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SEMI-STRONG FORM EFFICIENCY IN THE CEE STOCK MARKETS

Authors: Danielius Stasiulis

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Semi-Strong Form Efficiency in the CEE Stock Markets

Danielius Stasiulis

Supervisor: Anete Pajuste

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Abstract

This paper researches the semi-strong form of market efficiency in nine CEE markets for the period of 2005-2008. The event study methodology is applied to look at the earnings announcements. Patell's standardized test is employed to look whether the announcements have informational value. Generalized Sign Test, Standardized Cross-Sectional test and Patell's Z-test are used to search for the inefficiencies towards good and bad news respectively.

Firstly, the severe non-normality of CEE capital markets is found. Secondly, it is proved that earnings announcements do convey information to investors. Thirdly, the informational efficiency is failed to be rejected to all markets except Latvia and Slovenia. And finally, it is shown that it is possible to earn significant abnormal returns in Slovenia, however, in Latvia it is not due to the prohibition of short-selling.

Keywords: EMH, Event Study, Earnings Announcement, Semi-Strong Form Efficiency, CEE, Non-Normality, Generalized Sign Test, Standardized Cross-Sectional Test, Z-test, Trade-to-trade Returns, Lumped Returns.

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1 Introduction

Central and Eastern European (CEE) capital markets experienced a decade of rapid development, growing in both the number of market participants and capitalization. The effectiveness and efficiency of the stock exchanges must have developed in line with the time as once being small and unattractive, nowadays CEE stock exchanges attract capital from around the world by offering superb return opportunities.

The Efficient Market Hypothesis (EMH) developed by Fama in 1970, categorizes the efficiency of stock markets into three levels. The weak form claims that no past information influences current stock price movements, the semi-strong form states that all information should be incorporated into stock prices quickly, and the strong form argues that even insiders can get no excess returns while trading based on their knowledge. This paper will focus on the semi-strong form of EMH, which will be researched using the event study methodology.

The short-run event study, used in this research, provides the "cleanest evidence we have on efficiency" according to Fama (1991). Event studies try to capture the abnormal performance induced by a particular event. The event of interest to test semi-strong efficiency was chosen to be earnings announcement (EA) as commonly used in previous researches.

Even though by 2004 more than 500 event studies had been documented in the most reputable economics and finance journals (Kothari & Warner), almost all of them have focused on the US market. Far fewer studies were conducted in the international arena and left CEE stock markets still largely unexplored in terms of the semi-strong form of EMH.

This study aims to look at the pre and post announcement price settlement process for the 9 CEE stock markets, namely Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia, in the period from 2005 to 2008. The following research question is being raised:

"How do investors in CEE react in response to the corporate earnings announcements?"

a) *Do earnings announcements possess information content?*
b) *How quickly do prices converge to the new theoretically correct fundamental values after an announcement?*
c) *Do markets react efficiently to the announced information?*
d) *Is it possible to profit from the market inefficiencies, if discovered?*

The research will allow us to disentangle the differences and similarities across CEE stock markets from the market efficiency point of view and provide a relevant addition to the existing literature on EMH on small and emerging capital markets. Finally, it could highlight the potential areas for informational efficiency improvements for regulators and reveal to ordinary investors the specifics of market reaction towards EAs.

It is important to note that this research is the first of its kind exploring almost all CEE markets. Any previous research regarding semi-strong efficiency was done using techniques other than event studies or the research is not available in the English language.

The first section will introduce the necessary background. The second section will provide a review of relevant literature up to the present day. The third section will present the methodology used in this research. The next section will describe data and the sampling process. Afterwards, an analysis of empirical findings will follow. Later, the conclusions will be drawn. And lastly, the implication for the relevant parties will be outlined and suggestion for further research given.

2 Background Information

2.1 CEE Capital Markets

This study intends to research the quickly developing capital markets of the new EU countries that have had stock markets operating for at least 10 years. Therefore, the list of countries, in this research referred as to CEE, is comprised from the following capital markets: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia.

CEE stock exchanges were created or reopened in the beginning of the last decade when the need to recover capital market after the collapse of the Soviet Union emerged. Recently, CEE capital markets have experienced rapid growth attracting many investors. Just before the financial turmoil, in the beginning of 2008, an investor having put 1$ into all the major market indices of CEE in the beginning of 2001, would get 5.47$ back (in nominal terms) evidencing an annual return of 27.48%. If Bulgaria alone would be chosen, an incredible return of 149% per year could be pocketed. Compared to MSCI World Index, MSCI Europe and S&P500, at the beginning of 2008 CEE beats these indices 1.95, 5.65 and 4.92 times respectively. Even if we look at the end of 2008, where the stocks lost value heavily, CEE provided 11.38% return annually since the beginning of 2001. Meanwhile, for the same period the world index gave the return of 9.9% and Europe with S&P -7.85% and -4.95% respectively.

The ever more growing attractiveness of these markets has resulted in a gradual increase in the number of market participants not only from the local markets but from the outside as well. In order to foster the attractiveness of stock exchanges the rules and operational processes had to continuously convergence to the role models from the developed markets such as US, UK, Germany and Scandinavia. As a consequence, this convergence should have resulted in increasing market efficiency throughout the time. Therefore, it is of high interest to check whether CEE markets have reached the semi-strong form of market efficiency nowadays.

2.2 Efficient Market Hypothesis

Incorporating Samuelson's random walk model (1965) and logics of the weak and strong forms of efficient market by Roberts (1967), Fama presented the complete efficient market hypothesis in his paper: "Efficient capital markets: A review of theory and empirical work" in 1970. He defined the efficient market as the one where "…security prices at any time "fully reflect" all available information (Fama, 1970). He further distinguishes three forms of market efficiency: weak, semi-strong and strong.

Weak form of market efficiency looks at how well the past returns predict the future earnings. It claims that no abnormal returns can be realized by using investment strategies relying on the historical stock price movements. In other words, the future stock price developments are completely random and no technical analysis can consistently gain excess returns. However, for the strategies based on fundament analysis it is still possible to earn excess returns over the market portfolio. To prove this form of efficiency to be present one should find no serial dependence among stock prices, no stock price movement patterns can be consistent.

Semi-strong form implies that investors can not earn abnormal returns by trading on the new publicly available information (earnings, dividend and capital structure change announcements, etc) as the information is immediately incorporated into stock prices. Neither technical nor fundamental analysis can find a way for gaining excess returns. The speed of stock price adjustment is the determinant of this form of efficiency. It can be tested with the highest certainty using the event studies. If no missreaction or delayed reaction of investors is discovered after the news announcement (they all understood it in the same unbiased and timely manner), the market is semi-strong efficient. This form of market efficiency is researched in this paper.

Strong form of the market efficiency claims that even the investors possessing private information have no way to earn excess returns based on their knowledge. It means that at any point in time the share prices have fully incorporated all available information and nobody can gain excess returns. Usually to test this form of efficiency it is looked whether someone can consistently earn higher than market index returns for a long period of time and currently there is no clear answer to this issue. Jensen (1968) claims that "*on average the funds apparently were not quite successful enough in their trading activities to recoup even their brokerage expenses*", which proves the prevalence of the strong form of EMH. However, in 1991 Fama reviews mutual funds performance and finds that some mutual funds actually outperformed the market by gaining tiny excess returns. Nevertheless, it does not prove anything as when there are thousands of investors, according to the normal distribution it is probable that some will actually beat the market. From the event study point of view, strong form of efficiency can be rejected if there are pre-event abnormal returns that signal trading based on insider information.

3 Literature Review

This section overviews the literature developments on EMH with particular interest in semi-strong form efficiency testing with event window methodology when looking at earnings announcements. After going through the mainstream of the literature looking at the US market, the major researches worldwide and especially in CEE markets are presented.

3.1 Event Studies

Event study methodology is frequently used for testing the semi-strong form of EMH. This methodology aims to calculate the abnormal performance induced by an event and is pretty straightforward. By subtracting an estimate of the normal performance, conditioned on no event taking place, from the actual performance, abnormal returns are obtained. The normal performance model is estimated in the estimation period. Abnormal returns are calculated for the event window, which does not interfere with estimation window, and analyzed afterwards.

Event studies are perfect to look at the speed of announced information dissemination, which is predominant interest of semi-strong efficiency tests. Most of the adjustment to a news announcement (an event) happens before the announcement and the rest has to be incorporated into the stock prices on the event day. If it is not, market might not be semi-strong efficient.

The first event study was done by Fama, Fisher, Jensen and Roll (1969), although it was published only after Ball and Brown (1968). Ball and Brown have examined EAs, whereas Fama et al. focused on the stock price reaction to stock splits (Fama, 1976). Event study methodology was used by Beaver in 1968 and Patell in 1976 to study variances. Trading volume was researched by Campbell and Wasley (1996). Accounting performance was checked by Barber and Lyon (1996). Brown and Warner (1985) have modified the methodology to look at the daily data instead of monthly, like used in this study. In general, event studies are applied to test many more features of financial markets than mentioned here.

3.2 Earnings and Dividend Announcements

Many researchers investigate informational content of dividend and earnings announcements by analyzing their separate and corroborative (when announcements are made close to each other the first one conveys all the information to the market, whereas there is no reaction to the second one) effects on stock prices. Although this research is especially concerned with earnings announcements, the findings on information content of dividend announcements cannot be neglected and therefore are taken into account.

Pettit (1972), Charest (1978), Aharony and Swary (1980), and Woolridge (1983) have examined the information content of dividend announcements. Contemporaneous effect was sought first by Kane, Lee, and Marcus (1984). Others have looked at information content of dividend surprises, omissions and initiations (Asquith & Mullins, 1983; Dielman & Oppenheimer, 1984; Healy and Palepu, 1988).

By studying quarterly dividend changes in 1972 Pettit has concluded that earnings and dividends have considerable information content. A year later Watts (1973) checked annual dividend and earnings announcements, and found the information content of dividends to be rather low. In response to Watts, Pettit & Westerfield (1974) review his findings and conclude that dividends contain information beyond earnings announcements. However, Gonedes's (1978) results are coherent with Watts and tell that dividends convey little information when taking into account earnings. In 1980 Aharony and Swary found the evidence supporting information content of dividends to be present, however, they looked only at those earnings and dividend announcements that happen at least ten days one from another, which was considered to be biased. Meanwhile, Kane et al. (1984) have investigated earnings and dividend announcement that were within ten days from each other and found the relationship between EA and DA to be prevalent and the announcement that comes first informs the market fully, making the second announcement insignificant. In 1988, Oppenheimer, Binghampton and Dielman conclude that: “irrespective of the timing of dividend and earnings announcements the impact of dividend announcement is larger than that of earnings announcements” as well as provide critique to Aharony and Swary. The findings of Brown, Choi and Kim (1991) support those of Kane et al. and say that if dividends and earnings announcements convey similar messages, the last announcement contains the least information. In the same year Chang and Chen (1991) present a model showing that earnings and dividends can independently affect the firm value without interaction between them. They contradict to Kane et al. arguing that: “the informational content of earnings and dividend surprises is not affected by the announcement pattern and there is no interaction between the two types of signals released concurrently”. Leftwich and Zmijewski (1994) present evidence that in case of dividends being bad news and contemporaneous earnings announcement being good news, dividends are informative. In 1994, Brown, Choi and Kim examine the impact of timing on non-contemporaneous EA and DA informativeness. They find that timing does not matter for the informativeness of EA, however, for DA it does.

These studies form the core for theoretical backing of the researches being further developed and conducted around the world. The ideas of the author of this study are based on this literature.

3.2.1 Studies around the World

Although informational content has been research for four decades by now, the amount of studies covering other capital markets than those of US is small and very minor if looked at Europe (Dumontier & Raffournier, 2002).

Firth (1981) was the first one to research UK stock market and he came to a conclusion that there are abnormal stock returns and trading volume increases created by EA. Consistent with Kane et al. (1984), Brown, Finn and Hancock (1977), Easton (1991), How, Teo and Izan (1992) find that both, earnings and dividend, announcements have information content in the Australian market. Similarly, corroborative effect was discovered by Abeyratna et al. in UK market (1996) and by Kalluniki (1996) in Finland. In 1989 Liljeblom investigated the announcements of dividends and stock split in the Swedish capital market and found the corroboration between EA and DA to be present. Chen, Firth and Gao (2002) find that dividends are important to investors in a Chinese stock market and hence affect the stock prices. The corroborative effect is present too. Likewise, Cheng and Leung find corroboration between the announcements in Hong Kong (2006). In Norway, Capstaff et al. (2004) find dividend changes to produce abnormal stock returns. Amihud and Murgia (1997) study the German capital market, which has a tax advantage to dividends, and observe stock market reaction to DA similar to US despite the differences in taxation policy. Pellicer and Rees (1999) find abnormal volatility of stock returns in Spain on EA dates. In the similar fashion Sponholtz (2004) finds excess volatility in Denmark around EAs. McCluskey, Burton, Power and Sinclair (2006) provide evidence on the importance of dividend announcements to Irish investors, however, the effect is weaker than that of earnings announcements.

There are many studies covering different countries, but the results are varying due to different research objectives. Even though there are many differences between US and the stock markets in the rest of the world, usually, the same anomalies prevail.

3.2.2 Studies in CEE

Central and Eastern European markets with respect to semi-strong form of EMH are almost totally not researched, at least the evidence is not presented to the academics in the English language. Still, a few studies were found, however, they were focusing usually on a single market for a time period when it was considerably underdeveloped and tested different form of efficiency than it is intended to research in this paper.

Divis and Teply (2005) have investigated the weak form of efficiency using variance ratio. They have failed to reject weak form of efficiency for Hungary, Poland, the Czech Republic, Slovakia and the US. A tendency for the efficiency to improve with time was spotted.

Filler and Hanousek (1998) have concluded that in the early days of CEE stock markets, 1993-1998, stock returns were predictable from the changes in macroeconomic variables. This fact implies that the assumptions of the semi-strong efficiency were violated, however, the costs of arbitrage were not considered. On contrary, using volatility modelling Hric (2008) confirms the semi-strong efficiency to prevail for the Czech and Slovakian equity markets.

Kvedaras and Basdevant (2002) find that in the period from 1996 to 2001 Lithuanian and Estonian markets were weak-form efficient, however, Latvia was not. In 2003 Januskevicius found an evidence against the weak form of market efficiency when in the period from January 2001 to October 2002 it was possible to gain arbitrage profits in the Lithuanian stock market. However, Milieska (The evaluation of Lithuanian stock market, 2004) claims that from 2001 to 2004 the liquid part of Lithuanian stock market can be considered weak-form efficient.

The only paper investigating the semi-strong form of market efficiency in CEE using the event study methodology was written by Kiete and Uloza in 2005. They have examined the Lithuanian and Latvian stock markets, and found that the semi-strong form efficiency (measured via reaction to earnings announcement) in the period of 2001-2004 holds for Lithuania, but does not for Latvia.

4 Methodology

This part of the paper consists of three major parts and is based on the event study methodology, which allows us to research the impact of announcements on the stock price movements. Firstly, the study specifications are presented. Secondly, the abnormal return calculation process is defined. Lastly, the testing procedures are outlined.

4.1 Event Study Specifications

In this study the event of interest is a quarterly earnings announcement. The week on which an announcement should take place is usually known well before, however, without a precise announcement day and intraday time, one cannot know the event day for sure. A usual case is when an announcement comes after the trading hours or at some point of time during the day when investors cannot make transactions anymore. In such case, the event day is rather the next trading day. The data used in this study does not have the intraday announcement time, therefore a bias arises. To solve it one can either try to estimate the maximum likelihood of an event happening on that day or use a simple informal procedure where the event window is enlarged to capture the event for sure. Ball and Torous (1988) find that the informal procedure works as fine as the other one; hence it will be used in this research. Nevertheless, too large event windows result in weak power of tests to recognize the abnormal performance. Therefore, three kinds of event windows are considered [-1;+1], with hypothetical event day being day 0, [-5;+5], and for every day from -5 to +5 separately. The aim of looking at the days from -5 to +5, following Campbell, Cowan & Salotti (2007), is to take a look at the bigger view where due to inefficient markets the reaction to an event could continue for several days.

The estimation period, a time frame where the parameters to identify the normal performance of a security are calculated, according to Krivin et al. (2003) is usually chosen in a subjective manner and does not influence the end results too much. According to them, there is always a trade-off of having more sample data to estimate the parameters and having parameters representing more up to date normal performance. However, the estimation window should not include previous event as this would create bias in estimates. Therefore, in this study 50 trading day estimation window is used, which should not be contaminated by the previous quarter's announcements. For the robustness check a 120 day estimation window is also considered. Figure 1 depicts the time line of an event study.

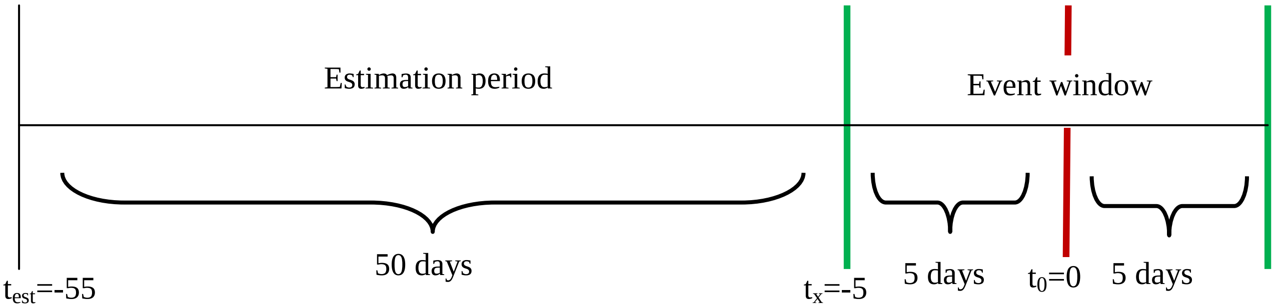

Figure 1. **Evenet Study Timeline.**

Note. Compiled by the author.

4.2 Abnormal Return Calculation

As mentioned before, the abnormal return is the actual return on a security during the event window minus an estimate of its normal return (expected return unconditional the event taking place) over a chosen period (MacKinlay, 1997). The formula is as follows:

$$AR_{it} = R_{it} - E[R_{it} | X_t] \qquad (1)$$

Where AR_{it}, R_{it}, $E[R_{it}|X_t]$ are abnormal, actual, and expected normal returns respectively, for the day t in an event window. X_t is the conditioning information, usually chosen as a broad market index, for the normal performance model.

4.2.1 Return Calculation

The returns are calculated in a continuously compounded fashion by performing a logarithmic transformation. The usage of logarithms is motivated by the normalization of returns, which lessens the impact of outliers.

$$\mathrm{R}_{it} = \ln\left(\frac{P_{it} + D_{it}}{P_{it-1}}\right) \qquad (2)$$

R_{it} is the return for the day t for stock i, P_{it} , P_{it-1} are the split-adjusted stock prices for the current and preceding trades and D_{it} is the dividend for the day t, if available. Further on the returns have to be adjusted for potential data inconsistencies.

Campbell et al. (2007), find that 60.3% of the times stocks were not traded in their research covering 50.000 non-US stock (part of it from CEE markets), which suggests that it is very likely to observe thin trading (large amount of days without trading taking place) in CEE markets too, especially due to immature capital markets age. Indeed, thin trading is present in the CEE markets (see Appendix A), and therefore it is necessary to account for the missing trade dates.

There are three ways to solve this issue. Firstly, geometrical backfilling could be used, which would evenly spread the return from two non-missing trades throughout the no-trade days between them (Sponholtz, 2004). However, it results in biased parameters of the normal performance model. Secondly, Trade-to-Trade returns (TT returns) could be used, which leave non-traded days unfilled, but add the market return from these days to the abnormal return calculation of the next non-missing trading day and do not touch the ordinary days (Maynes & Rumsey, 1993). And the third option, the lumped returns, just leaves non-traded dates with zero return, whereas the whole “lump” of return stays with the day when a stock was traded. The last two ways of handling the missing returns resemble the reality better, because TT returns always match the relationship between the stock and the market by creating appropriate periods and the lumped returns claim that a missing trade is still an expression of the equilibrium price between demand and supply, and therefore zero return is related to the market. These two types of returns were also found to be more representative by Campbell et al. (2007) and are commonly used in other researches. Therefore, TT and Lumped returns are used in this study.

4.2.2 Normal Returns

There are many models available for the normal performance modelling. Two groups can be distinguished: statistical and economic. The first group assumes returns to be jointly normal and independent and identically distributed throughout time, which is enough for the models to be well specified, strong but feasible, and robust to assumptions in practice (MacKinlay, 1997). The simplest statistical constant mean return model, developed by Brown and Warner in 1985, usually performs not worse than more advanced models, however, it can be miss-specified in the presence of variance increases that are likely to appear in this research. Examples of economic models are CAPM and APT. Although these models add economic restriction, these are not very valuable as the statistical models, especially in short horizon studies, capture the relationship between the market and security returns better and therefore dominate in the academic literature.

In this study the market model is used due to its good properties and the vast usage in previous studies (Campbell et al., 2007). It is a statistical model that instead of assuming the random walk of stock returns, relates them to a broad market portfolio. The linear specification of the model comes from the assumed joint normality of the returns (MacKinlay, 1997). In order to estimate the parameters of the normal performance model, the following regression is performed:

$$R_{it} = \alpha_i + \beta_i * R_{mt} + \varepsilon_{it} \qquad (3)$$

$$E[\varepsilon_{it}] = 0, \qquad Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_{it}} \qquad (4)$$

Where R_{it} and R_{mt} are the day t returns of the security i and the market portfolio in the estimation window, α_i and β_i are the coefficients to be estimated and $\sigma^2_{\varepsilon_{it}}$ is the variance of the residuals ε_{it} (Campbell, Lo, & MacKinlay, 1997).

Two different proxies for the market returns are used. First, the capitalization weighted portfolio (CWP) and, second, the equally weighted portfolio (EWP) are constructed. This is in accordance to Brown and Warner (1985) and Cowan and Sergeant (1996) who suggest that large companies are overrepresented in CWP, hence EWP has to be used if the sample includes more small companies.

4.2.3 Estimation of the Market Model Parameters

The OLS (Ordinary Least Squares) method is used to estimate the parameters of the normal performance model. The OLS procedure is good if normality of returns can be assumed

(MacKinlay, 1997), nevertheless, even in the case of non-normality academics usually do not have any better choice. Estimates of α_i and β_i are obtained by regressing the stock returns on the returns of a market portfolio (eq. 3). The usage of logarithms in the return calculation also allows us to account for non-linear relationship between variables. An assumption that the parameters are stationary and stable over the estimation period has to be made. Fortunately, this does not cause much of a trouble as the estimation period is sufficiently short for this assumption to hold. The way of abnormal returns calculation is presented below:

$$AR_{it} = R_{it} - E[R_{it} | X_t] = R_{it} - \hat{\alpha} - \hat{\beta} R_{mt} \qquad (5)$$

Where $\hat{\alpha}$ and $\hat{\beta}$ are estimated from the equation 2 (Peterson, 1989). The variance of residuals in the estimation period $\hat{\sigma}^2_{\varepsilon_t}$ is calculated as follows:

$$\hat{\sigma}^2_{\varepsilon_t} = \frac{\sum_{t=1}^{T_i} (\varepsilon_{it})^2}{T_i - 2} \qquad (6)$$

where T_i denotes the length of the estimation period *i* (MacKinlay, 1997).

Nevertheless, as the errors in the event window are not exactly residuals due to parameter estimation outside the event window (in the estimation period), an adjustment is necessary to account for potential bias (Boehmer, Musumeci & Poulsen, 1991; Patell, 1976):

$$C_{it} = 1 + \frac{1}{T} + \frac{(R_{mt} - \overline{R}_m)^2}{\sum_{r=1}^{T} (R_{mr} - \overline{R}_m)^2} \qquad (7)$$

$$\hat{\sigma}^2_{it} = \hat{\sigma}^2 (AR_{it}) = \sigma^2_{\varepsilon_i} * C_{it} \qquad (8)$$

The first term in the equation 8 is simply the variance of the residuals from the OLS regression, however, the second term C_{it} (the adjustment for additional variance) emanates from the sampling errors in α_i and β_i estimates and leads to serial correlation even though true disturbances are independent through time (Patell, 1976). R_{mr} and $\overline{R}_m$ from equation 7 are an ordinary market return and the mean market return in the estimation period, and R_{mt} is the market return on day t in the event window. It is important to note that when the estimation period enlarges, the second term in eq.8 C_{it} converges to one (additional variance tends to disappear) and observations become independent. The estimation period chosen in this study should be sufficiently large to minimize (however, not eliminate!) the second term. This is a trade-off between more stable market parameters and increased variance during the event window. As it will be presented in the further sections, the test procedures should be robust to the variance increases.

One more model for the normal performance estimation, which should serve as an additional measure against the prevalence of thin trading, is used. In addition to OLS, Adjusted Market Model is employed. It is based on the calculation of Scholes-Williams beta (1977) that assumes that true return process in uncorrelated throughout time (MacKinlay, 1997). This model is considered to be better than the usual market model when thin trading is prevalent as it captures the relationship between lead and lagged market returns, which makes the relationship between the market and a stock more stable when there are missing values. Even though Jain (1986) does not find an empirical support for the improvements, Peterson (1989) does, and the model is actively used in the researches thereafter.

4.2.4 Adjusted Market Model Estimation

In order to obtain the Scholes-Williams beta (SWB), three OLS regressions that account for the dependence between the current stock return (*Rt*) and the past (*t - 1*), current (*t*), and the future (*t +1*) market returns have to be run in the estimation window (Scholes & Williams 1977).

$$R_{it} = \alpha_{i1} + \beta_{i1}R_{mt} + \varepsilon_{1t}; \qquad (9)$$
$$R_{it} = \alpha_{i2} + \beta_{i2}R_{mt-1} + \varepsilon_{2t};$$
$$R_{it} = \alpha_{i3} + \beta_{i3}R_{mt+1} + \varepsilon_{3t};$$

R_{mt}, R_{mt-1}, R_{mt+1} are the market returns on day *t*, *t-1* and *t+1* respectively. From the estimates of these regressions SWB can be calculated in the following way:

$$\hat{\beta}_{iSW} = (\hat{\beta}_{i1} + \hat{\beta}_{i2} + \hat{\beta}_{i3}) / (1 + 2\hat{\rho}_m) \qquad (10)$$

where the $\hat{\beta}_{iSW}$ is SWB, the next betas represent estimates from the OLS regressions and $\hat{\rho}_m$ is the estimated first order serial correlation of R_{mt} from $t=-2$ to $t=T-1$. The SWA intercept is calculated as:

$$\hat{\alpha}_{iSW} = \frac{1}{T-2}\sum_{t-2}^{T-1} R_{it} - \frac{1}{T-2}\hat{\beta}_{iSW}\sum_{t-2}^{T-1} R_{mt} \qquad (11)$$

The AR from the adjusted market model is then calculated in the following manner:

$$\hat{AR}_{it} = R_{it} - \hat{\alpha}_{iSW} - \hat{\beta}_{iSW}\, R_{mt} \qquad (12)$$

Although there is a difference between OLS and Scholes-Williams estimation, no adjustments to the calculation of variance of residuals are applied in order to allow the model to capture the true sensitivity of the stock returns to the aforementioned three market returns. The same idea applies to the calculation of AR variance (Cowan & Sergeant, 1996).

4.3 Testing Procedures

This section presents the testing procedures used to answer the research question. There are quite a few tests available: parametric (Standardized and Z tests by Patell (1976), Standardized Cross-Sectional test by Boehmer et al. (1991) and etc) and non-parametric (Generalized Sign Test (GST) by Cowan (1992), Rank Statistic by Corrado (1989), etc). Campbell et al (2007) have conducted an in-depth research on the most popular test statistics and have found the Generalized Sign Test to perform exceptionally well, followed by Rank Statistic, whereas the power of Patell's standardized test was weaker. As their study has focussed on non-US stocks from many countries, including a part of CEE, the implications are of high importance to this research. Following the advice of previously mentioned researchers GST is given the most credibility when drawing conclusions, however, the other tests are employed too. Unlike other tests, Patell's Standardized test is widely used to look at the squared abnormal returns and therefore is employed in this research to assess the information content of announcements without making distinctions of the information they carry. Afterwards, Patell's Z-test, Standardized Cross-Sectional test and GST are employed to look at good and bad news announcements separately.

4.3.1 Testing Information Content of EA

In order to answer the question of whether the investors find the announced information relevant it is necessary to calculate the abnormal returns for the full sample of the announcements and check the significance. Patell's standardized test squares AR and in such way allows us to look at the news announcement without making any prior judgement whether they represent good or bad news release. Therefore, the test gives a glance on the magnitude of the market's reaction to news, with high values corresponding to significant reaction. This test fits the best to verify the information content of EAs as positive and negative reactions do not cancel each other out.

$$U_{it} = \frac{AR_{it}^2}{\hat{\sigma}^2_{it}} * \frac{T_i - 4}{T_i - 2} \qquad (13)$$

The squared abnormal returns are standardized (eq. 13) to yield an expected value of 1 in order to enable the comparability across events (Patell, 1976). AR_{it}^2 is the squared AR from the event window for a particular day *t*, $\sigma^2{}_{it}$ is the adjusted variance from eq. 7 and T_i is the estimation window length for an event *i*. Afterwards, by applying the Central Limit Theorem U_{it} are aggregated in cross-section and approximately unit normal test statistic is formed (eq. 14) (Patell, 1976).

$$Z_t = \frac{\sum_{i=1}^{N}(U_{it} - 1)}{\left(\sum_{i=1}^{N}\frac{2(T_i - 3)}{T_i - 6}\right)^{\frac{1}{2}}} \sim \mathrm{N}\,(0,\,1) \qquad (14)$$

This test has the null hypothesis that the mean of U_{it} for an event day *t* is equal to 1, versus the alternative hypothesis that it is more, which implies the occurrence of significant market reaction to the announcements. It is expected that the event day would have significant average squared abnormal returns because of the assumptions behind the semi-strong from of efficiency, where the market is expected to react to the EA right after the news are released. However, if some of the other days around the announcement are found to be experiencing significant reaction, it is being treated as the evidence on the speed of information dissemination.

4.3.2 Testing the Average Reaction towards Information Content

If the previous test proves that the investors do react to the earnings announcements then it is of high interest to analyze whether reaction differs with respect to the information content announced. By differentiating between the good and bad announcements it is possible to see whether investors had realistic expectations about the news coming with an announcement, whether they under or over react and how considerably. Three tests are used to judge whether there were significant abnormal returns in the event window.

4.3.2.1 Defining Good, Bad and Neutral news. There are four ways to define whether an announcement fits into a category of good, bad and neutral news. Firstly, analysts' forecasts could be compared to the actual figures, however, this data is scarcely available for the CEE markets (Hughes & Ricks, 1987; O'Brien, 1988). Secondly, a "naïve" assumption could be made that the company's earnings follow random walk, therefore the last year's figure should equal this year's and judge about the announcement accordingly if the figure differs (Fried & Givoly, 1982; Brown, Hagerman, Griffin & Zmijewski, 1987; Sponholtz, 2004). Unfortunately, both Bloomberg and DataStream time-series earnings data was scarcely recorded for CEE markets, hence this approach will not be used. The third way, used in this study, is to define whether it was good or bad news announcement according to the event day reaction reflected on AR. If the AR on the event day exceeds 1% level then the announcement is considered to convey good news, if it falls below -1% - bad news, if in between - no news. 1% threshold was chosen arbitrary, motivating with the fact that less observations are needed to have strong power of the test statistics as can be seen in the examples provided by MacKinlay (1997) and Campbell et al. (2007).

This approach has two drawbacks: the inferences about the event day cannot be made and the causal effect between the announced information and the price change cannot be established, however, there still are a few positive aspects. After thorough investigation, the announcement dates provided by Bloomberg were found to be inaccurate in quite a few instances. This problem can be easily discovered if CARs are used to define the market's reaction by applying the same threshold. In such a case quite many significant ARs around the announcement date are spotted, which can be explained by the poor quality of the announcement dates. After excluding the dates where no significant reaction happens on the event day the sample size diminishes by around 10% only. If the percentage would be substantially higher, then the abnormal activity around the day zero would need to be explained by some market specifics/inefficiencies and the sample shrinkage would be intolerable, but it is not. Therefore, the usage of the event date AR to classify the news leaves only accurately recorded dates and eliminates aforementioned biases. Griffin, Hirschey and Patrick (2008) find that around 75% of Bloomberg announcement dates for the developed markets and only 3% for the emerging ones are correct. Nevertheless, the bias of the validity of dates used in this research should be smaller as the aforementioned researchers look at the data from 1994 to 2005, which is not the case in this paper. The researchers gather only 123 announcement dates for Poland compared to over 2000 in this study, whereas for Lithuania and Slovenia they have 1 and 2 dates in total. These numbers provide evidence on poor disclosure during the sample period before 2005, however, the more recent data has higher accuracy. Finally, a threshold based event selection procedure creates an easy to follow rule of thumb for investors.

4.3.2.2 Patell's Z-test. Z-Test is performed in a similar fashion as the Patell's Standardized test. However, the aim of this test is to look at the ARs for having a particular direction and therefore it will be applied for good and bad news separately.

The abnormal returns are being standardised with the adjusted standard deviation (calculated as a square root of variance). Standardized ARs (SARs) follow Student t statistic with T_i-*2* degrees of freedom (Patell, 1976):

$$SAR_{it} = \frac{AR_{it}}{\hat{\sigma}_{it}} \sim t\ (T_i\text{-}2),\ \hat{\sigma}_{it} = \sqrt{\hat{\sigma}^2_{it}} \qquad (15)$$

By applying the Central Limit Theorem the Z-test if formed:

$$Z_t = \frac{\sum_{i=1}^{N} SAR_{it}}{\left(\sum_{i=1}^{N} \frac{T_i - 2)}{T_i - 4}\right)^{\frac{1}{2}}} \sim \mathrm{N}\ (0, 1) \qquad (16)$$

The test statistic provides one-sided test for both positive and negative ARs. For the negative ARs the null of zero AR (AR=0) against the alternative of negative AR is tested (AR < 0) and vice versa for the positive ARs. Although this test underperforms as compared to the other ones, it still remains as one of the most widely used tests and therefore the application of it in this research enables better interpretation of results and interoperability between test statistics in CEE markets.

4.3.2.3 Standardized Cross-Sectional Test. Boehmer et al. (1991) find that the increases in variance in the event window often make most of the conventional tests falsely reject the true null hypothesis of zero AR. To mitigate this problem they have proposed the standardized cross-sectional test, a parametric test, which is robust under event induced variance as well as performs as good as the other tests when there are no variance increases. The test was built up on Patell's (1976) Z-test and uses the same SAR, however, the variance is estimated from the cross-section. The test assumes no event clustering (many events happening at the same calendar time), but this issue is easily overcome using short estimation windows and pooling events from several years, like it is done in this study.

$$Z_t = \frac{\frac{1}{N}\sum_{i=1}^{N} SAR_{it}}{\sqrt{\frac{1}{N(N-1)}\sum_{i=1}^{N}\left(SAR_{it} - \frac{1}{N}\sum_{i=1}^{N} SAR_{it}\right)^2}} \sim \mathrm{N}\ (0, 1) \qquad (17)$$

SAR_{it} is the same as in eq.15 and *N* is the number of events in the cross-section. The test has the same hypotheses as Patell's Z-test. This test is considered to be the best parametric test, however, it is still vulnerable to non-normality of returns.

4.3.2.4 Generalized Sign Test. Nonparametric tests are good as they are free of specific assumptions concerning the distribution of returns. As the returns in CEE stock markets are severely non-normal (see Appendix A), GST should produce the most reliable results. It performs well in the presence of the thin trading too. One important assumption is that ARs (or rather CARs) have to be independent across securities, which is not true in the case of event clustering. Moreover, in the cases of extreme skewness and kurtosis GST is misspecified. A solution to this problem is to use Buy and Hold Abnormal Returns (BHAR), which alleviate the impact of the outlier returns (Campbell et al., 2007).

Under the null hypothesis GST says that the fraction of the day zero ARs having a particular sign should be equal to the fraction in the estimation period (Campbell et al., 2007). For the negative ARs, the null of a non-negative sign is tested, for positive – vice versa.

The number of expected positive abnormal returns in event window is based on the fraction of the positive abnormal returns for a portfolio of N securities in a T day estimation period.

$$\hat{p} = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{T}\sum_{t=T1}^{T2} S_{it} \text{ , where } \begin{array}{l} S_{it} = 1 \mid u_{it} > 0 \\ S_{it} = 0 \mid else \end{array} \qquad (18)$$

$T1$ and $T2$ denote the beginning and the end of the estimation period.

The test statistic uses the normal approximation of binomial distribution with a parameter $\hat{p}$. If we define w as the number of times a positive event day AR occurring, the GST test statistic is:

$$Z = \frac{w - N\hat{p}}{[N\hat{p}(1-\hat{p})]^{1/2}} \sim \text{N}(0, 1) \qquad (19)$$

4.3.3 Capitalizing on ARs

In order to see whether it is possible to capitalize on the market inefficiencies, if found, it is necessary to aggregate ARs and look whether it is possible to gain significant positive AR by taking positions in the stocks that experience EAs. As after the event day it should not be possible to capitalize on announced information, the presence of a trading strategy gaining significant abnormal returns would imply a violation of the semi-strong form of market efficiency. The tests mentioned in the previous section are used with cumulative ARs (CARs) and buy and hold returns (BHARs) to check the feasibility of trading strategies.

4.3.3.1 Aggregation of ARs. ARs have to be aggregated in order to perform the tests. Aggregation is done along two dimensions – through time and across securities. Aggregation through time period L for a single security gives CAR:

$$CAR_{it} = \sum_{i=1}^{L} AR_{it} \qquad (20)$$

In order to look at the broad picture all of the individual securities' CARs have to be averaged:

$$\overline{\mathrm{CAR}} = \frac{1}{N}\sum_{i=1}^{N} CAR_{iT} \qquad (21)$$

From $\overline{\mathrm{CAR}}$ now it is possible to draw conclusion about the sample. Alternatively, BHAR can be calculated, as due to compounding instead of summing (like in CARs) they give less weight to the extreme values. GST combined with BHAR is the best test according Campbell et al. (2007). BHAR for a stock *i* over the event window is:

$$BHAR_{it} = \prod_{t=1}^{t}[1+R_{it}] - \prod_{t=1}^{t}[1+E(R_{it})], where E(R_{it}) = R_{mt} \qquad (22)$$

Where R_{mt} is the market return for a day *t* (Campbell et al., 2007).

4.3.3.2 Adjusting tests for the usage of CARs. In order to perform the tests several adjustments concerning the usage of CAR have to be done. For Patell's Z-test instead of SAR, Cumulative SAR (CSAR) should be used:

$$CSAR_i = \sum_{t=1}^{L} \frac{SAR_{it}}{\sqrt{L}} \sim t\ (T\text{-}2) \qquad (23)$$

The SARs are cumulated through time to form CSAR. In eq.23, *L,* is the accumulation period length. CSARs are afterwards used instead of SARs in eq.16. For Standardized Cross-Sectional test CARs from eq.20 can be directly used in eq.17. In GST, the parameter *w* from eq.19, is defined as the positive CARs and the same test is used with an adjustment to the sample size *N*, when it is divided by the CARs aggregation period length *L*. The application of BHARs in these tests is the same as of CARs.

4.3.3.3 Economic feasibility. Although some of the strategies might report significant AR, they still carry the assumption of no trading costs. To tests whether an ordinary investor could exploit a strategy in reality the trading fees and capital gains taxes should be accounted for. Even though there was a variety of differences, the average trading fee for a buy or sell transaction of 0.5% was similar in most of the CEE stock markets and therefore was chosen to be unanimous for all countries. Moreover, in order to capture the AR, not only a higher than market's return, an investor has to enter in to an opposite position in the market index and a risk free asset, depending on a stock. An assumption is made that the afore-mentioned trading fees also cover the costs of buying index futures and bonds.

5 Data and Sampling

5.1 Data Description

The daily data for the last 20 year was collected for 10 emerging markets from the Bloomberg database. The data includes the daily stock closing prices, market capitalization, dividends and earnings per share, and dividend and earnings announcements. Due to scarce announcement availability the sample is reduced to the period from September 24, 2004 till December 25, 2008. Furthermore, the data was filtered to leave only the stocks from the main and, if traded actively, secondary lists. Due to extremely thin trading the Slovakian market was removed from the sample. The remaining 9 markets are Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovenia.

The markets were found to be severely non-normal (see Appendix A). The most extreme example was demonstrated by Hungary, which had returns characterized by skewness of less than -24 and kurtosis of more than 2300. This means that on average there were more positive returns than negative ones in the sample and extreme values were also frequent (fat tails), which is evident from high kurtosis. The most normal markets were found to be the Czech Republic (skewness -0.38, kurtosis 20.18), Lithuania (skewness -0.57, kurtosis 13.26) and Slovenia (skewness -0.64, kurtosis 22.42), followed by Poland (skewness -0.07, kurtosis 240.34).

In total there were over 560 thousands returns from 644 stocks, out of which 15.81% were missing. The sample had a total of 3144 EAs out of which 953 were classified as positive news, characterized by the ARs of at least 1%, and 1077 negative news with ARs on the event day being below -1%.

5.2 Sampling and Processing

For an event to be taken into a sample it had to have at least 2/3 of the estimation period length traded, decreasing this requirement was not considered as it gave almost no additional observations. Moreover, there should have been no missing returns in the event window. This restriction was relaxed to two days around the event for more illiquid markets. For most of the markets it gave sample increases of 1% to 5%, whereas for Estonia and Latvia it was over 30%, suggesting that many stocks there have missing trades during the event period. Therefore, such relaxation was applied only to the latter two markets.

Two types of returns were calculated Lumped and Trade-to-Trade. In order to create proxies for a broad market index the capitalization and equally weighted portfolios (CWP and EWP) were constructed from the returns on all the stocks in a sample for a particular country. The results with both approaches were very similar, however, because of bad representativeness of market movements due to numerous illiquid stocks in the samples with stock price jumps, EWP proved to perform worse (R^2 fell more than by a third for some countries) and instead only the results for CWP are presented.

Afterwards, the data was split into event samples around DAs and EAs. As the number of DAs for the majority of the markets was insufficient to make statistical inferences, only EAs were considered. An additional check revealed that the EAs are not affected by DAs. Two types of estimation windows were used: 50 trading days in order to have uncontaminated estimation period and more representative model parameters, and as robustness check 120 trading days. 120 days for the estimation of model parameters proved to be inadequate due to rapid development of the markets and hence high instability of parameters that were characterized by around 30% worse fit of the model parameters.

As Griffin et al. (2008) found that for the emerging markets only 3% of Bloomberg announcement dates match with reality, another robustness check was done to address this issue. The announcement dates for the Lithuanian market were collected manually from NASDAQ OMX Baltic website. Although, the number of announcements that were not overlapping in 50 day estimation period increased, the results did not change significantly. It suggests validity of the Bloomberg EAs cleaning and announcement picking procedure, which removes EAs if they have another EA happening ambiguously closely. The restriction of no other EAs in the event and estimation windows was set. After such cleaning Bloomberg announcements can be considered valid for usage in the event study.

6 Analysis of Results

This part of the paper presents the results obtained by applying the procedures described in the methodology part. At first, the results on information content for 9 markets are presented and analyzed. It is attempted to answer whether EAs convey information to market and how long it takes for the information to be fully incorporated into prices. Secondly, differences between reactions to bad and good news are provided. It aims at answering whether market participants have correct expectation of the upcoming information when trading before an announcement and whether they under/overreact creating potential for the arbitrage. Finally, the view on CARs is provided and followed by a set of strategies that intend to generate abnormal returns for speculators as well as ordinary investors.

6.1 The Information Content of EAs

Regulators set up mandatory disclosure rules in order to allow all market participants to track a company's performance, to be informed whether it surpasses expectations or on contrary - underperforms. EA is the most frequent disclosure available on a company and for the main list stocks is mandatory at least quarterly. Such frequency might not be sufficient, therefore, for the regulators it is crucial to know whether investors find the announced information important, and if not search for possible causes and solutions. Regulators are interested in providing equal access to information for all market participants as if the part of them are discriminated they might leave the marketplace and consequently the equity markets might dry out leading to potential slowdown in the whole economy.

All of the researched markets have displayed significant level of abnormal activity around and on the announcement day. Table B1 in Appendix B displays ARs and Patell's Standardised test values for the sample countries. This finding clearly supports the importance and relevance of EAs to investors. Furthermore, there are a few similar patterns among the countries in the way they respond to the announcements. By looking at the reaction to news, the markets can be separated into two broad groups: the ones that react mainly on and after the event day and the others that react throughout the whole event period – before and after an event takes place.

The first group consists of Bulgaria, the Czech Republic, Hungary and Slovenia. All of these countries have significant reaction before the event on the days -5, -3, -4 and -5 respectively, suggesting a leakage of to be announced information and insider trading. Afterwards, the reaction starts on day 0 (except for the Czech Republic) and continues for several days (till the day 2 for Bulgaria and Hungary, day 4 for Slovenia and day 5, but excluding day 4 for the Czech Republic), which signals possible over /under reactions to the news in these markets. However, the announcements should be first separated into good and bad in order to examine the semi-strong form of market efficiency.

Interestingly, Slovenia does not evidence significant reaction on the day 0, it might be because of the significant reaction on day -1, which would imply that the information might have leaked to the mass market a day before. Furthermore, the lack of reaction on day zero might prevail because of two types of hypothetical investors existing in the market: the active traders, who get insider information and trade on day -1, and the moderately active ones, who get the information after the trading hours (from the sources secondary to the stock exchange, like newspapers) and start trading only from the day 1 onwards. Most of the investors in Slovenia should be moderately active as the strongest reaction happens exactly on the day 1.

The significant AR on the day 5 after a not significant one on the day 4 in the Czech Republic might be a sign of active traders exploiting the overreaction that happened during the first three days. This can be supported by the fact that the strongest reaction in this market happens on the days 2 and 3. Bulgaria and Hungary react the most on the day 0, suggesting that these markets are characterized as having more active investors. Lastly, there should have been more of negative news, or their magnitude of them was higher, for Bulgaria and Hungary as the CARs after the event period end day tend to be negative for these two markets. Contrarian effect can be seen in the Czech and Slovenian markets, however, the sign of ARs changes day by day implying that the prices converge to their fundamentally correct values through a heavily speculative process.

The second group, consisting of Estonia, Latvia, Lithuania, Poland and Romania, starts reacting 4 (Romania) to 5 (all other markets) days prior to an announcement and continue doing so till the end of the event period (except for Romania, which reacts till the day 4 and Estonia – till the day 2). Such long reaction prior to an event cannot be explained by the insider trading solely. It implies that a significant part of all the investors in the market trade actively and even speculate on the future outcomes to be caused by EAs.

The significant activity after an announcement date might represent the true price discovery process or a delayed reaction of some part of investors. However, the gaps in the pre-announcement reaction in Lithuania (day -2) and Latvia (day -4) might indicate that the total amount of speculators is not that high to have the significant abnormal trading activity happening every day.

A gap on the day 4 in the Latvian market might be because of the same reasons as in the Czech Republic. Romania, Estonia and Latvia have the strongest abnormal activity on the day 1, implying that most of the investors are moderately active. However, Poland and Lithuania have the strongest reaction on the day zero, which means that most of the investors react to the news quickly. As the strongest reaction on the day 0 was spotted in Bulgaria and Hungary too, it implies that the bigger stock markets react to news more timely. It is surprising to note that in Lithuania and Poland the average preannouncement AR is positive and starting from the announcement day further on turn out to be negative. This phenomenon can be explained by a hypothesis that in the sample from 2005 till 2008 investors on average expected good news to be released and bought in the shares before the event day, however, the announced information did not meet their expectations and resulted in the negative ARs afterwards.

The sign of ARs for Estonia and Latvia changes in a similar fashion as for the Czech and Slovenian markets, whereas for Romania it changes in the same way as for Bulgaria and especially Hungary. This suggests that the markets are rather similar and the key differences mostly emerge because of the different market sizes. This finding relates the market size and its efficiency, suggesting that the bigger the size is, the more efficiently it operates.

To sum up, EAs in all of the markets do convey information. However, due to differences in the markets it is being disseminated throughout time in different fashions. The most likely explanation is the country-varying proportions of insiders, speculators and moderately-active traders in CEE.

6.2 Reaction Differences towards Good and Bad News Announcements

The results on good and bad news announcements separately can reveal the behavioural aspects of the market participants. Moreover, it can show whether the investors under/overreact to the news announcements and in this way create opportunities to earn ARs. Significant positive AR after the announcement date would signal a probability of some market being inefficient and therefore will be further tested with CARs. The preannouncement abnormal activity could suggest speculations, insider trading and the risk aversion to prevail.

The results for good and bad news EAs are presented throughout Appendices C to E, for Latvian, Lithuanian and Slovenian markets as these markets stand out from others. Because of the methodological specifications for all good and bad news subsamples there is a significant AR recognized by all three tests on the event day. For the other days the abnormal performance is considered to be significant only when all three tests agree upon it. The evidence is presented as generalized for all markets and only if unexpected significant findings are discovered for a particular market, they are provided separately.

The following abbreviations will be used to refer to the tests: P – Patell's Z-test and C- Standardized Cross-Sectional test. Throughout all samples P test exhibits exaggerated test scores while often finding significance of ARs where other tests do not. This is in line with the findings of Campbell et al. (2007) and therefore this test will be given the least weight to judge on the prevalence of AR.

Although all markets experience significant ARs on the announcement day, the overall reaction throughout the event period differs considerably from country to country. There was no significant reaction found when all the news was taken together. Although for some markets C and P tests provided significant values, the overall lack of significance was clearly shown by the GST test values. This finding supports the market efficiency as the positive and negative events should be equally likely to happen and therefore the reactions cancel each other out.

6.2.1 Buying Stocks before Bad News

Bulgaria (day -1), Estonia (day -1), Romania (-1) and Slovenia (-3, -1) demonstrate positive ARs before the bad news are announced. However, such reaction is significant only for Bulgaria and Slovenia (day -3 only). Other markets lack statistical support from GST, but the values are close to 10% significance level. Such reaction provides evidence on buying behaviour before the bad announcements. The speculators might buy stocks before negative announcements in false expectation of good news. Nevertheless, there is no similar significant effect for positive news announcements (except for Poland, although lacking significance from GST). Even though insignificant, the buying behaviour before positive news still exists for Slovenia. The lack of positive ARs in the good news sample for Bulgaria, Estonia and Romania, which contradict the idea of speculators buying in the stocks before all of the announcements, can be explained by unsuccessful speculative decision making. The positive ARs a day before the positive event can also be attributed to the information leakage to the market and the insider trading. Moreover, the same evidence as for Slovenia is present for Poland too – speculators buy before good and bad news, nevertheless it is not recognized as significant. In the Slovenian and Polish cases the effect could be attributed to the investor optimism.

6.2.2 Selling Stocks before Good News

Negative ARs before the good news announcements were observed in Estonia (day -3) and Romania (day -1). Both markets lack statistical significance from GST when looking at all model specifications, but the effect is still supported by GST if only trade-to-trade returns are chosen, which is desirable as this market is rather illiquid and thinly traded (Appendix A). Selling stocks before the good news might also be explained by the speculators' false expectations. Moreover, it could also occur because of the risk-averse investors selling off their stocks due to willingness to escape the uncertainty of to be announced information content.

Interestingly, Latvia is the only market that potentially exhibits the insider trading. The sign of AR a day before the announcement matches the one on the event day. This can be explained either by the information leakage to the market or insider trading. However, a strong conclusion cannot be made as the effect is not supported by GST, although values are close to significant.

6.2.3 Potential Inefficiencies

Some of the markets have noticeable ARs after the event day. Latvia (days 2 and 4) and Slovenia (days 2 and 4) demonstrate abnormal performance supported by all three tests for the positive news subsample. For Latvia results are supported by all the tests if it is looked at the trade-to-trade returns, nevertheless, with lumped returns the results are very close to, but not yet significant. As mentioned before, trade-to-trade returns provide a better proxy for the Latvian market. Day 2 exhibits an opposite reaction than the event day, which can be explained by an occurrence of overreaction. However, the adjustment to overreaction on the day 2 is too strong and leads to underreaction, hence another adjustment on the day 4 happens. Alternatively day 4 could signal slow reaction of some market participants. Similarly, Slovenia has reaction on the days 2 and 4 of the same direction that can be attributed to slow information dissemination to investors. Therefore, there are three stages in which different types of investors drive price to its fundamentally correct value.

For the negative news subsample Latvia again reveals significant abnormal reaction. The day 1, with reaction of the same direction as on the announcement day, has statistically significant AR. It can be explained either by announcements being made too late during the trading day and therefore investors do not manage to react quickly enough, or by slow information dissemination, where some of the investors react only on the next day after the announcement. Bulgaria exhibits the same pattern too, however, the AR is not supported by GST and hence the significance is rejected. The Polish market has noticeable ARs on the days 1 and 2, but none of them are supported by GST and therefore are considered to be insignificant. In general, the delayed reaction to the negative news can be fully explained by the prohibition of short sales in CEE markets, which implies that the arbitrageurs have no direct way how to profit from the negative ARs.

6.2.4 CARs and the Trading Strategies

As the previous section found that some markets actually have significant ARs it means that theoretically it is possible to profit on them. However, in order to check whether these ARs could really be pocketed, it is essential to account for the inconsistencies between theoretical and the real world – ARs have to be adjusted for taxes and trading fees. Four trading strategies are presented below. Two of them, 11 and 3 day holding period around the event day are available mainly for insiders who want to safely end up with positive amount of money in their pockets if they act on private information and know the outcome of an event for sure. The term insiders, with respect to the latter two strategies, refer to the insiders of a particular company that have continuous access to the undisclosed earnings information and can enter the strategy more than once. These strategies can also be employed by ordinary investors who believe in their ability to consistently guess or estimate the outcome of an announcement. The next two strategies are meant for ordinary investors as they check whether it is feasible to profit from the stocks affected by an EA right after an announcement has happened and the reaction to the news content is clear. The first strategy buys the stock on the next day after the announcement and sells it after 3 days, whereas the second one aims at exploiting ARs of a single particular day.

The results on the significance of CARs for these strategies are presented below. If some of the CARs are found to be significant then it is possible to create a trading strategy that would capitalize on them. Such strategies are adjusted for trading fees, which were set at 0.5% for one transaction for all markets. Moreover, the CARs were adjusted for capital gains taxes that can be found for each market in Appendix A. The strategies aiming to capitalize on negative ARs, although theoretically possible, are not empirically possible because of the prohibited short-selling in CEE markets. It is important to note that all these strategies can earn AR only if a hedging position in the market and a risk free asset is entered, otherwise they earn risk unadjusted returns that exceed the returns of the market.

6.2.4.1 11-day CARs. This strategy invests into the stock affected by the announcement at day -5 and then sells it on day 5. Such a strategy turned out to be statistically significant and profitable, even after adjustments for fees and taxes, for positive announcements in Bulgaria, Latvia and Lithuania, as well as for the negative announcements in the Latvian market. Yet, this strategy is not directly applicable for ordinary investors as one has to know, or guess, the outcome of an announcement before undertaking the strategy. Therefore, it can only be used by insiders who can be certain about the outcome of an announcement. Because of the latter reason the 11 day trading strategy does not violate market efficiency. The equivalent 3 day CAR strategy is significantly profitable for all these markets too.

6.2.4.2 3-day CARs. To undertake this strategy it is necessary to buy the stock experiencing an event one day before the announcement and sell it one day after it. In this way the whole lump of ARs triggered by an event is captured. Compared to the previous strategy this one is safer for more efficient markets as one is sure that the AR will appear on the event day only. This strategy is statistically significant according to all tests and proved to be profitable for Estonia, Hungary, Poland and Romania for the good news announcements and for Hungary, Lithuania and Poland for the bad ones. As the 11 day strategy does not work for these countries, it means that the magnitude of the event induced abnormal returns is smaller than of the countries where previous strategy can be employed.

6.2.4.3 Post event 3-day CARs. This strategy directly violates the semi-strong form of market efficiency if found to be profitable and significant. It suggest to invest into the stocks after an event takes place, in the morning of the day 1 when the reaction to the day 0 announcement is known, and sell the stocks on day 3, aiming to capitalize on the market inefficiencies such as delayed reaction and over or under reaction. For none of the markets it was found to be both, profitable (after adjusting for fees and taxes) and significant. Even for Latvia and Slovenia, which experience significant AR after the event, it does not work. This gives a direct implication about the market efficiency in CEE countries suggesting that in the short term after an announcement it is impossible to gain significant ARs.

Moreover, for a series of markets it is not possible to employ any of the previously described strategies: for good news announcements in the Czech and Slovenian markets and for the bad ones in Bulgaria, the Czech Republic, Estonia and Romania. Such absence of significant CARs can be explained by trading activity around the event day, which cancels out the day 0 AR.

6.2.4.4 1-day strategies. Although strategies lasting for several days proved to be inapplicable for ordinary investors, the single day strategies could still work. If there are days after the day 0 with significant AR that would exceed the trading fees it is still possible to gain profits. As the short-selling is prohibited, such profits for ordinary investors are accessible only from the positive ARs. Moreover, it is assumed that an investor buys the stock in the morning for the closing price of the last day and sells it in the evening of the same day for the price prevailing in the market. It is also possible to buy the stock for the closing price a day before or sell it the next day in the morning. Such discrepancies between trades are important, however, not accounted in this strategy, but as AR goes larger the importance of this decreases.

Latvia has significant positive AR on the day 4 for the good news subsample, however, it is only 0.54%, which is not sufficient to cover the trading costs. Moreover, the Slovenian market has two positive ARs: on the day 2 of 1.37% and on the day 4 of 1.42% that can be exploited by an ordinary investor. This finding directly violates the semi-strong form of market efficiency.

7 Conclusions

First of all, the stock markets in CEE are found to be severely non-normal, which can be explained by ongoing capital markets development as most of the stock exchanges operate for just over 10 years. Consequently, these markets have received much less attention from the major information databases, which resulted in lack or low quality of data. Therefore, it is important to make proper methodological adjustments to account for the announcement date uncertainty, thin trading, event-induced variance and event clustering. Trade-to-trade returns should be preferred if thin trading is prevalent, and even if it is not, they perform as well as the lumped returns. CWP is preferred to EWP as the latter one gives too much weight to illiquid stocks with unexpected considerable price changes that are less interesting for investors. Shorter estimation window performs better than the longer ones due to rapidly changing market parameters. There is no significant difference between the usage of market or adjusted market model if TT returns are used for thin data, however, BHAR should be preferred for wider event windows. Large samples diminish the importance of the latter choice even more. Most importantly, to draw the conclusions both parametric and non-parametric tests should be used as the parametric tests tend to reject the null hypothesis too often for non-normal data, but account for the magnitude of AR, whereas non-parametric tests find more precise probability of the abnormal performance occurring. The preferred choice is Standardized Cross-Sectional Test by Boehmer et al. (1991) and Generalized Sign Test by Cowan (1992).

Secondly, the results of information content testing prove that earnings announcements do convey information to the investors in all CEE countries. However, there are some differences in reactions among markets. Bulgaria, the Czech Republic, Hungary and Slovenia mainly react on and after the announcement, while the rest of the countries start 4 to 5 days before an event and continue reacting 4 to 5 days after it. The difference between two groups can be explained by different proportions of insiders, speculators and ordinary investors as well as the total amount of them in particular markets. In addition, the overall size of a market is an important determinant of the reaction to EAs too.

Thirdly, no significant reaction to EAs was found when looking at all types of announcements (good, bad, neutral) together, which supports the market efficiency. When looking at the good and bad news separately it was found to be statistically significant that investors buy the stocks before the bad news in the Bulgarian and Slovenian samples. The same finding was obtained for Estonia and Romania, however, it was insignificant. For Slovenia the phenomena can be explained by the investor optimism regarding the upcoming announcement. A similar conclusion could be drawn for Poland if the effect were significant. The reason behind buying the stocks that will experience negative AR requires further investigation as currently it can only be explained by unsuccessful speculations. The same explanation is applicable for the Estonian and Romanian markets where there is a tendency to sell stocks before good news announcement. In addition, this can be explained by the investors' preference to avoid uncertainty. Although not supported by GST, Latvia might be experiencing heavy insider trading.

Latvia has statistically sound proof of AR after the event day for the good news subsample, which can be characterized as overreaction. On the contrary, underreaction or slow information dissemination to investors is spotted in the Slovenian market for the same subsample. For the bad news subsample Latvia is again found to have significant AR after the event day. Therefore, these two markets are under suspicion of not being semi-strong efficient. Other markets have patterns of ARs violating the market efficiency too, however, none of them is significant.

There is no multiday strategy exploiting ARs after the announcement day that would be both profitable and significant in any of the markets. This finding gives a direct support for the semi-strong form of market efficiency. However, for the insiders in most of the markets it is possible to gain significant ARs if they enter a strategy knowing the event outcome before it happens. Nevertheless, in Slovenia for the 2nd and 4th day after a positive announcement happens there are opportunities for a single day trading strategies that are profitable and significant after adjusting for trading fees and taxes. Such opportunities are not available for Latvia due to insufficiently high AR for the positive subsample and the prohibition of short-selling for the negative one.

Finally, after taking all the evidence into account it is concluded that for Hungary, Lithuania, Poland, and Romania as well as with a bit lesser confidence for Bulgaria, the Czech Republic, and Estonia, the semi-strong form of market efficiency is failed to be rejected. This form of efficiency is clearly rejected for Slovenia, however, the Latvian case is inconclusive if the economic feasibility is taken into account, but rejected otherwise. The findings for Lithuania and Latvia are in line with those of Kiete and Uloza (2005), which means that the conditions in the markets, at least in Latvia, have not changed much. Nevertheless, it is pivotal to note that the semi-strong form of market efficiency test is a joint test, which means that these conclusions hold only if the methodological model is accepted as valid (Campbell, Lo & MacKinlay, 1997).

8 Implications

The findings of this research provide the direct evidence on stock market efficiency and are of high importance for three parties: academics, regulators and investors. This is the first research testing the semi-strong form efficiency of the vast majority of CEE stock markets and drawing comparison between them.

For the academic world this paper adds up to the pile of evidence on the semi-strong form of market efficiency for small and emerging stock markets, providing a particular insight into the CEE. The paper provides the view on the normality of CEE markets for the most recent period from 2005 till 2008. Moreover, different specifications of the event study methodology for these markets are applied and the best match is provided. Furthermore, the research reveals the inconsistencies in the data available for CEE markets provided by the major information databases.

For the regulators of capital markets this research provides an assessment of the current state of informational efficiency in CEE stock markets and highlights potential areas for improvement. Firstly, it is proved that EAs are indeed important and convey information to the market when released. Secondly, the speed of information dissemination should be further fostered by highlighting the upcoming announcements more actively and maybe setting up reminders for interested investors. Thirdly, the short-selling should be enabled in order to ensure efficient information dissemination of negative news. Next, the possibility of insider trading occurrence is revealed, which should be tried to curb by employing more of restrictive measures. Lastly, the bigger markets with more investors have demonstrated lower test values for ARs around the event day, which suggests that they could be more efficient than the small ones. Thus, the integration of stock exchanges and attraction of more potential investors by lowering the transaction fees could be considered for the further development of the markets.

For the investors this paper reveals the speed of information content dissemination so that they could anticipate the effect of EA occurrence on their stock portfolios. Moreover, the possibility to gain positive ARs in the Slovenian market was shown in addition to the lack of feasibility to earn post announcement event related ARs in the rest of CEE.

9 Suggestions for Further Research

Firstly, the semi-strong form of market efficiency could be further tested by employing the earnings data to make the separation between the good and bad news announcements. Secondly, the effect of concurrent disclosures, firstly of dividends and afterwards of all the other announcements, could be checked on the informational value of EAs. Thirdly, the effects of EAs could be researched on different types of companies: large, small, value and growth. And finally, the reaction to the EAs should be attempted to be explained while hypothesizing on behavioural aspects of market participants.

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Appendices

Appendix A

Table A1

The Sample Summary

The table contains data for the sample period from 2004.09.24 till 2008.12.25. The returns are calculated according to the formula from the eq.2. Active returns represent the number of non-missing trade dates. The number of EAs represents only the announcements that were used in the event study tests. The source for the capital gains tax rates is http://www.worldwide-tax.com.

Country	# of Stocks	# of returns	Active returns	Active returns per stock	Missing returns	Missing Returns per stock	% of missing returns	Mean	Min	Med.	Max	Skewness	Kurtosis	# of EA	# of >1% Positive EAs	# of <-1% Negative EAs	Capital gains tax
Bulgaria	114	89868	68363	600	21505	189	23.93%	-0.00054	-3.40	0	3.22	-6.31	504.29	226	62	71	0%
Czech Rep.	19	18717	18511	974	206	11	1.10%	0.00020	-0.25	0	0.26	-0.38	20.18	71	18	10	15%
Estonia	18	14675	13274	737	1401	78	9.55%	-0.00025	-0.61	0	2.14	20.17	845.66	100	25	29	21%
Hungary	32	31665	27282	853	4383	137	13.84%	0.00022	-3.95	0	0.80	-25.78	2327.25	183	54	64	20%
Latvia	20	21063	14211	711	6852	343	32.53%	-0.00061	-3.93	0	3.93	-0.31	1603.77	80	22	24	0%
Lithuania	41	40381	31392	766	8989	219	22.26%	-0.00077	-0.52	0	0.53	-0.57	13.26	187	64	49	15%
Poland	305	250460	243785	799	6675	22	2.67%	-0.00047	-2.94	0	1.80	0.07	240.34	2030	636	751	19%
Romania	76	75786	58466	769	17320	228	22.85%	-0.00049	-2.92	0	2.24	-5.58	450.49	185	54	60	16%
Slovenia	19	17835	15416	811	2419	127	13.56%	-0.00035	-0.43	0	0.35	-0.64	22.43	82	18	19	20%
Total	644	560450	490700	-	69750	-	-	-	-	-	-	-	-	3144	953	1077	-
Average	72	62272	54522	780	7750	150	15.81%	-0.00034	-2.11	0	1.70	-2.15	670	349	106	120	14%

Note. Compiled by the author.

Appendix B

Table B1

The Information Content of EA

The table presents ARs and Patell's Standardized test values for the sample period from 2004.09.24 till 2008.12.25. The values with asterisk (*) are significant at 5% level.

Country	Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
	AR	0.23%	0.18%	-0.21%	-0.10%	0.08%	-0.03%	-1.20%	0.15%	-0.54%	-0.12%	-0.12%
Bulgaria	**S (Z)**	4.72*	1.21	-1.16	-0.71	-1.55	5.01*	57.02*	1.85*	1.43	1.56	1.20
	AR	0.17%	0.25%	0.03%	-0.18%	0.38%	0.32%	-0.20%	0.16%	0.09%	0.06%	-0.45%
Czech Rep.	**S (Z)**	-1.78	-1.15	1.82*	1.39	-1.24	2.64*	3.69*	5.93*	6.05*	1.11	3.94*
	AR	0.22%	-0.34%	-0.21%	-0.20%	0.11%	-0.29%	0.35%	0.01%	-0.21%	0.74%	-0.09%
Estonia	**S (Z)**	9.36*	17.97*	4.89*	6.78*	4.48*	2.60*	12.03*	3.71*	1.48	0.65	0.18
	AR	0.03%	0.00%	0.02%	0.05%	-0.28%	-0.22%	-0.11%	-0.07%	-0.30%	-0.41%	-0.03%
Hungary	**S (Z)**	-0.08	1.75*	0.37	-1.97	-0.54	4.92*	2.06*	0.70	1.73*	0.60	-2.03
	AR	0.30%	0.17%	-0.11%	0.52%	0.10%	0.10%	-0.19%	-0.08%	-0.07%	0.35%	-0.40%
Latvia	**S (Z)**	3.86*	-1.09	2.08*	6.02*	7.12*	5.16*	20.13*	8.10*	1.30	2.92*	4.26*
	AR	-0.17%	-0.02%	-0.11%	0.14%	0.23%	0.27%	-0.40%	-0.15%	-0.34%	-0.35%	0.20%
Lithuania	**S (Z)**	2.95*	2.02*	3.69*	0.25	4.88*	18.11*	21.11*	7.39*	6.10*	9.61*	4.10*
	AR	-0.10%	-0.03%	-0.14%	-0.05%	0.19%	-0.30%	-0.88%	-0.35%	-0.32%	-0.18%	-0.11%
Poland	**S (Z)**	10.01*	12.17*	8.24*	4.74*	9.00*	68.75*	71.76*	20.74*	21.94*	22.63*	20.77*
	AR	-0.42%	-0.04%	-0.36%	-0.58%	0.04%	-0.08%	-0.57%	-0.37%	-0.71%	-0.30%	-0.24%
\ Romania	**S (Z)**	0.31	1.90*	5.98*	9.29*	4.74*	2.64*	23.78*	6.63*	4.04*	1.05	0.44
	AR	0.15%	-0.20%	0.16%	0.15%	0.26%	-0.17%	0.17%	0.40%	-0.09%	0.11%	-0.05%
Slovenia	**S (Z)**	2.40*	-1.48	-0.68	0.36	2.67*	1.48	3.65*	4.63*	2.75*	3.21*	-0.76

Note. Compiled by the author.

Appendix C

Table C1

ARs and CARs for Latvia

AR and CAR values are for Latvia for the sample period from 2005 to 2008.The estimation window is 50 days long. The stocks affected by the event had to be traded at least 1/3 of the of the estimation period length. No missing trade dates for the event window [-1; +1] were allowed. The sample is divided into three parts: all news – takes all the observations, good news – takes only observations that exceed 1% in AR on the event day, bad news – observations with negative AR of less than 1%. Four tests were performed on all subsamples, however, the ones that are actually reported have the most power to discover abnormal activity. All the tests were performed on 2 types of returns (lumped and TT returns, both calculated on logarithmic returns) for 3 different normal performance estimation models (market model, adjusted market model and BHAR), however as long as the results are very similar only lumped market model values are provided below. In case of inconsistencies notes are added. Models use CWP as the market proxy.

Abbreviations. S – Patell's Standardized test values, G – GST values , C – Standardized Cross-Sectional test values, P – Patell's Z-test values, GB – GST with BHAR, Z stands for Z-score ~ N (0, 1), N – amount of observation. In CAR table, the accumulation periods with A letter indicate CARs adjusted for trading fees (0.5%) and capital gains taxes (see appendix B). If adjusted CARs are negative, it is impossible to gain positive returns. However, the unadjusted values just indicate the direction of CAR and both, positive and negative, values can be exploited by entering either short of long position in a stock. Test statistics with asterisk (*) indicate statistical significance at 5% level.

ALL news			N=	80															
Day	-5	-4	-3	-2	-1	0	1	2	3	4	5		Period	[-1; +1]	[-5;+5]	[+1; +3]	A[-1;+1]	A[-5;+5]	A[+1; +3]
AR	0.30%	0.17%	-0.11%	0.52%	0.10%	0.10%	-0.19%	-0.08%	-0.07%	0.35%	-0.40%		CAR	0.00%	0.68%	-0.34%	-1.00%	-0.32%	-0.66%
S(Z)	3.86*	-1.09	2.08*	6.02*	7.12*	5.16*	20.13*	8.1*	1.30	2.92*	4.26*		C(Z)	-0.26	0.21	-1.16	-0.27	0.20	-1.11
Good news>1%			N=	22															
AR	0.35%	0.57%	0.41%	0.35%	1.07%	2.86%	1.11%	-0.73%	-0.65%	0.54%	0.32%		CAR	5.04%	6.21%	-0.27%	4.04%	5.21%	-0.73%
G(Z)	1.05	1.78*	0.33	1.05	0.33	3.96*	-0.04	-1.49	-1.13	2.15*	0.33		GB(Z)	2.68*	2.3*	1.15	2.68*	2.3*	1.15
C(Z)	0.13	0.81	0.83	-0.25	0.94	5.87*	0.92	-2.11*	-1.93*	1.19	0.96		C(Z)	2.94*	2.5*	-0.72	2.81*	2.39*	-0.84
P(Z)	0.19	0.81	1.38	-0.39	1.79*	7.68*	2.49	-2.38*	-1.8*	1.78*	1.62		P(Z)	6.91*	3.97*	-0.98	6.91*	3.97*	-0.98
Bad news<1%			N=	24															
AR	0.14%	0.16%	0.37%	0.88%	-0.77%	-2.21%	-1.43%	0.14%	0.79%	0.42%	-1.01%		CAR	-4.41%	-2.53%	-0.50%	3.41%	1.53%	-0.50%
G(Z)	0.31	-0.02	1.31	1.65	-1.02	-4.02*	-1.69*	0.31	0.65	0.65	-0.35		GB(Z)	-2.84*	-1.58	1.16	-2.84*	-1.58	1.16
C(Z)	0.50	0.32	1.93*	2.2*	-1.46	-7.95*	-2.46*	0.75	1.89*	-0.17	-1.37		C(Z)	-5.22*	-1.57	-0.70	-4.95*	-1.57	-0.71
P(Z)	0.58	0.28	1.26	2.62*	-1.89*	-5.87*	-4.13*	0.86	1.97*	-0.23	-1.52		P(Z)	-6.87*	-1.83*	-0.75	-6.87*	-1.83*	-0.75

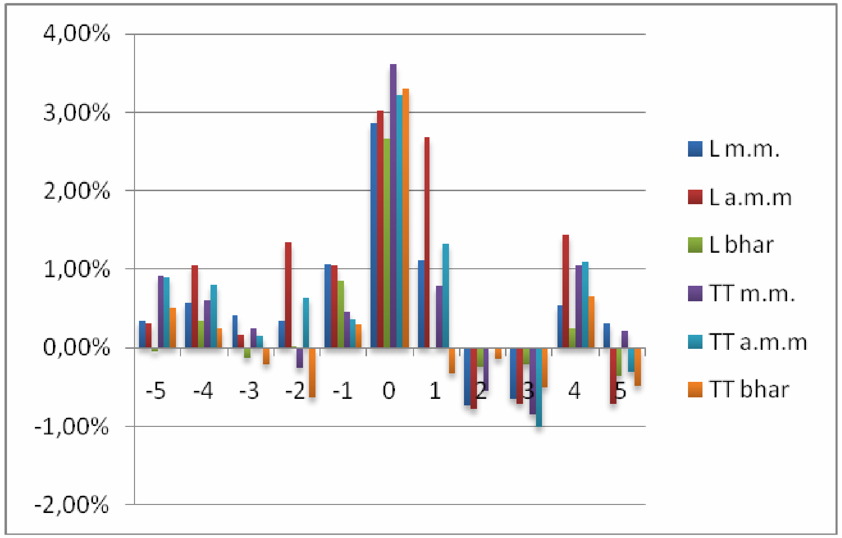

Figure C1. ARs for positive EAs

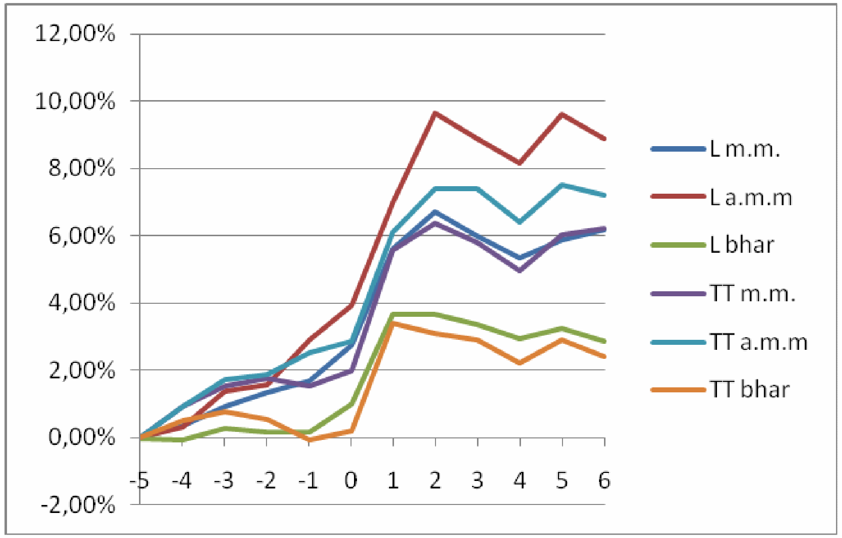

Figure C2. CARs for positive EAs

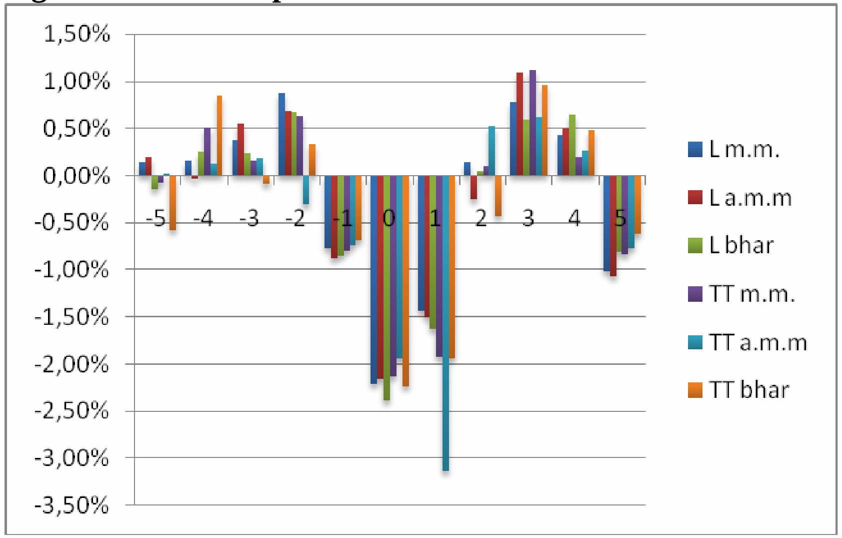

Figure C3. ARs for negative EAs

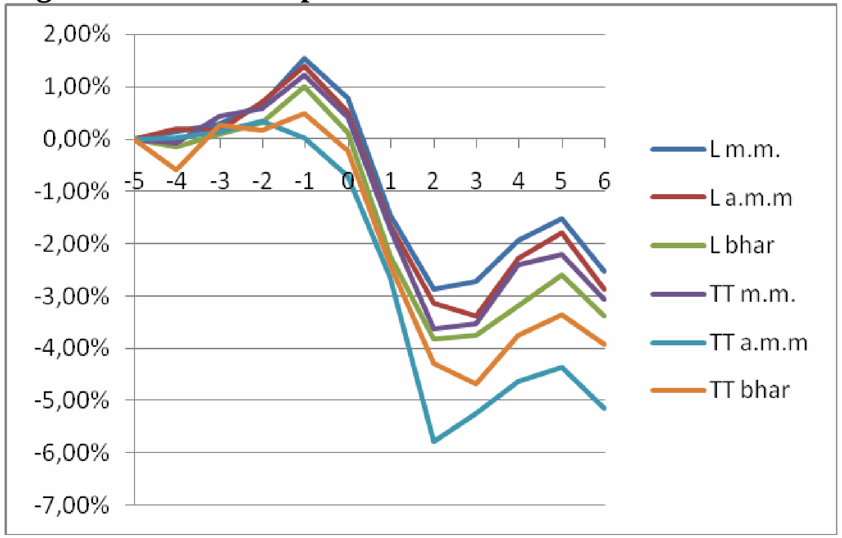

Figure C4. CARs for negative EAs

Note. All figures are compiled by the author. L stands for Lumped, TT – for Trade-to-Trade returns, m.m., a.m.m and bhar stand for market model, adjusted market model and buy and hold returns

Appendix D

Table D1

ARs and CARs for Lithuania

AR and CAR values are for Lithuania for the sample period from 2005 to 2008.The estimation window is 50 days long. The stocks affected by the event had to be traded at least 1/3 of the of the estimation period length. No missing trade dates for the event window [-5; +5] were allowed. The sample is divided into three parts: all news – takes all the observations, good news – takes only observations that exceed 1% in AR on the event day, bad news – observations with negative AR of less than 1%. Four tests were performed on all subsamples, however, the ones that are actually reported have the most power to discover abnormal activity. All the tests were performed on 2 types of returns (lumped and TT returns, both calculated on logarithmic returns) for 3 different normal performance estimation models (market model, adjusted market model and BHAR), however as long as the results are very similar only lumped market model values are provided below. In case of inconsistencies notes are added. Models use CWP as the market proxy.

Abbreviations. S – Patell's Standardized test values, G – GST values , C – Standardized Cross-Sectional test values, P – Patell's Z-test values, GB – GST with BHAR, Z stands for Z-score ~ N (0, 1), N – amount of observation. In CAR table, the accumulation periods with A letter indicate CARs adjusted for trading fees (0.5%) and capital gains taxes (see appendix B). If adjusted CARs are negative, it is impossible to gain positive returns. However, the unadjusted values just indicate the direction of CAR and both, positive and negative, values can be exploited by entering either short of long position in a stock. Test statistics with asterisk (*) indicate statistical significance at 5% level.

ALL news			N=	187														
Day	-5	-4	-3	-2	-1	0	1	2	3	4	5		Period	[-1; +1]	[-5;+5]	[+1; +3]	A[-1;+1]	A[-5;+5]	A[+1; +3]
AR	-0.17%	-0.02%	-0.11%	0.14%	0.23%	0.27%	-0.40%	-0.15%	-0.34%	-0.35%	0.20%		CAR	0.10%	-0.69%	-0.89%	-0.77%	-0.27%	-0.09%
S(Z)	2.95*	2.02*	3.69*	0.25	4.88*	18.11*	21.11*	7.39*	6.1*	9.61*	4.1*		C(Z)	0.69	-0.68	-1.94*	0.67	-0.68	-1.91*
Good news>1%			N=	64														
AR	-0.13%	-0.01%	0.25%	0.17%	0.15%	3.38%	0.01%	0.13%	0.07%	-0.34%	-0.06%		CAR	3.54%	3.62%	0.21%	2.16%	2.23%	-0.67%
G(Z)	-0.55	-0.67	1.21	0.45	-0.17	4.21*	0.45	-0.17	0.45	-1.18	0.33		GB(Z)	3.61*	1.87*	0.29	3.61*	1.87*	0.29
C(Z)	-0.25	-0.02	0.98	0.96	0.12	10.62*	0.33	-0.35	0.23	-1.00	-0.88		C(Z)	5.56*	3.53*	0.19	4.8*	2.99*	0.12
P(Z)	-0.31	-0.02	0.97	1.04	0.12	14.19*	0.58	-0.38	0.30	-1.26	-0.81		P(Z)	8.6*	4.36*	0.29	7.31*	3.7*	0.25
Bad news<1%			N=	49														
AR	0.45%	0.57%	-0.19%	0.20%	-0.07%	-3.35%	-0.81%	-0.69%	0.05%	-0.03%	0.71%		CAR	-4.23%	-3.16%	-1.45%	2.75%	1.84%	0.38%
G(Z)	0.35	0.52	0.52	1.01	0.03	-3.75*	-0.47	-0.14	0.03	0.19	0.85		GB(Z)	-2.17*	-0.67	0.50	-2.17*	-0.67	0.50
C(Z)	0.54	2.64*	-0.66	0.62	0.25	-8.37	-1.25	-1.43	0.01	-0.06	1.06		C(Z)	-5.31*	-2.47*	-1.97*	-3.53*	-1.75*	-1.38
C(Z)	0.64	2.73*	-0.89	0.62	0.30	-11.59*	-2.33*	-1.81*	0.01	-0.08	1.43		C(Z)	-7.86*	-3.31*	-2.39*	-6.68*	-2.81*	-2.03*

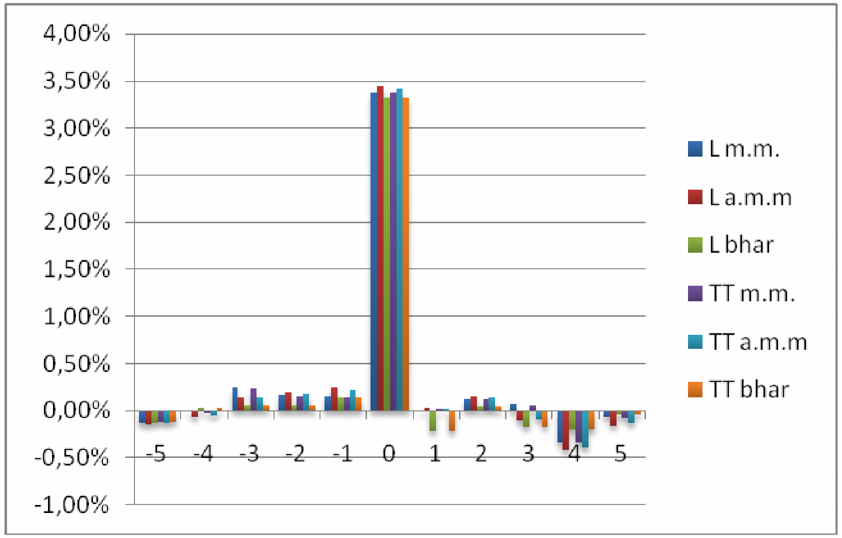

Figure D1. ARs for positive EAs

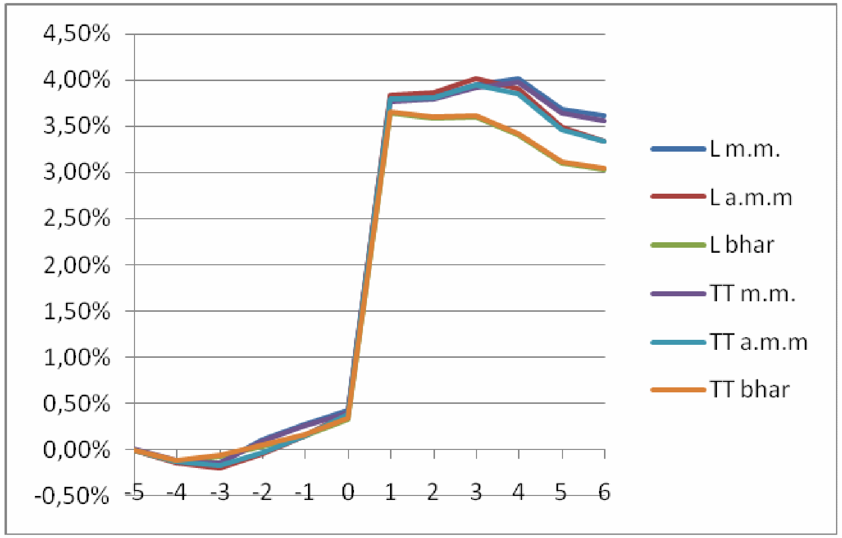

Figure D2. CARs for positive EAs

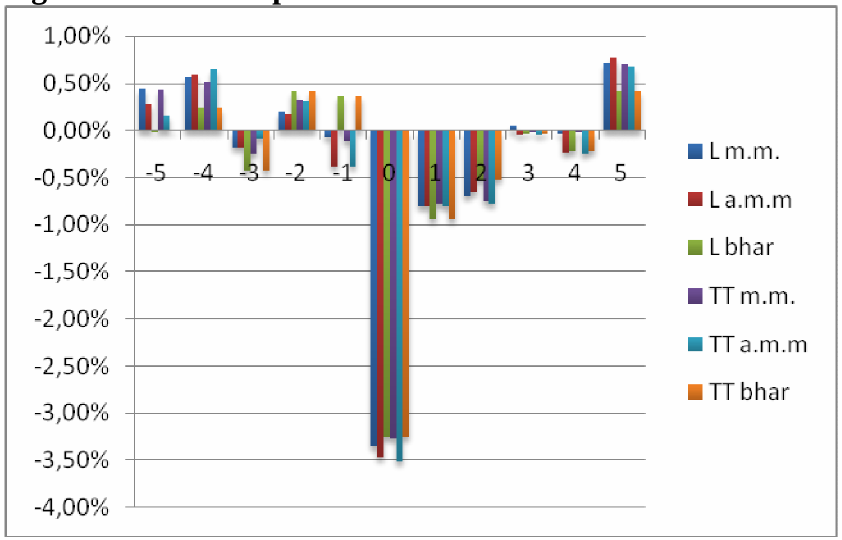

Figure D3. ARs for negative EAs

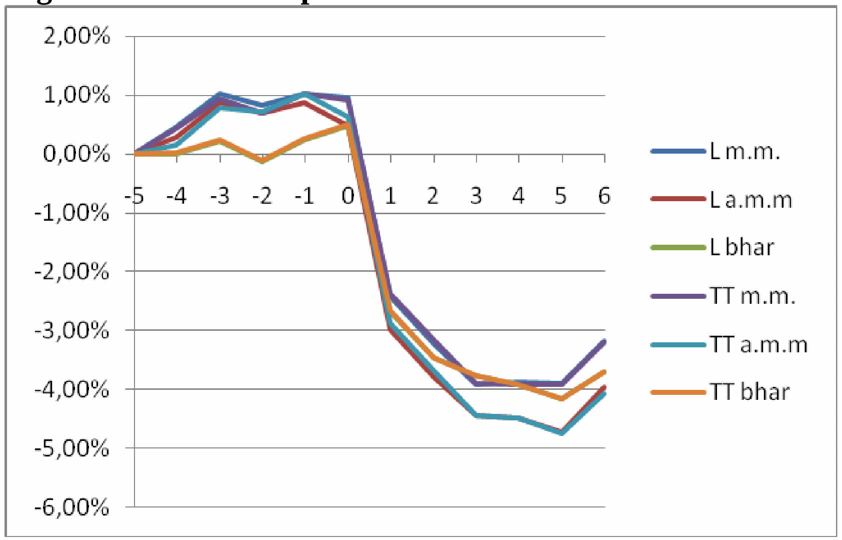

Figure D4. CARs for negative EAs

Note. All figures are compiled by the author. L stands for Lumped, TT – for Trade-to-Trade returns, m.m., a.m.m and bhar stand for market model, adjusted market model and buy and hold returns

Appendix E

Table E1

ARs and CARs for Slovenia

AR and CAR values are for Slovenia for the sample period from 2005 to 2008.The estimation window is 50 days long. The stocks affected by the event had to be traded at least 1/3 of the of the estimation period length. No missing trade dates for the event window [-5; +5] were allowed. The sample is divided into three parts: all news – takes all the observations, good news – takes only observations that exceed 1% in AR on the event day, bad news – observations with negative AR of less than 1%. Four tests were performed on all subsamples, however, the ones that are actually reported have the most power to discover abnormal activity. All the tests were performed on 2 types of returns (lumped and TT returns, both calculated on logarithmic returns) for 3 different normal performance estimation models (market model, adjusted market model and BHAR), however as long as the results are very similar only lumped market model values are provided below. In case of inconsistencies notes are added. Models use CWP as the market proxy.

Abbreviations. S – Patell's Standardized test values, G – GST values , C – Standardized Cross-Sectional test values, P – Patell's Z-test values, GB – GST with BHAR, Z stands for Z-score ~ N (0, 1), N – amount of observation. In CAR table, the accumulation periods with A letter indicate CARs adjusted for trading fees (0.5%) and capital gains taxes (see appendix B). If adjusted CARs are negative, it is impossible to gain positive returns. However, the unadjusted values just indicate the direction of CAR and both, positive and negative, values can be exploited by entering either short of long position in a stock. Test statistics with asterisk (*) indicate statistical significance at 5% level.

ALL news			N=	82							
Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AR	0.15%	-0.20%	0.16%	0.15%	0.26%	-0.17%	0.17%	0.40%	-0.09%	0.11%	-0.05%
S(Z)	2.4*	-1.48	-0.68	0.36	2.67*	1.48	3.65*	4.63*	2.75*	3.21*	-0.76
Good news>1%			N=	18							
AR	0.22%	0.04%	-0.44%	0.09%	0.35%	2.00%	-0.34%	1.37%	-0.11%	1.42%	0.34%
G(Z)	0.07	0.96	-1.26	0.52	0.52	4.07*	0.07	1.85*	0.96	1.85*	0.96
C(Z)	0.02	0.18	-1.57	0.26	0.56	9.21*	-0.71	2.5*	0.21	3.31*	0.86
P(Z)	0.03	0.15	-1.46	0.23	0.60	5.67*	-1.07	3.1*	0.28	3.5*	0.90
Bad news<1%			N=	19							
AR	0.78%	-0.37%	0.71%	0.37%	1.03%	-2.75%	0.98%	0.13%	-0.19%	0.02%	-0.41%
G(Z)	0.44	-0.41	1.28	0.86	0.86	-3.78*	1.28	-0.41	-0.41	-0.41	-1.25
C(Z)	1.55	-1.06	2.18	0.91	1.70	-6.61*	1.58	0.35	-0.15	0.21	-1.04
P(Z)	1.92*	-0.68	1.67	1.09	2.71*	-6.01*	2.3*	0.27	-0.25	0.21	-0.93

Period	[-1; +1]	[-5;+5]	[+1; +3]	A[-1;+1]	A[-5;+5]	A[+1; +3]
CAR	0.26%	0.90%	0.49%	-0.59%	-0.08%	-0.41%
C(Z)	1.16	1.27	1.68*	1.06	1.23	1.57
CAR	2.01%	4.93%	0.93%	0.81%	3.14%	-0.06%
GB(Z)	4.07*	3.62*	1.96*	4.07*	3.62*	1.96*
C(Z)	3.38*	4.35*	1.63	0.59	0.85	0.12
P(Z)	3*	3.6*	1.34	2.4*	2.88*	1.07
CAR	-0.74%	0.31%	0.92%	-0.21%	-0.55%	-0.06%
GB(Z)	-2.18*	-0.73	-0.61	-2.18*	-0.73	-0.61
C(Z)	-0.44	0.62	1.05	-0.47	0.59	0.99
P(Z)	-0.58	0.69	1.34	-0.47	0.55	1.07

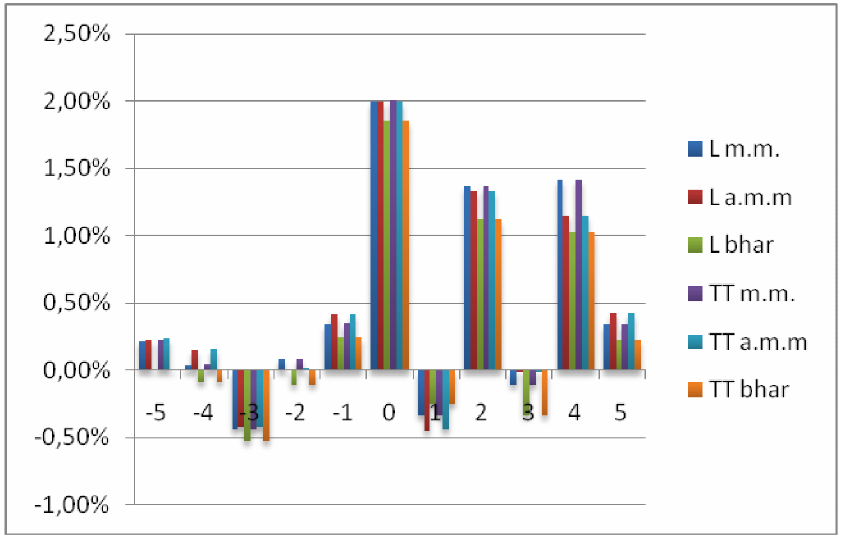

Figure E1. ARs for positive EAs

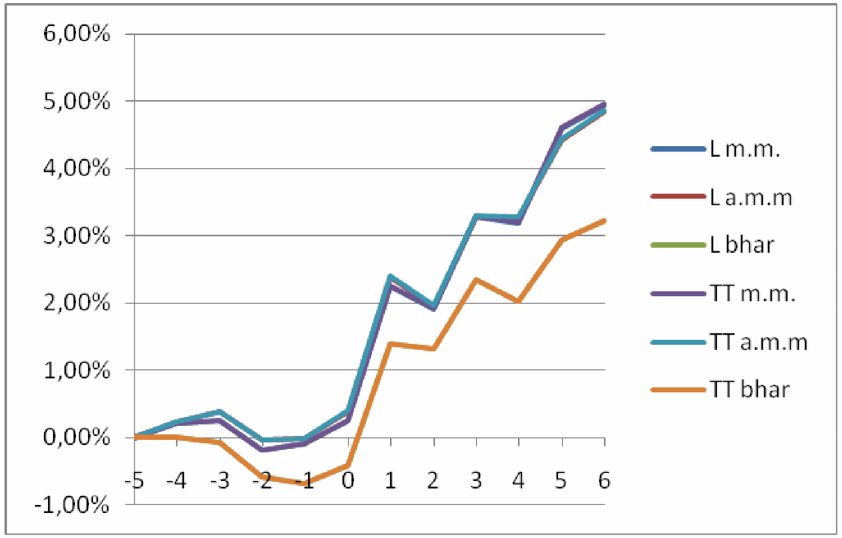

Figure E2. CARs for positive EAs

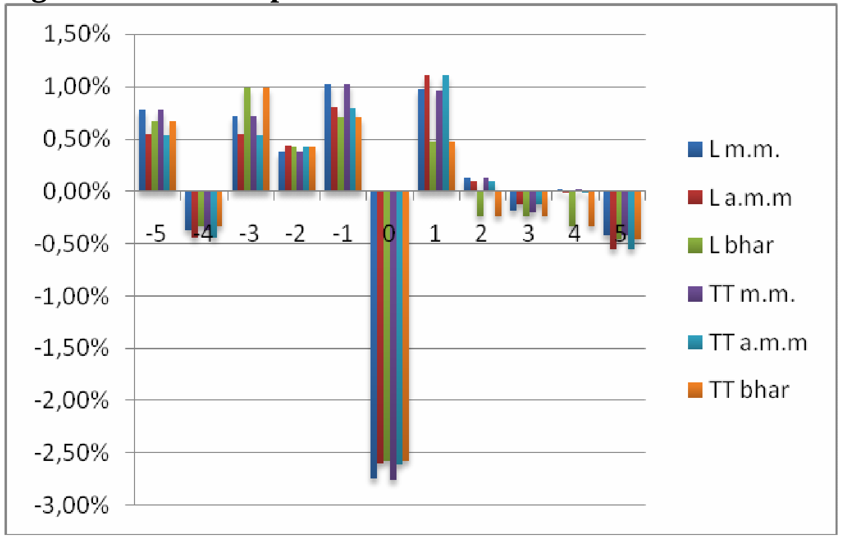

Figure E3. ARs for negative EAs

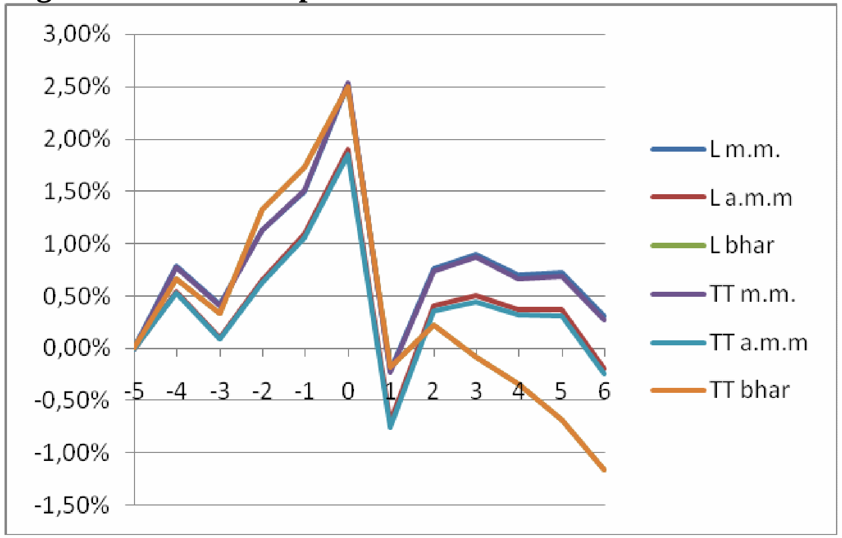

Figure E4. CARs for negative EAs

Note. All figures are compiled by the author. L stands for Lumped, TT – for Trade-to-Trade returns, m.m., a.m.m and bhar stand for market model, adjusted market model and buy and hold returns