulative abnormal return of 46.35% per quarter is definitely an impressive number, and if we would be able to reduce transaction and borrowing costs to 2% and 7%, respectively, we would end up with 74.25% CAR for 60 days holding period, which is an outstanding return. However, there are few major problems, which make the real life implication potentially unreasonable.

Firstly, if we consider all the 8 significant CAR strategies, the problem that they do not have too much in common arises. To be more exact, although 6 out of 8 are based on either IAR4 or IAR5 quintile, they are significant in different holding periods, all becoming in a way special cases sharing no systematic characteristics. The dispersion leads to situation where there is no clear and simple target and rule for portfolio formation, and this becomes a problem when the portfolio formation is based on model, which can as well be to some extent misspecified. To draw an example, for obtaining high CAR, instead of aiming to follow a strategy of IAR5xIAV5, the investor has to follow IAR4xIAV1. The first strategy should also imply that there is certain linear or similar trend towards higher returns, for example higher CAR-s are achieved when buying stocks which have the highest IAR and IAV. Consequently, when looking at the CAR of a “neighbouring strategy“ in the matrix, for example, IAR5xIAV4, it does not differ drastically, leaving the investor some room for estimation errors. However, in the current case, where the investor should follow exactly the strategy of IAR4xIAV1, there is little if any room for estimation errors. Out of 5 “neighbouring strategies” around IAR4xIAV1(60), only one of them (IAR4xIAV2) yields positive CAR after deducting baseline transaction and borrowing costs. Thus, investor cannot

[25] These strategies are: IAR4(20,60,120); IAR5(20); IAR4xIAV1(20,60,120); IAR4xIAV2(20,60); IAR4xIAV4(20), IAR4xIAV5(20); IAR5xIAV3(20,60,120); IAR5xIAV5(20); IAR3xIAV3(60); IAR3xIAV4(60,120)

[26] These include: IAR4xIAV1(20); IAR3xIAV4(60,120); IAR4xIAV2(60); IAR5xIAV3(60,120)

allow for any deviations, because it could yield a substantial negative outcome, up to -90% in this specific case. It is also found that transaction costs eat up to 30-90% of profitability, which is in line with the findings from literature.

However, the non-systematic trend concerning the portfolios raises additional issue. Namely, that one cannot be sure that exactly this specific portfolio will remain the best at CAR-s generation in future as well. As there is no clear economic reason why exactly this portfolio should perform the best in abnormal terms, it could as well be that it will change the location on the matrix to the neighbouring or further away specific strategy and there is no way for investor to know it in advance. Although the same uncertainty argument applies to any strategies on stock markets which are determined via using past data including the situation where an investor aims at corner portfolio as well (the illustrative IAR5xIAV5 case), it is reasonable to assume that changes in such more linear and systematic relation between metrics and returns take place more gradually; thus, having more predictable outcome and being less risky.

Moreover, there is an additional cost which is not incorporated in any of the strategies, namely income tax on capital gains. If an investor is pursuing any profitable strategy, he/she must also make provision for taxes. However, it is nearly impossible to account for income tax giving a specific number, because of several reasons. Firstly, the tax rules and rates have changed throughout the study period and differ in countries, each presenting possible opportunities for different tax scheme. Moreover, different investors might be subject to different taxation rules, especially if the investor originates outside of the Baltics; thus, while transaction and borrowing costs cannot differ substantially among investors and sensitivity analysis should present estimates for different investors, effective tax rates might vary substantially from investor to investor and are out of the scope of this research. However, what can be said is that taxes will eventually make returns lower. When looking at the recent income and capital gain taxes in the Baltics, a relatively fair estimate is that taxes would deduct another 15-25 per cent of profits on average (Global Property Guide, 2010). However, it could as well be that the profit generation from certain portfolios is concentrated only into few years out of 9; thus, possibly increasing the effective tax rate substantially.

Given the described risks associated with non-systematic allocation of profitable strategies, deducting possible taxes and adding the fact that all these portfolios still carry market risk, it is natural that at least any other portfolio except for IAR4xIAV cannot be considered as viable option for potential profiting, as abnormal returns below 8% are not that extreme anymore. Furthermore, in addition to the non-systematic profiting strategies argument, there is no good economic justification for why exactly IAR4xIAV1 strategy, which yields return of 48.73% per holding period of 120 days, is the most profitable one; thus, it could have actually occurred by chance. Therefore, the results do not provide enough evidence that PEAD can be profitably exploited on the NASDAQ OMX Baltic stock exchanges.

To sum it up, our findings suggest that PEAD are present on the Baltic stock exchanges and some significantly positive strategies remain profitable in abnormal terms even after applying transaction costs. However, effectively only one strategy remained profitable enough in order to consider exploitation; thus, in many cases, even higher significant CAR-s would be needed, while most importantly, the strategies should be more consistent with respect to each other and share more systematic characteristics, so that there would be more room for model errors. This all means that investors cannot profit based on past information, which is an argument for market development, that is, Efficient Market Hypothesis cannot be formally rejected.

However, even if one considers the possibility of conducting the real-life trading using the most profitable CAR strategy disregarding the risk of 'not hitting' the right portfolio, the actual profitability of the strategy should also be assessed. Tables 10-22 in appendix 4 present the CNR-s of the trading strategies after accounting for transaction costs. As it can be seen, the positive CAR does not always imply that the return is favourable for the investor. For example, for IAR4xIAV1(120), the most profitable CAR strategy, the nominal return after accounting for transaction costs and borrowing costs would have been -43.02% with baseline scenario and -14.75% with transaction cost of 2% and borrowing cost of 7%. The CNR-s for other positive CAR-s were also mixed. This provides extra support to the finding that investors should not be willing to exploit the PEAD considering the risks. When talking in general terms, CNR-s for top two IAR quintiles are on average substantially higher than CNR-s for lowest quintiles, which shows that there is positive relationship between IAR and CNR, being in line with finding that CAR-s are positively correlated with IAR. Another interesting finding concerning CNR is that when looking at nominal returns of different strategies, then, actually, the IAR2 portfolios have higher CNR-s than IAR4, which again emphasizes the difference between two metrics. What it essentially means is that although in abnormal terms the IAR4 strategy generated higher return, the realized value was higher for IAR2 portfolio; thus, investor would have profited more in monetary terms in the latter case. When we consider the formula where AR is equal to NR minus expected return of the stock, easy rearranging gives us the result that the reason for such situation is that the stocks in

IAR2 portfolio had on average higher expected returns compared to IAR4 strategy. Thus, they showed very good performance during the estimation period, but after negative earnings announcement the return was relatively weaker; however, still positive in nominal terms. The explanation can be found when looking at the MAR model for the same portfolios (see tables 10-22 in appendix 4), which reveals that IAR2 portfolios performed largely in line with market; thus, the beta was roughly equal to 1, which means that high expected return can only come from high positive alphas, which are often the case when estimating models in case of infrequent trading.

5.4 Robustness and validity of the results

As discussed in the methodology section we check the robustness of the results with compared-to-market-return model, which measures the excess return of the stock to market. Naturally, given the simplicity of the model, we do not expect it to replicate the results when using AR metric; however, it should indicate at least the general picture. The MAR measure shows that IAR5 portfolio generates significant (at 1% level) positive excess returns compared to market in all the holding periods, while the drift compared to market increases in magnitude over time. Moreover, it reports that IAR2(5) and IAR3(20) strategies had significant negative excess returns to market. The MAR measure confirms that in case of good news, significant positive PEAD relative to market occur; however, it provides only weak evidence of the presence of negative drifts.

Meanwhile, most of the significant abnormal returns based on the AR measure are located in the bottom-quintile portfolios and have negative values, in most of the cases being significant at 5% or 1% level. Moreover, the portfolio returns which were found to be significant using the MAR metric, do not experience positive significant returns when the AR is used, e.g. for IAR5 portfolio only the holding period of 20 days yielded significantly positive abnormal return using AR metric.

However, it should be stressed that since the IAR metrics for AR and MAR strategies are calculated differently, seemingly same portfolios are likely to consist of different stocks and, thus, are directly incomparable. The fact may well be the reason for difference in significance levels across the same portfolios for the AR and MAR. Disregarding the significance of the returns, though, one can compare the ‘general trend’ in the distribution of the returns over different quintile portfolios for both the AR and MAR. This then shows that, in general, bottom-quintile portfolios for both metrics are associated with more negative returns if compared to top-quintile portfolios. The finding holds for both IAR and simultaneous IAR and IAV strategies. This implies that even though the compared-to-market-return model does not show strong support of the findings obtained via the AR model, it does not contradict it either.

A general point regarding the market model with Scholes-Williams betas, which was used for calculating AR-s, though, is that the model might not be able to provide valid estimates of the coefficients. Even though the Scholes-Williams adjustment accounts for thin trading, on many occasions the shares on the Baltic markets experienced extremely infrequent trading, thus making estimation of their normal return practically impossible. This, consequently, might lead to misspecification of the model. However, one cannot correct for it since, as it has already been argued, the market model is essentially the best to apply for the case of Baltic stock markets, as all other models would have possibly even more problems concerning the validity.

Apart from the possible bias of model misspecification, the results of the study may also be subject to other biases which cannot be controlled for. One of the main problematic points is the survivorship bias, i.e. the fact that we were able to access the data only for those stocks which were traded on the Baltic stock exchanges in the end of December 2009. Naturally, in the previous years, some stocks were delisted and it might have been the case that their price performance could have strengthened the evidence of either existence or absence of PEAD on the Baltic stock exchanges. Moreover, since the market SV, which is used for calculation of the IAV, is obtained using stock-specific volumes, it can be biased since it does not represent the true market scaled volume, because volumes of not all of the stocks which were traded on the market on a particular day are used to calculate it. Thus, the IAV metric can be biased leading to inappropriate attribution of stocks to portfolios and ambiguous regression results.

The applicability and external validity of the study may also be undermined if market conditions change, leading to disappearance of PEAD. The latter may be a result of, for example, a change in the patterns of management announcements, e.g. management forecasts of earnings might become more common; thus, leading to possible switch of abnormal returns to earnings forecasts dates. Another significant change in the market conditions would be abolition of short-selling constraints, allowing for more selling pressure in case of negative PEAD.

Finally, one should bear in mind that in this paper only certain strategies are simulated and evaluated for profitability. Although such strategies are to our view the most logical and have clearly understandable economic reasoning, one can possibly create numerous other strategies, which could possibly lead to higher profitability. Therefore, the results of the paper hold only with respect to the particular strategies investigated.

To sum up, we tried to minimize the errors associated with conducting the study; however, the potential effect of biases and possible model misspecification remains unknown.

6 Conclusion

The thesis has investigated the presence of the post-earnings announcement drifts on the Baltic stock exchanges. For this reason the data on earnings announcements and stock prices of the companies listed on the NASDQ OMX Baltic stock exchanges were collected for the period of 10 years from 2000 to 2009. Altogether, 2,668 earnings announcements were investigated. One of the clear merits of the research compared to most of the previous studies is that all the earnings announcements dates and times were hand-collected, leading to very high quality of the data and creating no bias from data perspective.

The thesis conducted regression analysis and used trading strategy approach to examine whether the post-earnings announcement drifts are present in the Baltics and whether a profit-maximizing investor could earn significant abnormal returns on them. In order to determine the presence of PEAD, normal performance of stocks was estimated using a market model approach, while applying Scholes-Williams estimation of alphas and betas to correct for thin trading. Further on, portfolios were created based on two metrics – initial abnormal return and initial abnormal volume. The performance of portfolios was compared to the predicted scenario in order to identify any systematic deviations on the portfolio trading strategy level. Finally, the significance and magnitude in determining average abnormal returns and cumulative abnormal returns was examined to draw conclusion.

It was found that PEAD exists on the Baltic stock exchanges for trading strategies with holding periods of 5, 20, 60 and 120 days with the majority of the significant abnormal returns lying within IAR1 and IAR2 portfolios both for individual IAR as well as combined IAR and IAV strategies. Most of the significant abnormal returns were negative, while 18 strategies yielded significant positive average abnormal returns. The highest cumulative abnormal return was found for IAR4xIAV1(120) strategy, being equal to 112.31% per year. Concerning the individual strategies, IAV4 strategy yielded 254.33% cumulative abnormal return per annum, while being significant at 1% level.

When accounting for transaction and borrowing costs, only 8 portfolios retained positive CAR values, highest of which remained with the IAR4xIAV1(120) strategy and returned 48.73% of average CAR per year. Nevertheless, the positive CAR-s after accounting for transaction and borrowing costs seem to appear rather non-systematically and have no real economic justification, which leads to conclusion that it is safer for a profit-maximizing investor not to try exploiting PEAD on the Baltics stock markets. The study goes by and large in line with findings across other countries which say that PEAD are mostly present but are not exploitable due to different factors, such as high transaction cost. Concerning combined strategies, we obtain consistent results with Börjesson that volume provides mixed explanations.

When assessing the potential realized profitability of the trading strategies, the nominal returns of the portfolios were also examined. The comparison of CNR-s and significant positive CAR-s showed that even though abnormal returns could have been present, it was hard to profit from those due to the fact that after deducting borrowing and transaction costs, the cumulative nominal returns for profitable CAR strategies were often negative.

Finally, when performing robustness checks to the market model with Scholes-Williams betas, no clear support or contradictions concerning the validity of the model were found. This suggests that too strong conclusions should not be drawn, especially when considering few other biases of the study. This leads us to conclude that there is weak evidence that the post-earnings announcement drifts are present on the NASDAQ OMX Baltic stock exchanges; however, no formal rejection of the Efficient Markets Hypothesis is done, because there is hardly any viable profiting strategy from the drifts. Even though the result means that Baltic markets are fairly developed and efficient as no clear profiting strategy was found, there is still room for development, since significant drifts existed over the studied period.

Although the research question of the study was answered, there is space for further research on the topic. Firstly, analysis of post-earnings announcement drifts could be done using different models to estimate normal return. Secondly, applicability of the market model to modelling the price changes on the Baltic stock exchanges could be investigated deeper. Together with this, it could be investigated how the methodology on adjusting for thin trading could be improved. Thirdly, the analysis of determining the model best describing prices on the Baltic stock markets could be conducted. Finally, the short-term and medium-term pre-earnings announcement drifts on the Baltic stock markets should be investigated in more detail. Moreover, adding firm-fixed effects such as size and actual profitability could be studied. Finally, looking at information content of earnings announcement, for example separate those which mention forecast for dividends, could be potentially yielding.

Speaking about the possible suggestions for policy implementation that have stemmed out of the study, the main one regards short-selling constraints. Constraints on short-selling are generally thought to reduce efficiency of the market and, thus, on its ability to reflect the current fair values of the companies. In our case inability to short-sell could have led to excessive negative values of PEAD observed in the sample and, subsequently, to a smaller degree of market efficiency. Moreover, measures to unify the stock markets and introduce a common trading currency, Euro, could be taken. This, consequently, should increase the market liquidity due to lower trading costs for foreign investors and lead to more correct pricing of the currently illiquid stocks. Additionally more companies could be attracted to increase the trading volumes in absolute values.

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Appendix 1

Table 3. List of abbreviations and variables. *Source: created by authors.*

Abbreviation/Variable	Description
AR	Abnormal return over the post earnings-announcement holding period
CAR	Cumulative abnormal return over the post earnings-announcement periods within one year.
CMAR	Cumulative return compared to market over the post earnings-announcement periods within one year.
CNR	Cumulative normal return over the post earnings-announcement periods within one year.
D_YEAR	Dummy variable for a particular year in regressions 2-10. It is equal to 1 in case the observation was recorded after the respective year, and is equal to 0 in case the observation was recorded either on a respective year or prior to it.
DAR	Daily average abnormal return (abnormal return for the period adjusted by the number of days in the period)
IAR	Initial abnormal return
IAR_D_YEAR	Interaction term between IAR and D_YEAR
IAV	Initial abnormal volume
IAV_NEGAT_IAR	Interaction term between NEGAT_IAR and IAV
MAR	Compared-to-market return over the post earnings-announcement holding period
NEGAT_IAR	Dummy variable which is equal to 1 in case IAR<0 and is equal to 0 otherwise.
NR	Nominal return over the post earnings-announcement holding period
PEAD	Post-earnings announcement drift
SV	Scaled volume

Appendix 2

Table 4. Descriptive statistics for regression specifications (1)-(10). *Source: created by authors using NASDAQ OMX Baltic (2009a) database.*

Variable	Mean	Median	Std. dev	# of observations
DAR (general)	-0.0014	-0.0002	0.0074	2668
IAR (general)	0.0043	0	0.0536	2668
DAR (before and including 2000)	-0.0012	0	0.0081	155
IAR (before and including 2000)	0.0018	0	0.0343	155
DAR (after 2000)	-0.0014	-0.0002	0.0074	2513
IAR (after 2000)	0.0044	0	0.0545	2513
DAR (before and including 2001)	-0.0011	0	0.0073	334
IAR (before and including 2001)	0.0005	0	0.0312	334
DAR (after 2001)	-0.0014	-0.0003	0.0075	2334
IAR (after 2001)	0.0048	0.0001	0.0560	2334
DAR (before and including 2002)	-0.0013	0	0.0073	512
IAR (before and including 2002)	0.0027	0	0.0334	512
DAR (after 2002)	-0.0014	-0.0003	0.0075	2156
IAR (after 2002)	0.0046	0.0001	0.0573	2156
DAR (before and including 2003)	-0.0013	0	0.0076	716
IAR (before and including 2003)	0.0031	0	0.0359	716
DAR (after 2003)	-0.0014	-0.0003	0.0074	1952
IAR (after 2003)	0.0047	0.0002	0.0587	1952
DAR (before and including 2004)	-0.0011	0	0.0073	956
IAR (before and including 2004)	0.0046	0	0.0456	956
DAR (after 2004)	-0.0016	-0.0004	0.0075	1712
IAR (after 2004)	0.0040	0.0003	0.0575	1712
DAR (before and including 2005)	-0.0015	-0.0001	0.0081	1275
IAR (before and including 2005)	0.0046	0	0.0499	1275
DAR (after 2005)	-0.0012	-0.0003	0.0068	1393
IAR (after 2005)	0.0039	0.0005	0.0567	1393
DAR (before and including 2006)	-0.0013	0	0.0076	1618
IAR (before and including 2006)	0.0052	0	0.0535	1618
DAR (after 2006)	-0.0015	-0.0004	0.0073	1050
IAR (after 2006)	0.0029	0.0005	0.0537	1050
DAR (before and including 2007)	-0.0015	-0.0002	0.0074	2005
IAR (before and including 2007)	0.0045	0	0.0521	2005
DAR (after 2007)	-0.0011	-0.0001	0.0076	663
IAR (after 2007)	0.0034	0.0010	0.0579	663
DAR (before and including 2008)	-0.0015	-0.0002	0.0074	2391
IAR (before and including 2008)	0.0044	0	0.0523	2391
DAR (after 2008)	-0.0002	0.0003	0.0076	277
IAR (after 2008)	0.0031	0.0016	0.0634	277

Table 5. Descriptive statistics for regression specifications (11)-(12). *Source: created by authors using NASDAQ OMX Baltic (2009a) database.*

Variable	Mean	Median	Std. dev	# of observations
DAR	-0.0015	-0.0003	0.0075	2537

IAV	1.8863	-0.1696	10.0741	2537
IAR	0.0042	0.0000	0.0546	2537

Appendix 3

Table 6. Effect of IAR on DAR over the post-announcement periods. *Source: created by authors.*

The table provides coefficients from OLS regressions for the whole sample (1) as well as for sample split by years (2)-(10). Highly leveraged observations were deleted from the sample. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent Variable: Average daily abnormal return over the post-announcement periods					
Regression	***1***	***2***	***3***	***4***	***5***
Year	General	2000	2001	2002	2003
IAR	0.0103***	0.0215	0.0277	0.0346***	0.0324***
	(0.0031)	(0.0353)	(0.0216)	(0.0134)	(0.0097)
D_YEAR	-	-0.0002	-0.0004	-0.0001	-0.0000
		(0.0007)	(0.0004)	(0.0004)	(0.0003)
IAR_D_YEAR	-	-0.0114	-0.0181	-0.0262*	-0.0251**
		(0.0354)	(0.0217)	(0.0138)	(0.0102)
Intercept	-0.0014***	-0.0013**	-0.0011***	-0.0014***	-0.0014***
	(0.0001)	(0.0006)	(0.0004)	(0.0003)	(0.0003)
R^2	0.0055	0.0057	0.0065	0.0080	0.0090
Adjusted R^2	0.0051	0.0046	0.0054	0.0069	0.0079
SER	0.0074	0.0074	0.0074	0.0074	0.0074
Number of observations	2668	2668	2668	2668	2668

Regression	***6***	***7***	***8***	***9***	***10***
Year	2004	2005	2006	2007	2008
IAR	0.0162**	0.0133**	0.0101**	0.0114***	0.0129***
	(0.0067)	(0.0060)	(0.0042)	(0.0038)	(0.0034)
D_YEAR	-0.0005	0.0003	-0.0001	0.0004	0.0014***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0005)
IAR_D_YEAR	-0.0080	-0.0051	0.0006	-0.0036	-0.0175*
	(0.0076)	(0.0068)	(0.0061)	(0.0066)	(0.0091)
Intercept	-0.0011***	-0.0016*	-0.0014***	-0.0015***	-0.0016***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
R^2	0.0072	0.0063	0.0056	0.0061	0.0107
Adjusted R^2	0.0060	0.0052	0.0045	0.0050	0.0096
SER	0.0074	0.0074	0.0074	0.0074	0.0074
Number of observations	2668	2668	2668	2668	2668

*,**,*** denote significance at 10%, 5% and 1% level respectively.

Table 7. Effect of IAV on DAR over the post-announcement periods. *Source: created by authors.*

The table provides coefficients from OLS regressions (11) and (12). Highly leveraged observations were deleted from the sample. Heteroskedasticity-robust standard errors are reported in parentheses.

Dependent Variable: Average daily abnormal return over the post-announcement periods		
Regression	***11***	***12***
IAV	0.00003**	0.00001
	(0.00001)	(0.00001)
IAR	-	0.0095***
		(0.0032)
IAV_NEGAT_IAR	-0.00003	$-7.47*10^{-6}$
	(0.00002)	(0.0000)
Intercept	-0.0015***	-0.0015***
	(0.0002)	(0.0002)
R^2	0.0012	0.0055
Adjusted R^2	0.0004	0.0043
SER	0.0075	0.0075
Number of observations	2537	2537

*,**,*** denote significance at 10%, 5% and 1% level respectively.

Appendix 4

Table 8. Average annual and simple average abnormal, nominal and compared-to-market return of IAR trading strategy with zero borrowing and transaction costs. *Source: created by authors.*

*The table shows cumulative average annual and simple average AR, NR and MAR assuming zero borrowing and transaction costs. Cumulative average annual numbers (denoted by CUM) are calculated as the sum of ARs, NRs and MARs for all transactions over the sample divided by nine. Simple average numbers (denoted by AVG) are calculated as an arithmetic mean of all ARs, NRs and MARs for all transactions over the sample. Threshold values for IAR quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. Simple averages of AR and MAR are tested for significance using a conventional T-test. *,**,*** denote significance at 10%, 5% and 1% level respectively.*

		Initial abnormal return (IAR) percentiles														
		Abnormal return (AR)					Nominal return (NR)					Compared-to-market return (MAR)				
		IAR 1	IAR 2	IAR 3	IAR 4	IAR 5	IAR 1	IAR 2	IAR 3	IAR 4	IAR 5	IAR 1	IAR 2	IAR 3	IAR 4	IAR 5
5 days	AVG	-1.13%***	-1.37%***	0.29%	0.00%	0.48%	-0.49%	0.07%	0.32%	-0.46%	0.71%	0.25%	-0.66%*	-0.20%	0.34%	0.93%**
	CUM	-57.85%	-61.91%	11.80%	0.11%	24.71%	-24.94%	3.07%	13.17%	-22.00%	36.26%	13.40%	-29.41%	-8.11%	16.36%	48.65%
20 days	AVG	-4.22%***	-7.81%***	0.99%	3.54%***	2.6%**	1.08%	0.98%	0.38%	0.42%	4.86%	0.22%	0.11%	-0.93%*	-0.33%	2.55%***
	CUM	-216.37%	-354.79%	40.13%	170.72%	133.35%	55.48%	44.74%	15.59%	20.09%	249.25%	11.77%	5.04%	-37.15%	-15.72%	132.94%
60 days	AVG	-9.83%***	-15.07%***	1.65%	4.69%***	1.24%	0.92%	3.70%	1.96%	1.97%	7.30%	-1.22%	-0.18%	0.42%	1.47%	4.12%***
	CUM	-556.77%	-748.71%	74.81%	254.33%	69.68%	52.39%	183.91%	89.00%	106.79%	412.23%	-71.30%	-8.66%	19.59%	74.98%	236.74%
120 days	AVG	-11.99%***	-17.88%***	1.44%	4.59%***	1.64%	0.67%	3.93%	2.01%	2.37%	8.73%	-1.33%	0.03%	0.23%	2.21%	4.9%***
	CUM	-679.16%	-887.94%	65.36%	249.12%	92.56%	38.16%	195.02%	91.25%	128.83%	492.51%	-78.10%	1.69%	10.78%	112.49%	281.34%

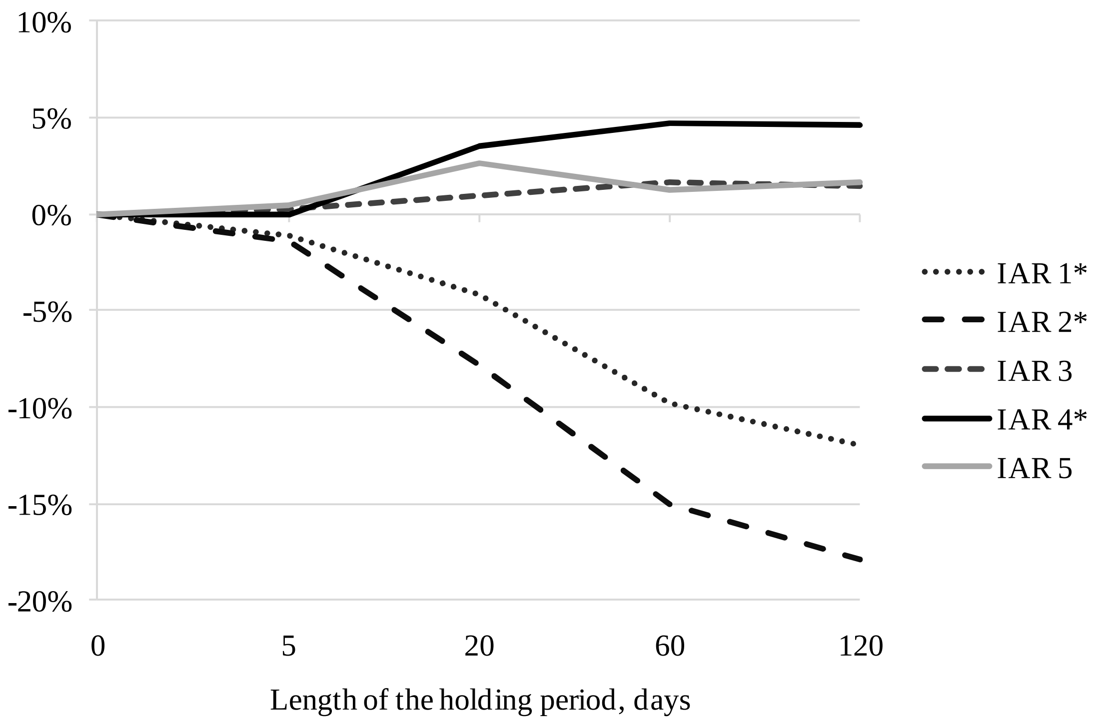

Figure 3. Development of average abnormal return over time for different IAR portfolios. *Source: created by authors.*
* denote IAR portfolios for which average abnormal returns are significant in majority of times.

Table 9. Average annual and simple average abnormal, nominal and compared-to-market return of simultaneous IAR and IAV trading strategy with zero borrowing and transaction costs. *Source: created by authors*.

*The table shows average annual and simple average CAR, CNR and CMAR assuming zero borrowing and transaction costs. Average annual numbers (denoted by CUM) are calculated as the sum of CARs, CNRs and CMARs for all transactions over the sample divided by nine. Simple average numbers (denoted by AVG) are calculated as an arithmetic mean of all CARs, CNRs and CMARs for all transactions over the sample. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. Simple averages of AR and MAR are tested for significance using a conventional T-test. *,**,*** denote significance at 10%, 5% and 1% level respectively.*

			Initial abnormal return (IAR) percentiles														
			Abnormal return (AR)					Nominal return (NR)					Return compared to market (MAR)				
Initial abnormal volume (IAV) percentiles			IAR 1	IAR 2	IAR 3	IAR 4	IAR 5	IAR 1	IAR 2	IAR 3	IAR 4	IAR 5	IAR 1	IAR 2	IAR 3	IAR 4	IAR 5
5 days	IAV 1	AVG	-0.77%	-2.41%**	1.14%	1.09%	-0.01%	-0.12%	-0.90%	1.02%	0.38%	0.52%	0.19%	-1.22%	0.10%	0.61%	1.85%
		CUM	-5.68%	-28.12%	12.40%	10.13%	-0.02%	-0.87%	-6.30%	13.92%	6.45%	2.02%	1.87%	-12.92%	1.14%	5.65%	8.24%
	IAV 2	AVG	-1.26%	-2.48%**	0.04%	-0.35%	-1.68%*	-0.21%	-0.85%	0.09%	-1.23%	-1.28%	-0.12%	-1.4%*	-0.75%	0.60%	-0.89%
		CUM	-8.93%	-33.30%	0.48%	-3.88%	-8.41%	-1.52%	-11.46%	1.07%	-13.81%	-6.40%	-0.95%	-14.17%	-9.16%	7.61%	-5.44%
	IAV 3	AVG	-1.69%**	0.69%	0.00%	-0.83%	0.14%	-0.90%	1.47%	0.09%	-1.29%	-0.79%	0.69%	0.04%	-0.89%	0.30%	0.56%
		CUM	-19.50%	6.29%	-0.03%	-8.89%	1.06%	-10.44%	13.39%	0.60%	-13.90%	-5.87%	7.75%	0.45%	-6.24%	2.98%	3.91%
	IAV 4	AVG	-1.82%**	-1.30%	-1.40%	0.27%	-0.16%	-1.25%	0.11%	-1.41%	0.31%	0.10%	-0.40%	-0.39%	-0.20%	0.23%	0.35%
		CUM	-25.63%	-9.51%	-6.37%	2.90%	-1.75%	-17.64%	0.82%	-6.42%	3.23%	1.15%	-5.40%	-3.52%	-1.11%	2.05%	3.86%
	IAV 5	AVG	0.17%	0.72%	0.80%	-0.03%	1.43%	0.50%	2.69%	1.00%	0.22%	1.91%	0.96%	0.17%	2.18%	-0.28%**	1.61%*
		CUM	1.89%	2.73%	3.18%	-0.16%	33.83%	5.54%	10.18%	4.00%	1.41%	45.34%	10.12%	0.75%	7.27%	-1.93%	38.07%
20 days	IAV 1	AVG	-3.04%	-9.41%***	0.50%	5.31%***	1.41%	2.84%	0.83%	0.17%	-0.35%	3.01%	-0.39%	-0.56%	-0.68%	-2.95%*	-1.72%
		CUM	-22.28%	-109.73%	6.73%	49.60%	5.50%	20.82%	9.63%	2.38%	-3.24%	11.71%	-3.86%	-5.94%	-7.96%	-27.21%	-7.66%
	IAV 2	AVG	-7.19%	-7.97%***	-0.62%	3.59%*	0.28%	5.68%	0.66%	-0.70%	-2.41%	2.55%	1.86%	-0.08%	-1.26%	-3.45%	1.82%
		CUM	-51.10%	-107.21%	-7.49%	40.26%	1.42%	40.39%	8.88%	-8.41%	-27.09%	12.73%	14.29%	-0.82%	-15.38%	-21.46%	11.15%
	IAV 3	AVG	-7.15%***	-3.56%*	3.61%	1.36%	4.33%**	-1.61%	0.73%	2.51%	-1.36%	0.54%	-0.28%	0.98%	-2.45%*	1.21%	0.99%
		CUM	-82.68%	-32.43%	22.88%	14.53%	31.78%	-18.55%	6.68%	15.88%	-14.70%	4.05%	-3.14%	10.03%	-17.18%	11.97%	6.94%
	IAV 4	AVG	-4.36%*	-6.44%**	2.19%	3.67%*	1.05%	0.32%	0.47%	-0.27%	4.26%	3.57%	0.58%	-0.15%	0.97%	0.72%	2.41%**
		CUM	-61.50%	-47.96%	9.96%	38.75%	11.79%	4.55%	3.54%	-1.21%	44.93%	40.07%	7.84%	-1.33%	5.38%	6.41%	26.29%
	IAV 5	AVG	0.11%	-15.21%	2.01%	4.28%*	3.49%*	0.74%	4.24%	1.74%	3.13%	7.60%	-0.32%	0.68%	-0.60%	1.26%	4.07%**
		CUM	1.19%	-57.46%	8.04%	27.59%	82.87%	8.27%	16.01%	6.96%	20.17%	180.69%	-3.37%	3.10%	-2.02%	8.79%	96.22%
60 days	IAV 1	AVG	-6.62%	-15.71%***	-0.23%	9.32%***	0.61%	4.78%	3.59%	-0.99%	1.21%	3.75%	1.26%	-2.71%	0.80%	-1.80%	2.06%
		CUM	-51.49%	-212.98%	-3.56%	108.68%	3.05%	37.20%	48.61%	-15.74%	14.10%	18.74%	13.00%	-32.78%	12.16%	-18.78%	11.90%
	IAV 2	AVG	-8.10%	-16.8%***	-1.37%	5.49%*	1.23%	11.20%	2.74%	-0.57%	1.06%	6.84%	0.82%	-2.09%	-1.61%	5.62%	2.76%
		CUM	-63.04%	-240.76%	-17.90%	67.66%	6.83%	87.07%	39.24%	-7.53%	13.84%	38.00%	7.10%	-23.92%	-21.51%	74.31%	17.80%
	IAV 3	AVG	-13.81%***	-6.06%**	5.25%**	2.04%	6.21%*	-3.97%	4.84%	6.58%	-1.27%	2.24%	-2.6%**	0.87%	0.32%	0.38%	2.35%
		CUM	-179.51%	-56.51%	37.93%	23.12%	47.60%	-51.63%	45.17%	47.55%	-14.50%	17.43%	-32.40%	9.26%	2.52%	3.91%	17.74%
	IAV 4	AVG	-9.81%***	-16.00%***	6.06%**	2.68%	-4.72%	-1.32%	3.26%	5.62%	3.83%	3.92%	-1.75%	2.39%	2.45%	0.45%	1.62%
		CUM	-155.81%	-128.00%	30.32%	31.28%	-59.75%	-20.91%	26.08%	28.08%	44.65%	49.59%	-26.87%	22.79%	15.53%	4.28%	20.37%
	IAV 5	AVG	-8.75%**	-24.85%	6.64%	3.27%	2.83%	0.05%	5.58%	8.68%	6.74%	11.34%	-2.73%	4.00%	2.72%	1.51%	6.73%***
		CUM	-106.92%	-110.45%	28.03%	23.59%	71.96%	0.65%	24.82%	36.63%	48.71%	288.46%	-32.13%	15.99%	10.89%	11.27%	168.93%
120 days	IAV 1	AVG	-7.70%	-19.96%***	-0.41%	9.63%***	2.87%	5.14%	3.79%	-1.20%	1.76%	6.37%	1.78%	-2.15%	0.20%	-2.54%	3.90%
		CUM	-59.86%	-270.55%	-6.50%	112.31%	14.36%	40.00%	51.39%	-19.08%	20.55%	31.83%	18.43%	-26.08%	3.02%	-26.50%	22.51%
	IAV 2	AVG	-10.12%	-19.15%***	-0.89%	5.12%	8.42%	10.74%	3.04%	0.07%	2.05%	14.17%	0.52%	-2.09%	-0.58%	8.67%*	3.78%
		CUM	-78.74%	-274.42%	-11.70%	63.16%	46.81%	83.50%	43.56%	0.94%	25.31%	78.73%	4.50%	-23.95%	-7.71%	114.58%	24.35%
	IAV 3	AVG	-16.72%***	-6.86%**	4.00%	2.67%	6.22%*	-4.83%	5.66%	5.70%	-0.70%	2.39%	-2.78%**	0.44%	0.12%	0.83%	3.29%
		CUM	-217.34%	-64.06%	28.90%	30.28%	47.65%	-62.76%	52.81%	41.15%	-8.06%	18.58%	-34.64%	4.66%	0.94%	8.53%	24.87%
	IAV 4	AVG	-10.49%***	-20.17%***	6.14%**	1.83%	-5.84%	-0.75%	2.94%	5.90%	3.50%	4.06%	-1.36%	2.86%	1.32%	0.91%	1.43%
		CUM	-166.70%	-161.37%	30.72%	21.38%	-74.03%	-11.96%	23.50%	29.48%	40.88%	51.39%	-20.84%	27.32%	8.37%	8.65%	18.01%
	IAV 5	AVG	-12.81%**	-26.45%	5.67%	3.05%	2.27%	-0.87%	5.35%	9.18%	6.94%	15.34%	-3.87%*	3.78%	1.54%	0.97%	7.63%***
		CUM	-156.51%	-117.54%	23.94%	22.00%	57.77%	-10.61%	23.76%	38.76%	50.15%	311.98%	-45.55%	19.75%	6.16%	7.23%	191.58%

Table 10. Average annual cumulative abnormal, nominal and compared-to-market return of IAR trading strategy. *Source: created by authors.*

The table shows average annual CAR, CNR and CMAR in excess of the borrowing and transaction costs. Average annual CAR, CNR and CMAR is calculated as the sum of CARs, CNRs and CMARs for all transactions over the sample divided by nine respectively. Threshold values for IAR quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

				Initial abnormal return (IAR) percentiles														
				IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
				Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
				7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
Cumulative abnormal return (CAR)	**5 days**	Transaction costs	2%	-165.04%	-166.98%	-168.87%	-156.78%	-158.50%	-160.17%	-72.83%	-74.36%	-75.85%	-100.80%	-102.63%	-104.41%	-82.02%	-83.95%	-85.83%
			4%	-267.48%	**-269.43%**	-271.32%	-247.44%	**-249.16%**	-250.84%	-153.72%	**-155.25%**	-156.74%	-197.25%	**-199.08%**	-200.85%	-184.02%	**-185.95%**	-187.83%
			6%	-369.93%	-371.87%	-373.76%	-338.11%	-339.83%	-341.50%	-234.61%	-236.14%	-237.63%	-293.69%	-295.52%	-297.30%	-286.02%	-287.95%	-287.95%
	20 days	Transaction costs	2%	-337.48%	-345.13%	-352.58%	-462.31%	-469.13%	-475.77%	-55.54%	-61.61%	-67.51%	56.55%	49.29%	42.21%	12.11%	4.41%	-3.09%
			4%	-439.93%	**-447.58%**	-455.03%	-553.20%	**-560.02%**	-566.66%	-136.43%	**-142.49%**	-148.40%	-39.89%	**-47.16%**	-54.24%	-90.33%	**-98.03%**	-105.54%
			6%	-542.37%	-550.02%	-557.47%	-644.09%	-650.91%	-657.55%	-217.32%	-223.38%	-229.29%	-136.34%	-143.60%	-150.68%	-192.78%	-200.48%	-207.98%
	60 days	Transaction costs	2%	-724.39%	-746.73%	-768.57%	-894.63%	-913.81%	-932.55%	-59.05%	-76.83%	-94.20%	94.83%	73.81%	53.27%	-97.44%	-119.86%	-141.77%
			4%	-837.72%	**-860.07%**	-881.90%	-993.97%	**-1013.14%**	-1031.88%	-149.72%	**-167.50%**	-184.87%	-13.62%	**-34.64%**	-55.17%	-210.11%	**-232.53%**	-254.43%
			6%	-951.06%	-973.40%	-995.24%	-1093.30%	-1112.48%	-1131.21%	-240.38%	-258.16%	-275.54%	-122.06%	-143.08%	-163.62%	-322.77%	-345.19%	-367.10%
	120 days	Transaction costs	2%	-854.61%	-880.26%	-905.37%	-1039.48%	-1061.00%	-1082.05%	-77.63%	-99.46%	-120.98%	84.62%	61.51%	38.90%	-81.58%	-106.96%	-131.79%
			4%	-967.94%	**-993.59%**	-1018.70%	-1138.81%	**-1160.33%**	-1181.38%	-168.30%	**-190.13%**	-211.64%	-23.82%	**-46.94%**	-69.55%	-194.25%	**-219.63%**	-244.46%
			6%	-1081.27%	-1106.92%	-1132.03%	-1238.15%	-1259.67%	-1280.71%	-258.96%	-280.80%	-302.31%	-132.27%	-155.38%	-177.99%	-306.92%	-332.29%	-357.13%
Cumulative nominal return (CNR)	**5 days**	Transaction costs	2%	-132.14%	-134.08%	-135.97%	-92.03%	-93.76%	-95.44%	-71.69%	-73.22%	-74.71%	-123.14%	-124.97%	-126.75%	-71.17%	-73.12%	-75.01%
			4%	-234.58%	**-236.52%**	-238.41%	-182.92%	**-184.65%**	-186.32%	-152.80%	**-154.33%**	-155.82%	-219.81%	**-221.64%**	-223.42%	-173.84%	**-175.78%**	-177.68%
			6%	-337.03%	-338.97%	-340.86%	-273.81%	-275.54%	-277.21%	-233.91%	-235.44%	-236.93%	-316.48%	-318.30%	-320.08%	-276.50%	-278.45%	-280.35%
	20 days	Transaction costs	2%	-65.63%	-73.28%	-80.73%	-62.78%	-69.60%	-76.24%	-80.31%	-86.37%	-92.28%	-94.31%	-101.58%	-108.66%	127.75%	120.03%	112.51%
			4%	-168.08%	**-175.72%**	-183.18%	-153.67%	**-160.49%**	-167.13%	-161.42%	**-167.48%**	-173.39%	-190.98%	**-198.24%**	-205.32%	25.08%	**17.36%**	9.84%
			6%	-270.52%	-278.17%	-285.62%	-244.56%	-251.38%	-258.02%	-242.53%	-248.60%	-254.50%	-287.65%	-294.91%	-301.99%	-77.59%	-85.31%	-92.83%
	60 days	Transaction costs	2%	-115.23%	-137.58%	-159.41%	37.99%	18.82%	0.08%	-45.08%	-62.87%	-80.24%	-52.94%	-73.96%	-94.50%	244.77%	222.31%	200.36%
			4%	-228.56%	**-250.91%**	-272.75%	-61.34%	**-80.52%**	-99.25%	-135.97%	**-153.75%**	-171.13%	-161.61%	**-182.63%**	-203.17%	131.89%	**109.42%**	87.47%
			6%	-341.90%	-364.24%	-386.08%	-160.67%	-179.85%	-198.59%	-226.86%	-244.64%	-262.02%	-270.28%	-291.30%	-311.83%	19.00%	-3.47%	-25.42%
	120 days	Transaction costs	2%	-137.29%	-162.94%	-188.05%	43.48%	21.96%	0.92%	-51.96%	-73.80%	-95.31%	-35.90%	-59.02%	-81.63%	317.97%	292.53%	267.62%
			4%	-250.62%	**-276.27%**	-301.38%	-55.85%	**-77.37%**	-98.42%	-142.85%	**-164.69%**	-186.20%	-144.57%	**-167.69%**	-190.30%	205.09%	**179.64%**	154.73%
			6%	-363.96%	-389.61%	-414.72%	-155.18%	-176.70%	-197.75%	-233.74%	-255.58%	-277.09%	-253.24%	-276.35%	-298.96%	92.20%	66.75%	41.84%
Cumulative compared-to-market return (CMAR)	**5 days**	Transaction costs	2%	-97.05%	-99.05%	-101.00%	-122.65%	-124.34%	-125.98%	-91.57%	-93.07%	-94.54%	-83.16%	-84.95%	-86.71%	-60.41%	-62.38%	-64.31%
			4%	-202.60%	**-204.60%**	-206.55%	-211.76%	**-213.45%**	-215.10%	-171.34%	**-172.85%**	-174.32%	-178.27%	**-180.07%**	-181.82%	-164.63%	**-166.61%**	-168.53%
			6%	-308.16%	-310.16%	-312.11%	-300.87%	-302.56%	-304.21%	-251.12%	-252.63%	-254.10%	-273.38%	-275.18%	-276.93%	-268.85%	-270.83%	-272.75%
	20 days	Transaction costs	2%	-113.08%	-120.99%	-128.70%	-100.34%	-107.01%	-113.51%	-131.50%	-137.47%	-143.29%	-128.17%	-135.27%	-142.19%	9.53%	1.67%	-5.99%
			4%	-218.64%	**-226.55%**	-234.25%	-189.45%	**-196.12%**	-202.62%	-211.28%	**-217.25%**	-223.07%	-223.28%	**-230.38%**	-237.30%	-94.69%	**-102.56%**	-110.22%
			6%	-324.19%	-332.10%	-339.81%	-278.57%	-285.23%	-291.73%	-291.06%	-297.03%	-302.84%	-318.39%	-325.49%	-332.41%	-198.92%	-206.78%	-214.44%
	60 days	Transaction costs	2%	-244.23%	-267.21%	-289.66%	-152.96%	-172.02%	-190.65%	-118.11%	-136.29%	-154.05%	-74.57%	-94.24%	-113.46%	66.23%	43.33%	20.95%
			4%	-361.34%	**-384.32%**	-406.77%	-250.96%	**-270.02%**	-288.65%	-211.67%	**-229.84%**	-247.60%	-176.35%	**-196.02%**	-215.23%	-48.66%	**-71.56%**	-93.94%
			6%	-478.45%	-501.43%	-523.88%	-348.96%	-368.02%	-386.65%	-305.22%	-323.40%	-341.16%	-278.13%	-297.79%	-317.01%	-163.55%	-186.45%	-208.82%
	120 days	Transaction costs	2%	-257.85%	-283.69%	-308.98%	-146.61%	-167.33%	-187.60%	-137.36%	-160.10%	-182.50%	-43.73%	-66.24%	-88.29%	104.15%	78.43%	53.27%
			4%	-374.96%	**-400.80%**	-426.09%	-244.61%	**-265.33%**	-285.60%	-230.91%	**-253.66%**	-276.05%	-145.51%	**-168.02%**	-190.07%	-10.74%	**-36.46%**	-61.62%
			6%	-492.07%	-517.92%	-543.20%	-342.61%	-363.33%	-383.60%	-324.47%	-347.21%	-369.61%	-247.29%	-269.80%	-291.84%	-125.63%	-151.34%	-176.51%

Table 11. Average annual cumulative abnormal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 5 days. *Source: created by authors.*

The table shows average annual CAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 5 days. Average annual CAR is calculated as the sum of CARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-21.02%	-21.30%	-21.57%	-52.53%	-52.98%	-53.41%	-10.39%	-10.80%	-11.21%	-9.40%	-9.75%	-10.10%	-7.93%	-8.07%	-8.21%
	4%	-35.69%	**-35.97%**	-36.24%	-75.87%	**-76.31%**	-76.74%	-32.17%	**-32.58%**	-32.98%	-28.07%	**-28.42%**	-28.76%	-15.48%	**-15.63%**	-15.77%
	6%	-50.36%	-50.63%	-50.90%	-99.20%	-99.64%	-100.07%	-53.95%	-54.36%	-54.76%	-46.73%	-47.09%	-47.43%	-23.04%	-23.18%	-23.32%
IAV 2	2%	-23.81%	-24.08%	-24.34%	-61.43%	-61.94%	-62.44%	-24.62%	-25.08%	-25.52%	-27.36%	-27.79%	-28.20%	-18.87%	-19.06%	-19.24%
	4%	-38.03%	**-38.30%**	-38.57%	-88.32%	**-88.83%**	-89.33%	-48.62%	**-49.08%**	-49.52%	-49.81%	**-50.23%**	-50.65%	-28.87%	**-29.06%**	-29.24%
	6%	-52.26%	-52.53%	-52.79%	-115.21%	-115.72%	-116.22%	-72.62%	-73.08%	-73.52%	-72.25%	-72.68%	-73.09%	-38.87%	-39.06%	-39.24%
IAV 3	2%	-43.68%	-44.12%	-44.55%	-12.78%	-13.12%	-13.46%	-13.28%	-13.52%	-13.75%	-31.21%	-31.61%	-32.01%	-14.29%	-14.56%	-14.84%
	4%	-66.79%	**-67.23%**	-67.66%	-31.00%	**-31.34%**	-31.68%	-25.95%	**-26.19%**	-26.42%	-52.54%	**-52.95%**	-53.34%	-28.95%	**-29.23%**	-29.50%
	6%	-89.90%	-90.34%	-90.77%	-49.22%	-49.57%	-49.90%	-38.61%	-38.85%	-39.09%	-73.88%	-74.28%	-74.67%	-43.62%	-43.90%	-44.17%
IAV 4	2%	-55.16%	-55.69%	-56.21%	-24.85%	-25.13%	-25.40%	-15.90%	-16.07%	-16.24%	-19.19%	-19.58%	-19.97%	-25.23%	-25.66%	-26.07%
	4%	-83.38%	**-83.92%**	-84.44%	-39.52%	**-39.80%**	-40.07%	-25.01%	**-25.19%**	-25.35%	-40.30%	**-40.70%**	-41.08%	-47.68%	**-48.10%**	-48.52%
	6%	-111.60%	-112.14%	-112.66%	-54.19%	-54.46%	-54.73%	-34.12%	-34.30%	-34.47%	-61.41%	-61.81%	-62.20%	-70.12%	-70.55%	-70.96%
IAV 5	2%	-21.37%	-21.79%	-22.20%	-5.18%	-5.32%	-5.46%	-5.19%	-5.34%	-5.48%	-13.65%	-13.89%	-14.13%	-15.70%	-16.60%	-17.47%
	4%	-43.59%	**-44.01%**	-44.42%	-12.73%	**-12.88%**	-13.02%	-13.19%	**-13.34%**	-13.48%	-26.54%	**-26.78%**	-27.02%	-63.03%	**-63.93%**	-64.80%
	6%	-65.81%	-66.23%	-66.64%	-20.29%	-20.43%	-20.57%	-21.19%	-21.34%	-21.48%	-39.43%	-39.67%	-39.91%	-110.37%	-111.26%	-112.14%

Table 12. Average annual cumulative abnormal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 20 days. *Source: created by authors.*

The table shows average annual CAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 20 days. Average annual CAR is calculated as the sum of CARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-39.61%	-40.70%	-41.76%	-137.36%	-139.12%	-140.83%	-25.40%	-27.46%	-29.46%	27.50%	26.10%	24.73%	-3.71%	-4.30%	-4.87%
	4%	-54.28%	**-55.37%**	-56.43%	-160.69%	**-162.45%**	-164.16%	-52.51%	**-54.57%**	-56.57%	8.83%	**7.43%**	6.06%	-11.49%	**-12.08%**	-12.65%
	6%	-68.94%	-70.03%	-71.10%	-184.02%	-185.78%	-187.50%	-79.62%	-81.68%	-83.68%	-9.83%	-11.24%	-12.61%	-19.27%	-19.85%	-20.42%
IAV 2	2%	-67.90%	-68.96%	-69.99%	-139.00%	-141.02%	-142.97%	-35.81%	-37.59%	-39.32%	13.68%	11.99%	10.34%	-10.42%	-11.18%	-11.91%
	4%	-82.13%	**-83.18%**	-84.22%	-165.89%	**-167.90%**	-169.86%	-59.81%	**-61.59%**	-63.32%	-8.76%	**-10.45%**	-12.10%	-20.42%	**-21.18%**	-21.91%
	6%	-96.35%	-97.41%	-98.44%	-192.78%	-194.79%	-196.75%	-83.81%	-85.59%	-87.32%	-31.20%	-32.90%	-34.55%	-30.42%	-31.18%	-31.91%
IAV 3	2%	-110.04%	-111.78%	-113.48%	-53.96%	-55.31%	-56.63%	7.87%	6.91%	5.97%	-10.76%	-12.38%	-13.96%	14.45%	13.35%	12.29%
	4%	-133.15%	**-134.90%**	-136.59%	-72.18%	**-73.54%**	-74.85%	-4.80%	**-5.76%**	-6.70%	-32.09%	**-33.71%**	-35.29%	-0.22%	**-1.31%**	-2.38%
	6%	-156.26%	-158.01%	-159.70%	-90.40%	-91.76%	-93.08%	-6.70%	-6.70%	-6.70%	-53.42%	-55.04%	-56.62%	-14.89%	-15.98%	-17.05%
IAV 4	2%	-94.85%	-96.94%	-98.99%	-65.58%	-66.70%	-67.79%	-0.83%	-1.52%	-2.19%	13.81%	12.23%	10.70%	-14.74%	-16.41%	-18.04%
	4%	-123.07%	**-125.17%**	-127.21%	-80.47%	**-81.59%**	-82.68%	-9.94%	**-10.63%**	-11.30%	-7.31%	**-8.88%**	-10.41%	-37.18%	**-38.85%**	-40.48%
	6%	-151.29%	-153.39%	-155.43%	-95.36%	-96.48%	-97.56%	-19.05%	-19.74%	-20.42%	-28.42%	-29.99%	-31.52%	-59.63%	-61.30%	-62.93%
IAV 5	2%	-25.08%	-26.74%	-28.36%	-66.41%	-66.99%	-67.55%	-1.37%	-1.95%	-2.51%	12.32%	11.34%	10.39%	26.54%	22.94%	19.44%
	4%	-47.30%	**-48.96%**	-50.58%	-73.97%	**-74.54%**	-75.10%	-9.37%	**-9.95%**	-10.51%	-0.57%	**-1.55%**	-2.50%	-21.02%	**-24.61%**	-28.12%
	6%	-69.52%	-71.18%	-72.80%	-81.53%	-82.10%	-82.66%	-17.37%	-17.95%	-18.51%	-13.46%	-14.44%	-15.39%	-68.57%	-72.17%	-75.67%

Table 13. Average annual cumulative abnormal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 60 days. *Source: created by authors.*

The table shows average annual CAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 60 days. Average annual CAR is calculated as the sum of CARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			IAR 2			IAR 3			IAR 4			IAR 5		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-74.12%	-77.03%	-79.87%	-253.36%	-258.82%	-264.15%	-51.10%	-57.68%	-64.11%	74.25%	69.69%	65.23%	-11.70%	-13.65%	-15.56%
	4%	-89.67%	**-92.58%**	-95.43%	-280.47%	**-285.93%**	-291.26%	-82.66%	**-89.24%**	-95.67%	50.92%	**46.35%**	41.89%	-21.70%	**-23.65%**	-25.56%
	6%	-105.23%	-108.14%	-110.98%	-307.58%	-313.04%	-318.38%	-114.21%	-120.79%	-127.22%	27.59%	23.02%	18.56%	-31.70%	-33.65%	-35.56%
IAV 2	2%	-85.96%	-89.00%	-91.96%	-282.99%	-288.57%	-294.03%	-56.50%	-61.59%	-66.57%	31.76%	27.13%	22.61%	-9.47%	-11.61%	-13.69%
	4%	-101.52%	**-104.55%**	-107.52%	-311.66%	**-317.24%**	-322.70%	-82.72%	**-87.81%**	-92.79%	7.09%	**2.46%**	-2.06%	-20.58%	**-22.72%**	-24.81%
	6%	-117.07%	-120.11%	-123.07%	-340.32%	-345.91%	-351.36%	-108.94%	-114.04%	-119.01%	-17.58%	-22.20%	-26.72%	-31.69%	-33.83%	-35.92%
IAV 3	2%	-217.97%	-223.10%	-228.11%	-83.40%	-86.78%	-90.09%	16.44%	13.54%	10.71%	-10.19%	-14.57%	-18.85%	24.98%	21.98%	19.04%
	4%	-243.97%	**-249.10%**	-254.11%	-102.07%	**-105.45%**	-108.76%	2.00%	**-0.90%**	-3.73%	-32.86%	**-37.23%**	-41.51%	9.64%	**6.64%**	3.71%
	6%	-269.97%	-275.10%	-280.11%	-120.74%	-124.12%	-127.42%	-12.45%	-15.34%	-18.18%	-55.52%	-59.90%	-64.18%	-5.69%	-8.69%	-11.62%
IAV 4	2%	-202.85%	-209.14%	-215.27%	-151.27%	-154.26%	-157.18%	16.13%	14.41%	12.72%	-2.80%	-7.22%	-11.54%	-96.81%	-101.64%	-106.36%
	4%	-234.63%	**-240.91%**	-247.05%	-167.27%	**-170.26%**	-173.18%	6.13%	**4.41%**	2.72%	-26.13%	**-30.55%**	-34.88%	-122.15%	**-126.98%**	-131.70%
	6%	-266.41%	-272.69%	-278.83%	-183.27%	-186.26%	-189.18%	-3.87%	-5.59%	-7.28%	-49.46%	-53.89%	-58.21%	-147.48%	-152.31%	-157.03%
IAV 5	2%	-143.48%	-148.48%	-153.35%	-123.61%	-125.37%	-127.09%	15.98%	14.49%	13.04%	1.80%	-1.22%	-4.18%	-4.43%	-14.93%	-25.19%
	4%	-167.93%	**-172.92%**	-177.80%	-132.50%	**-134.26%**	-135.98%	7.53%	**6.05%**	4.60%	-12.64%	**-15.67%**	-18.62%	-55.32%	**-65.82%**	-76.08%
	6%	-192.37%	-197.36%	-202.24%	-141.39%	-143.15%	-144.87%	-0.91%	-2.40%	-3.85%	-27.09%	-30.11%	-33.07%	-106.21%	-116.71%	-126.97%

Table 14. Average annual cumulative abnormal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 120 days. *Source: created by authors.*

The table shows average annual CAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 120 days. Average annual CAR is calculated as the sum of CARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			IAR 2			IAR 3			IAR 4			IAR 5		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-83.48%	-86.80%	-90.05%	-312.52%	-318.64%	-324.63%	-55.27%	-62.36%	-69.30%	77.00%	72.07%	67.24%	-2.06%	-4.73%	-7.36%
	4%	-99.03%	**-102.35%**	-105.61%	-339.63%	**-345.75%**	-351.74%	-86.82%	**-93.92%**	-100.85%	53.67%	**48.73%**	43.91%	-12.06%	**-14.73%**	-17.36%
	6%	-114.59%	-117.91%	-121.16%	-366.74%	-372.86%	-378.85%	-118.38%	-125.47%	-132.41%	30.33%	25.40%	20.58%	-22.06%	-24.73%	-27.36%
IAV 2	2%	-102.97%	-106.56%	-110.08%	-318.06%	-324.23%	-330.26%	-53.69%	-60.28%	-66.79%	25.66%	20.35%	15.16%	30.20%	27.94%	25.73%
	4%	-118.52%	**-122.11%**	-125.64%	-346.73%	**-352.90%**	-358.93%	-79.91%	**-86.50%**	-93.01%	0.99%	**-4.31%**	-9.51%	19.09%	**16.83%**	14.62%
	6%	-134.08%	-137.67%	-141.19%	-375.40%	-381.57%	-387.60%	-106.13%	-112.73%	-119.23%	-23.68%	-28.98%	-34.18%	7.98%	5.72%	3.51%
IAV 3	2%	-258.04%	-264.12%	-270.07%	-91.80%	-95.54%	-99.20%	5.51%	1.77%	-1.92%	-4.12%	-8.95%	-13.68%	24.00%	20.56%	17.20%
	4%	-284.04%	**-290.12%**	-296.07%	-110.47%	**-114.21%**	-117.87%	-8.93%	**-12.67%**	-16.36%	-26.79%	**-31.62%**	-36.35%	8.67%	**5.23%**	1.87%
	6%	-310.04%	-316.12%	-322.07%	-129.13%	-132.87%	-136.53%	-23.37%	-27.11%	-30.80%	-49.45%	-54.29%	-59.01%	-6.67%	-10.10%	-13.46%
IAV 4	2%	-215.19%	-222.08%	-228.81%	-185.79%	-189.26%	-192.65%	16.30%	14.48%	12.70%	-13.46%	-18.20%	-22.83%	-112.34%	-117.69%	-122.92%
	4%	-246.97%	**-253.86%**	-260.59%	-201.79%	**-205.26%**	-208.65%	6.30%	**4.48%**	2.70%	-36.79%	**-41.53%**	-46.16%	-137.67%	**-143.02%**	-148.25%
	6%	-278.75%	-285.63%	-292.37%	-217.79%	-221.26%	-224.65%	-3.70%	-5.52%	-7.30%	-60.13%	-64.86%	-69.49%	-163.00%	-168.35%	-173.59%
IAV 5	2%	-194.93%	-200.70%	-206.35%	-131.32%	-133.33%	-135.30%	9.51%	6.93%	4.33%	-0.46%	-3.76%	-6.99%	-21.39%	-33.05%	-44.45%
	4%	-219.37%	**-225.15%**	-230.80%	-140.20%	**-142.22%**	-144.19%	1.07%	**-1.52%**	-4.12%	-14.90%	**-18.21%**	-21.44%	-72.28%	**-83.94%**	-95.34%
	6%	-243.82%	-249.59%	-255.24%	-149.09%	-151.11%	-153.08%	-7.38%	-9.96%	-12.56%	-29.35%	-32.65%	-35.88%	-123.17%	-134.83%	-146.23%

Table 15. Average annual cumulative nominal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 5 days. *Source: created by authors*.

The table shows average annual CNR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 5 days. Average annual CNR is calculated as the sum of CNRs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-16.22%	-16.50%	-16.77%	-20.95%	-21.21%	-21.47%	-14.68%	-15.19%	-15.69%	-28.66%	-29.30%	-29.91%	-6.12%	-6.26%	-6.41%
	4%	-30.89%	**-31.17%**	-31.44%	-34.95%	**-35.21%**	-35.47%	-42.01%	**-42.52%**	-43.03%	-62.21%	**-62.85%**	-63.47%	-13.89%	**-14.04%**	-14.19%
	6%	-45.55%	-45.83%	-46.10%	-48.95%	-49.21%	-49.47%	-69.34%	-69.86%	-70.36%	-95.77%	-96.41%	-97.03%	-21.67%	-21.82%	-21.96%
IAV 2	2%	-16.41%	-16.67%	-16.94%	-39.60%	-40.11%	-40.60%	-24.03%	-24.49%	-24.93%	-37.30%	-37.72%	-38.14%	-16.86%	-17.05%	-17.23%
	4%	-30.63%	**-30.90%**	-31.16%	-66.49%	**-67.00%**	-67.49%	-48.03%	**-48.49%**	-48.93%	-59.74%	**-60.17%**	-60.58%	-26.86%	**-27.05%**	-27.23%
	6%	-44.85%	-45.12%	-45.38%	-93.38%	-93.89%	-94.38%	-72.03%	-72.49%	-72.93%	-82.19%	-82.61%	-83.03%	-36.86%	-37.05%	-37.23%
IAV 3	2%	-34.62%	-35.06%	-35.49%	-5.68%	-6.03%	-6.36%	-12.66%	-12.90%	-13.13%	-36.45%	-36.85%	-37.25%	-21.45%	-21.73%	-22.01%
	4%	-57.73%	**-58.17%**	-58.60%	-23.90%	**-24.25%**	-24.58%	-25.32%	**-25.56%**	-25.80%	-58.00%	**-58.41%**	-58.80%	-36.34%	**-36.62%**	-36.89%
	6%	-80.84%	-81.28%	-81.71%	-42.12%	-42.47%	-42.81%	-37.99%	-38.23%	-38.46%	-79.56%	-79.96%	-80.36%	-51.23%	-51.51%	-51.78%
IAV 4	2%	-47.17%	-47.71%	-48.23%	-14.76%	-15.04%	-15.32%	-15.95%	-16.12%	-16.29%	-18.85%	-19.25%	-19.64%	-22.33%	-22.76%	-23.17%
	4%	-75.40%	**-75.93%**	-76.45%	-29.65%	**-29.93%**	-30.20%	-25.06%	**-25.24%**	-25.40%	-39.96%	**-40.36%**	-40.75%	-44.77%	**-45.20%**	-45.61%
	6%	-103.62%	-104.15%	-104.67%	-44.54%	-44.82%	-45.09%	-34.17%	-34.35%	-34.52%	-61.07%	-61.47%	-61.86%	-67.22%	-67.64%	-68.06%
IAV 5	2%	-17.72%	-18.14%	-18.55%	2.27%	2.13%	1.99%	-4.37%	-4.52%	-4.67%	-12.07%	-12.32%	-12.56%	-4.42%	-5.32%	-6.20%
	4%	-39.94%	**-40.36%**	-40.77%	-5.28%	**-5.43%**	-5.57%	-12.37%	**-12.52%**	-12.67%	-24.96%	**-25.21%**	-25.45%	-51.97%	**-52.87%**	-53.75%
	6%	-62.16%	-62.58%	-62.99%	-12.84%	-12.98%	-13.12%	-20.37%	-20.52%	-20.67%	-37.85%	-38.10%	-38.33%	-99.53%	-100.43%	-101.31%

Table 16. Average annual cumulative nominal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 20 days. *Source: created by authors*.

The table shows average annual CNR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 20 days. Average annual CNR is calculated as the sum of CNRs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	3.49%	2.40%	1.34%	-18.00%	-19.76%	-21.47%	-29.98%	-32.04%	-34.04%	-25.33%	-26.73%	-28.10%	2.50%	1.91%	1.34%
	4%	-11.17%	**-12.26%**	-13.33%	-41.33%	**-43.09%**	-44.80%	-57.31%	**-59.37%**	-61.38%	-44.00%	**-45.40%**	-46.77%	-5.28%	**-5.87%**	-6.44%
	6%	-25.84%	-26.93%	-27.99%	-64.66%	-66.42%	-68.14%	-84.65%	-86.70%	-88.71%	-62.66%	-64.07%	-65.44%	-13.06%	-13.65%	-14.22%
IAV 2	2%	23.58%	22.52%	21.49%	-22.91%	-24.92%	-26.88%	-36.73%	-38.51%	-40.24%	-53.66%	-55.35%	-57.00%	0.89%	0.14%	-0.60%
	4%	9.36%	**8.30%**	7.27%	-49.80%	**-51.81%**	-53.77%	-60.73%	**-62.51%**	-64.24%	-76.11%	**-77.80%**	-79.45%	-9.11%	**-9.86%**	-10.60%
	6%	-4.86%	-5.92%	-6.95%	-76.69%	-78.70%	-80.66%	-84.73%	-86.51%	-88.24%	-98.55%	-100.24%	-101.89%	-19.11%	-19.86%	-20.60%
IAV 3	2%	-45.92%	-47.66%	-49.36%	-14.85%	-16.20%	-17.52%	0.87%	-0.10%	-1.03%	-40.21%	-41.84%	-43.42%	-13.55%	-14.66%	-15.74%
	4%	-69.03%	**-70.77%**	-72.47%	-33.07%	**-34.42%**	-35.74%	-11.80%	**-12.76%**	-13.70%	-61.77%	**-63.39%**	-64.97%	-28.44%	**-29.55%**	-30.63%
	6%	-92.14%	-93.88%	-95.58%	-51.29%	-52.65%	-53.97%	-24.47%	-25.43%	-26.37%	-83.33%	-84.95%	-86.53%	-43.33%	-44.44%	-45.52%
IAV 4	2%	-28.79%	-30.89%	-32.93%	-14.08%	-15.20%	-16.29%	-12.01%	-12.70%	-13.37%	19.99%	18.42%	16.88%	13.55%	11.88%	10.25%
	4%	-57.01%	**-59.11%**	-61.15%	-28.97%	**-30.09%**	-31.18%	-21.12%	**-21.81%**	-22.48%	-1.12%	**-2.70%**	-4.23%	-8.90%	**-10.57%**	-12.20%
	6%	-85.24%	-87.33%	-89.38%	-43.86%	-44.98%	-46.07%	-30.23%	-30.92%	-31.59%	-22.23%	-23.81%	-25.34%	-31.34%	-33.01%	-34.64%
IAV 5	2%	-18.00%	-19.66%	-21.28%	7.06%	6.48%	5.93%	-2.46%	-3.04%	-3.60%	4.91%	3.93%	2.98%	124.36%	120.77%	117.26%
	4%	-40.22%	**-41.88%**	-43.50%	-0.50%	**-1.07%**	-1.63%	-10.46%	**-11.04%**	-11.60%	-7.98%	**-8.96%**	-9.91%	76.81%	**73.21%**	69.71%
	6%	-62.44%	-64.10%	-65.72%	-8.05%	-8.63%	-9.19%	-18.46%	-19.04%	-19.60%	-20.87%	-21.85%	-22.80%	29.25%	25.65%	22.15%

Table 17. Average annual cumulative nominal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 60 days. *Source: created by authors.*

The table shows average annual CNR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 60 days. Average annual CNR is calculated as the sum of CNRs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

Initial abnormal volume (IAV) percentiles	Transaction costs	Initial abnormal return (IAR) percentiles														
		IAR 1			IAR 2			IAR 3			IAR 4			IAR 5		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
		7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	14.57%	11.66%	8.82%	8.24%	2.78%	-2.56%	-63.50%	-70.08%	-76.51%	-20.33%	-24.89%	-29.35%	4.00%	2.05%	0.14%
IAV 1	**4%**	-0.98%	**-3.89%**	-6.74%	-18.87%	**-24.33%**	-29.67%	-95.28%	**-101.86%**	-108.29%	-43.66%	**-48.23%**	-52.69%	-6.00%	**-7.95%**	-9.86%
IAV 1	6%	-16.54%	-19.45%	-22.29%	-45.98%	-51.45%	-56.78%	-127.06%	-133.64%	-140.07%	-66.99%	-71.56%	-76.02%	-16.00%	-17.95%	-19.86%
IAV 2	2%	64.15%	61.11%	58.15%	-2.99%	-8.57%	-14.03%	-46.13%	-51.22%	-56.20%	-46.13%	-51.22%	-56.20%	21.70%	19.56%	17.47%
IAV 2	**4%**	48.59%	**45.56%**	42.59%	-31.65%	**-37.24%**	-42.70%	-72.35%	**-77.44%**	-82.42%	-72.35%	**-77.44%**	-82.42%	10.59%	**8.45%**	6.36%
IAV 2	6%	33.04%	30.00%	27.04%	-60.32%	-65.91%	-71.36%	-98.57%	-103.66%	-108.64%	-98.57%	-103.66%	-108.64%	-0.53%	-2.66%	-4.75%
IAV 3	2%	-90.08%	-95.21%	-100.22%	18.28%	14.89%	11.59%	26.06%	23.17%	20.34%	-48.04%	-52.42%	-56.70%	-5.52%	-8.57%	-11.55%
IAV 3	**4%**	-116.08%	**-121.21%**	-126.22%	-0.39%	**-3.77%**	-7.08%	11.62%	**8.72%**	5.89%	-70.92%	**-75.31%**	-79.59%	-21.08%	**-24.13%**	-27.10%
IAV 3	6%	-142.08%	-147.21%	-152.22%	-19.06%	-22.44%	-25.74%	-2.82%	-5.72%	-8.55%	-93.81%	-98.19%	-102.48%	-36.63%	-39.68%	-42.66%
IAV 4	2%	-67.95%	-74.23%	-80.37%	2.81%	-0.18%	-3.11%	13.89%	12.17%	10.48%	10.57%	6.14%	1.82%	12.53%	7.70%	2.98%
IAV 4	**4%**	-99.73%	**-106.01%**	-112.15%	-13.19%	**-16.18%**	-19.11%	3.89%	**2.17%**	0.48%	-12.77%	**-17.19%**	-21.51%	-12.81%	**-17.63%**	-22.35%
IAV 4	6%	-131.50%	-137.79%	-143.92%	-29.19%	-32.18%	-35.11%	-6.11%	-7.83%	-9.52%	-36.10%	-40.52%	-44.85%	-38.14%	-42.97%	-47.69%
IAV 5	2%	-35.92%	-40.91%	-45.79%	11.66%	9.90%	8.18%	24.58%	23.10%	21.65%	26.92%	23.90%	20.94%	212.07%	201.57%	191.31%
IAV 5	**4%**	-60.36%	**-65.36%**	-70.23%	2.77%	**1.01%**	-0.71%	16.14%	**14.66%**	13.21%	12.48%	**9.45%**	6.50%	161.18%	**150.68%**	140.42%
IAV 5	6%	-84.81%	-89.80%	-94.68%	-6.12%	-7.88%	-9.60%	7.69%	6.21%	4.76%	-1.97%	-4.99%	-7.95%	110.30%	99.80%	89.53%

Table 18. Average annual cumulative nominal return of simultaneous IAR and IAV trading strategy for the holding period of no longer than 120 days. *Source: created by authors*.

The table shows average annual CNR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 120 days. Average annual CNR is calculated as the sum of CNRs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

Initial abnormal volume (IAV) percentiles	Transaction costs	Initial abnormal return (IAR) percentiles														
		IAR 1			IAR 2			IAR 3			IAR 4			IAR 5		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
		7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	16.38%	13.06%	9.81%	9.43%	3.30%	-2.69%	-68.07%	-75.17%	-82.11%	-14.75%	-19.69%	-24.51%	15.41%	12.74%	10.12%
IAV 1	**4%**	0.83%	**-2.50%**	-5.75%	-17.68%	**-23.81%**	-29.80%	-99.85%	**-106.95%**	-113.88%	-38.09%	**-43.02%**	-47.84%	5.41%	**2.74%**	0.12%
IAV 1	6%	-14.73%	-18.05%	-21.30%	-44.80%	-50.92%	-56.91%	-131.63%	-138.72%	-145.66%	-61.42%	-66.35%	-71.18%	-4.59%	-7.26%	-9.88%
IAV 2	2%	59.27%	55.68%	52.16%	-0.08%	-6.25%	-12.28%	-41.05%	-47.64%	-54.15%	-12.19%	-17.49%	-22.69%	62.13%	59.87%	57.66%
IAV 2	**4%**	43.72%	**40.13%**	36.61%	-28.75%	**-34.92%**	-40.95%	-67.27%	**-73.86%**	-80.37%	-36.86%	**-42.16%**	-47.36%	51.02%	**48.76%**	46.55%
IAV 2	6%	28.16%	24.57%	21.05%	-57.41%	-63.58%	-69.62%	-93.49%	-100.08%	-106.59%	-61.52%	-66.83%	-72.02%	39.91%	37.65%	35.44%
IAV 3	2%	-103.46%	-109.54%	-115.49%	25.07%	21.33%	17.67%	17.77%	14.03%	10.34%	-42.69%	-47.53%	-52.26%	-5.47%	-8.98%	-12.41%
IAV 3	**4%**	-129.46%	**-135.54%**	-141.49%	6.40%	**2.66%**	-1.00%	3.32%	**-0.42%**	-4.11%	-65.58%	**-70.42%**	-75.14%	-21.03%	**-24.54%**	-27.97%
IAV 3	6%	-155.46%	-161.54%	-167.49%	-12.27%	-16.01%	-19.66%	-11.12%	-14.86%	-18.55%	-88.47%	-93.30%	-98.03%	-36.59%	-40.09%	-43.53%
IAV 4	2%	-60.45%	-67.34%	-74.07%	-0.92%	-4.39%	-7.78%	15.06%	13.24%	11.46%	6.04%	1.31%	-3.32%	13.08%	7.73%	2.49%
IAV 4	**4%**	-92.23%	**-99.12%**	-105.85%	-16.92%	**-20.39%**	-23.78%	5.06%	**3.24%**	1.46%	-17.29%	**-22.03%**	-26.66%	-12.25%	**-17.61%**	-22.84%
IAV 4	6%	-124.01%	-130.89%	-137.63%	-32.92%	-36.39%	-39.78%	-4.94%	-6.76%	-8.54%	-40.62%	-45.36%	-49.99%	-37.59%	-42.94%	-48.17%
IAV 5	2%	-49.03%	-54.80%	-60.46%	9.99%	7.97%	6.00%	24.32%	21.74%	19.14%	27.69%	24.38%	21.15%	160.09%	150.76%	141.64%
IAV 5	**4%**	-73.48%	**-79.25%**	-84.90%	1.10%	**-0.92%**	-2.89%	15.88%	**13.29%**	10.70%	13.24%	**9.94%**	6.71%	119.42%	**110.10%**	100.97%
IAV 5	6%	-97.92%	-103.69%	-109.34%	-7.79%	-9.81%	-11.78%	7.43%	4.85%	2.25%	-1.20%	-4.51%	-7.74%	78.75%	69.43%	60.31%

Table 19. Average annual cumulative return compared to market of simultaneous IAR and IAV trading strategy for the holding period of no longer than 5 days. *Source: created by authors*.
The table shows average annual CMAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 5 days. Average annual CMAR is calculated as the sum of CMARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-18.82%	-19.20%	-19.56%	-35.01%	-35.41%	-35.80%	-23.50%	-23.95%	-24.38%	-13.64%	-13.99%	-14.33%	-1.06%	-1.23%	-1.39%
	4%	-38.60%	**-38.97%**	-39.34%	-56.12%	**-56.52%**	-56.91%	-47.06%	**-47.50%**	-47.93%	-32.09%	**-32.44%**	-32.78%	-9.95%	**-10.11%**	-10.28%
	6%	-58.38%	-58.75%	-59.12%	-77.23%	-77.64%	-78.02%	-70.62%	-71.06%	-71.49%	-50.53%	-50.88%	-51.22%	-18.83%	-19.00%	-19.17%
IAV 2	2%	-17.00%	-17.29%	-17.57%	-35.33%	-35.71%	-36.08%	-34.74%	-35.20%	-35.65%	-18.90%	-19.38%	-19.85%	-18.23%	-18.46%	-18.69%
	4%	-32.33%	**-32.62%**	-32.90%	-55.55%	**-55.93%**	-56.31%	-59.18%	**-59.65%**	-60.10%	-44.24%	**-44.72%**	-45.18%	-30.45%	**-30.68%**	-30.91%
	6%	-47.66%	-47.95%	-48.24%	-75.77%	-76.16%	-76.53%	-83.63%	-84.09%	-84.54%	-69.57%	-70.05%	-70.52%	-42.67%	-42.91%	-43.13%
IAV 3	2%	-15.73%	-16.16%	-16.57%	-20.94%	-21.33%	-21.71%	-20.89%	-21.15%	-21.41%	-17.48%	-17.85%	-18.21%	-10.74%	-11.00%	-11.26%
	4%	-38.18%	**-38.60%**	-39.02%	-41.39%	**-41.77%**	-42.15%	-34.89%	**-35.15%**	-35.41%	-37.04%	**-37.40%**	-37.76%	-24.74%	**-25.00%**	-25.26%
	6%	-60.62%	-61.05%	-61.46%	-61.83%	-62.22%	-62.60%	-48.89%	-49.15%	-49.41%	-56.59%	-56.96%	-57.32%	-38.74%	-39.00%	-39.26%
IAV 4	2%	-33.53%	-34.04%	-34.54%	-22.59%	-22.94%	-23.27%	-12.73%	-12.94%	-13.15%	-16.54%	-16.88%	-17.21%	-18.92%	-19.34%	-19.74%
	4%	-60.42%	**-60.93%**	-61.43%	-40.81%	**-41.16%**	-41.49%	-23.84%	**-24.05%**	-24.26%	-34.32%	**-34.66%**	-34.98%	-40.70%	**-41.12%**	-41.52%
	6%	-87.31%	-87.82%	-88.31%	-59.03%	-59.38%	-59.72%	-34.95%	-35.16%	-35.37%	-52.10%	-52.44%	-52.76%	-62.48%	-62.89%	-63.29%
IAV 5	2%	-11.96%	-12.37%	-12.75%	-8.78%	-8.95%	-9.12%	0.30%	0.17%	0.05%	-16.58%	-16.85%	-17.11%	-11.46%	-12.36%	-13.23%
	4%	-33.08%	**-33.48%**	-33.87%	-17.89%	**-18.06%**	-18.23%	-6.37%	**-6.50%**	-6.62%	-30.58%	**-30.85%**	-31.11%	-58.79%	**-59.69%**	-60.56%
	6%	-54.19%	-54.59%	-54.98%	-27.00%	-27.17%	-27.34%	-13.04%	-13.16%	-13.28%	-44.58%	-44.85%	-45.11%	-106.12%	-107.02%	-107.90%

Table 20. Average annual cumulative return compared to market of simultaneous IAR and IAV trading strategy for the holding period of no longer than 20 days. *Source: created by authors*.
The table shows average annual CMAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 20 days. Average annual CMAR is calculated as the sum of CMARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

		Initial abnormal return (IAR) percentiles														
		IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
		Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
Initial abnormal volume (IAV) percentiles	Transaction costs	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
IAV 1	2%	-27.27%	-28.76%	-30.21%	-30.91%	-32.49%	-34.03%	-35.83%	-37.60%	-39.33%	-49.04%	-50.43%	-51.79%	-18.19%	-18.86%	-19.51%
	4%	-47.05%	**-48.53%**	-49.98%	-52.02%	**-53.60%**	-55.14%	-59.39%	**-61.16%**	-62.88%	-67.49%	**-68.88%**	-70.23%	-27.08%	**-27.75%**	-28.40%
	6%	-66.82%	-68.31%	-69.76%	-73.13%	-74.71%	-76.25%	-82.94%	-84.71%	-86.44%	-85.93%	-87.32%	-88.68%	-35.96%	-36.64%	-37.29%
IAV 2	2%	-3.82%	-4.95%	-6.06%	-24.72%	-26.22%	-27.69%	-44.29%	-46.12%	-47.91%	-36.20%	-37.15%	-38.07%	-3.33%	-4.26%	-5.16%
	4%	-19.15%	**-20.29%**	-21.39%	-44.94%	**-46.45%**	-47.91%	-68.74%	**-70.57%**	-72.35%	-48.65%	**-49.59%**	-50.51%	-15.55%	**-16.48%**	-17.38%
	6%	-34.48%	-35.62%	-36.73%	-65.16%	-66.67%	-68.14%	-93.18%	-95.01%	-96.80%	-61.09%	-62.04%	-62.96%	-27.78%	-28.70%	-29.60%
IAV 3	2%	-29.72%	-31.41%	-33.07%	-14.16%	-15.69%	-17.18%	-33.74%	-34.80%	-35.82%	-11.41%	-12.88%	-14.32%	-9.64%	-10.69%	-11.72%
	4%	-52.16%	**-53.86%**	-55.51%	-34.60%	**-36.13%**	-37.62%	-47.74%	**-48.80%**	-49.82%	-31.19%	**-32.66%**	-34.10%	-23.64%	**-24.69%**	-25.72%
	6%	-74.61%	-76.30%	-77.95%	-55.04%	-56.58%	-58.07%	-61.74%	-62.80%	-63.82%	-50.96%	-52.44%	-53.88%	-37.64%	-38.69%	-39.72%
IAV 4	2%	-23.96%	-25.97%	-27.93%	-22.86%	-24.22%	-25.54%	-7.76%	-8.59%	-9.41%	-14.57%	-15.89%	-17.17%	0.53%	-1.10%	-2.69%
	4%	-50.85%	**-52.86%**	-54.82%	-41.09%	**-42.44%**	-43.77%	-18.87%	**-19.71%**	-20.52%	-32.35%	**-33.66%**	-34.94%	-21.25%	**-22.88%**	-24.47%
	6%	-77.74%	-79.75%	-81.71%	-59.31%	-60.66%	-61.99%	-29.99%	-30.82%	-31.63%	-50.13%	-51.44%	-52.72%	-43.02%	-44.66%	-46.25%
IAV 5	2%	-28.32%	-29.90%	-31.43%	-7.70%	-8.39%	-9.07%	-9.87%	-10.35%	-10.83%	-7.78%	-8.83%	-9.86%	40.15%	36.58%	33.09%
	4%	-49.43%	**-51.01%**	-52.54%	-16.81%	**-17.50%**	-18.18%	-16.53%	**-17.02%**	-17.49%	-21.78%	**-22.83%**	-23.86%	-7.18%	**-10.75%**	-14.24%
	6%	-70.54%	-72.12%	-73.65%	-25.92%	-26.61%	-27.29%	-23.20%	-23.69%	-24.16%	-35.78%	-36.83%	-37.86%	-54.51%	-58.09%	-61.57%

Table 21. Average annual cumulative return compared to market of simultaneous IAR and IAV trading strategy for the holding period of no longer than 60 days. *Source: created by authors.*
The table shows average annual CMAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 60 days. Average annual CMAR is calculated as the sum of CMARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

			Initial abnormal return (IAR) percentiles														
			IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
			7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
Initial abnormal volume (IAV) percentiles	**IAV 1**	Transaction costs 2%	-17.29%	-21.26%	-25.13%	-68.58%	-73.35%	-78.00%	-33.61%	-39.93%	-46.09%	-49.72%	-53.86%	-57.91%	-5.21%	-7.50%	-9.74%
		4%	-37.96%	**-41.93%**	-45.80%	-92.80%	**-97.57%**	-102.22%	-64.06%	**-70.37%**	-76.54%	-70.61%	**-74.75%**	-78.80%	-16.77%	**-19.06%**	-21.29%
		6%	-58.63%	-62.59%	-66.47%	-117.02%	-121.79%	-126.45%	-94.50%	-100.82%	-106.98%	-91.50%	-95.64%	-99.69%	-28.32%	-30.61%	-32.85%
	IAV 2	Transaction costs 2%	-17.92%	-21.09%	-24.18%	-57.87%	-62.42%	-66.87%	-61.12%	-66.44%	-71.65%	35.92%	31.00%	26.20%	-1.19%	-3.70%	-6.16%
		4%	-35.26%	**-38.42%**	-41.52%	-80.75%	**-85.31%**	-89.75%	-87.78%	**-93.11%**	-98.32%	9.47%	**4.56%**	-0.25%	-14.08%	**-16.59%**	-19.05%
		6%	-52.59%	-55.76%	-58.85%	-103.64%	-108.20%	-112.64%	-114.45%	-119.78%	-124.98%	-16.97%	-21.89%	-26.69%	-26.97%	-29.48%	-31.93%
	IAV 3	Transaction costs 2%	-69.28%	-74.21%	-79.04%	-21.98%	-26.06%	-30.05%	-20.28%	-23.17%	-25.99%	-26.03%	-29.93%	-33.75%	-4.65%	-7.65%	-10.58%
		4%	-94.17%	**-99.10%**	-103.93%	-43.32%	**-47.40%**	-51.39%	-36.05%	**-38.94%**	-41.77%	-46.47%	**-50.38%**	-54.19%	-19.76%	**-22.76%**	-25.69%
		6%	-119.06%	-123.99%	-128.81%	-64.65%	-68.73%	-72.72%	-51.83%	-54.72%	-57.54%	-66.92%	-70.82%	-74.64%	-34.87%	-37.87%	-40.80%
	IAV 4	Transaction costs 2%	-72.33%	-78.42%	-84.37%	-5.09%	-8.71%	-12.24%	-2.43%	-4.61%	-6.74%	-23.58%	-27.17%	-30.69%	-16.39%	-21.18%	-25.86%
		4%	-102.99%	**-109.08%**	-115.03%	-24.21%	**-27.82%**	-31.35%	-15.10%	**-17.28%**	-19.41%	-42.69%	**-46.29%**	-49.80%	-41.50%	**-46.29%**	-50.98%
		6%	-133.66%	-139.75%	-145.70%	-43.32%	-46.93%	-50.46%	-27.77%	-29.94%	-32.07%	-61.80%	-65.40%	-68.91%	-66.61%	-71.40%	-76.09%
	IAV 5	Transaction costs 2%	-67.40%	-72.23%	-76.94%	-0.67%	-2.14%	-3.57%	-0.67%	-2.14%	-3.57%	-11.16%	-14.27%	-17.31%	93.67%	83.36%	73.29%
		4%	-90.96%	**-95.78%**	-100.50%	-8.67%	**-10.14%**	-11.57%	-8.67%	**-10.14%**	-11.57%	-26.05%	**-29.16%**	-32.19%	43.45%	**33.14%**	23.06%
		6%	-114.52%	-119.34%	-124.05%	-16.67%	-18.14%	-19.57%	-16.67%	-18.14%	-19.57%	-40.94%	-44.05%	-47.08%	-6.78%	-17.08%	-27.16%

Table 22. Average annual cumulative return compared to market of simultaneous IAR and IAV trading strategy for the holding period of no longer than 120 days. *Source: created by authors.*
The table shows average annual CMAR in excess of the borrowing and transaction costs for the trading strategy with maximum length of the holding period being 120 days. Average annual CMAR is calculated as the sum of CMARs for all transactions over the sample divided by nine. Threshold values for IAR and IAV quintiles are calculated using the data for the last 365 days up to and including the earnings announcement. The returns calculated assuming 10% borrowing cost and 4% round-trip transaction cost are shaded.

			Initial abnormal return (IAR) percentiles														
			IAR 1			**IAR 2**			**IAR 3**			**IAR 4**			**IAR 5**		
			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs			Borrowing costs		
			7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%	7%	**10%**	13%
Initial abnormal volume (IAV) percentiles	**IAV 1**	Transaction costs 2%	-12.88%	-17.27%	-21.57%	-62.97%	-68.19%	-73.29%	-44.48%	-51.51%	-58.39%	-58.37%	-62.90%	-67.32%	3.78%	0.80%	-2.13%
		4%	-33.55%	**-37.94%**	-42.24%	-87.19%	**-92.41%**	-97.52%	-74.92%	**-81.95%**	-88.83%	-79.26%	**-83.78%**	-88.21%	-7.77%	**-10.75%**	-13.68%
		6%	-54.22%	-58.61%	-62.90%	-111.42%	-116.64%	-121.74%	-105.37%	-112.40%	-119.27%	-100.15%	-104.67%	-109.10%	-19.33%	-22.31%	-25.24%
	IAV 2	Transaction costs 2%	-21.97%	-25.75%	-29.46%	-59.02%	-64.04%	-68.95%	-51.43%	-58.57%	-65.63%	75.13%	69.77%	64.53%	5.11%	2.49%	-0.06%
		4%	-39.30%	**-43.08%**	-46.79%	-81.91%	**-86.93%**	-91.84%	-78.10%	**-85.24%**	-92.29%	48.68%	**43.33%**	38.09%	-7.78%	**-10.39%**	-12.95%
		6%	-56.63%	-60.42%	-64.12%	-104.80%	-109.82%	-114.73%	-104.76%	-111.90%	-118.96%	22.24%	16.88%	11.64%	-20.67%	-23.28%	-25.84%
	IAV 3	Transaction costs 2%	-73.15%	-78.76%	-84.25%	-27.34%	-31.73%	-36.02%	-23.22%	-26.69%	-30.09%	-23.72%	-28.64%	-33.48%	1.41%	-2.04%	-5.42%
		4%	-98.04%	**-103.65%**	-109.14%	-48.67%	**-53.06%**	-57.35%	-39.00%	**-42.47%**	-45.87%	-44.16%	**-49.08%**	-53.93%	-13.70%	**-17.15%**	-20.53%
		6%	-122.92%	-128.54%	-134.03%	-70.00%	-74.39%	-78.69%	-54.78%	-58.25%	-61.65%	-64.61%	-69.53%	-74.37%	-28.81%	-32.26%	-35.64%
	IAV 4	Transaction costs 2%	-67.84%	-74.57%	-81.15%	-1.21%	-5.09%	-8.88%	-10.47%	-13.02%	-15.51%	-19.85%	-23.71%	-27.49%	-19.86%	-25.12%	-30.27%
		4%	-98.50%	**-105.24%**	-111.82%	-20.32%	**-24.20%**	-28.00%	-23.14%	**-25.68%**	-28.18%	-38.96%	**-42.82%**	-46.60%	-44.97%	**-50.23%**	-55.38%
		6%	-129.17%	-135.90%	-142.49%	-39.43%	-43.31%	-47.11%	-35.80%	-38.35%	-40.84%	-58.07%	-61.93%	-65.71%	-70.08%	-75.34%	-80.49%
	IAV 5	Transaction costs 2%	-82.02%	-87.34%	-92.54%	3.93%	1.72%	-0.44%	-7.76%	-10.32%	-12.89%	-16.93%	-20.77%	-24.53%	113.70%	102.30%	91.14%
		4%	-105.57%	**-110.90%**	-116.10%	-6.51%	**-8.72%**	-10.89%	-15.76%	**-18.32%**	-20.89%	-31.82%	**-35.66%**	-39.42%	63.48%	**52.07%**	40.92%
		6%	-129.13%	-134.45%	-139.66%	-16.96%	-19.17%	-21.33%	-23.76%	-26.32%	-28.89%	-46.71%	-50.55%	-54.31%	13.26%	1.85%	-9.30%