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## INVESTORS' REACTIONS ON PUBLICATION OF QUARTERLY EARNINGS AT ZAGREB STOCK EXCHANGE: TRENDS AND FIRMS SPECIFIC EXPLANATORY FACTORS\*\*\*\*

*This study investigates the investors' reactions to the publication of quarterly earnings for companies at the Zagreb Stock Exchange. The empirical research based on the event study and 409 firm-year observations confirms that investors react to the publication of quarterly earnings, while the Friedman test indicates that the reactions are most frequent for earnings announcements from the second quarter (Q2). The occurrence of abnormal standardized returns on announcement day suggests that the efficient market hypothesis in semi-strong form does not hold for the Croatian capital market. Moreover, there is evidence of gradual price adjustment after announcement day. Longitudinal analysis in the period 2010-2022 indicated that investors' reactions are stable and that there is no trend of growth or decline in standardized abnormal returns. The estimated pool regression model revealed that several firm characteristics influence the information content of quar-*

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*terly earnings. The earnings surprise variable positively affects standardized abnormal returns, while firm size and reporting of losses variables negatively affect standardized abnormal returns. The results of the study confirm to capital market regulators the practical benefits of quarterly financial reporting, to firms that they can use quarterly financial reports to reduce information asymmetry and to investors that after the quarterly earnings publication there is the possibility of achieving abnormal returns. The limitation of this study is relatively small sample in comparison with similar studies. Findings about slow price adjustment after the day of earnings release might be challenged by the occurrence of other price-sensitive information. Some future research might improve findings by use of additional independent variables, like management analysis and analyst forecast, which could shed new light on the quarterly earnings information content at ZSE.*

**Keywords:** *accounting earnings, information content, event study, Croatia*

## 1. INTRODUCTION

Contemporary financial reporting conceptual frameworks (IASB & FASB) clearly define that accounting information should be useful when making investment decisions related to equity investments. The pioneering papers of Ball & Brown (1968) and Beaver (1968) paved the way for numerous studies that explore investors' reactions to releasing accounting earnings. Recent studies put focus on the longitudinal analysis of the information content of earnings publications, with control for potentially significant independent variables such as size, the announcement of losses, the introduction of IFRS, the introduction of additional disclosure requirements, etc. Considering that such studies are very rare in Croatia and other Central & Eastern European (CEE) countries, it was interesting to research investors' reaction on a sample of listed companies from the Zagreb Stock Exchange - ZSE, which would provide answers to several questions. First, do investors on the ZSE react to the publication of quarterly earnings? Second, is the share price reaction stable over time or are there positive/negative trends? Finally, are any other firm-specific variables important for explaining abnormal returns? Answers to these research questions can be useful for capital market regulators, as well as for listed companies and investors at the ZSE.

This research contributes to the existing body of knowledge in several ways. The majority of the previous research was done in countries with developed capital markets (USA, UK, France, Western Europe countries, etc.), while this study

analyzes investors' reactions to the publication of quarterly earnings in the small and shallow Croatian capital market. Empirical results confirmed that a high quality and stable regulatory environment even in small and shallow capital markets results in a stable reaction of investors to the quarterly earnings announcements. This study provides the original finding that the Croatian capital market is not semi-strong efficient since standardized abnormal returns are evident up to six days after the publication of quarterly earnings. In addition, this research contributes to the improvement of the research methodology because the existence of abnormal returns is determined statistically more sophisticated and strictly compared to other studies. Namely, the abnormal returns are not determined only in relation to the variance of the abnormal returns from the non-reporting period, but a parametric test is used. The study uses a very long time series in the period 2010-2022, which enables insight into the information content of earnings over a long period of time that includes years of economic prosperity and crisis.

This study belongs to a relatively small number of studies that explored a battery of firm-specific variables that could explain the existence of abnormal standardized returns. Although one part of the empirical results (influence of company size, unexpected earnings and announcement of losses) is comparable with findings from similar studies, the conclusion related to the effect of the time variable is fundamentally different. Namely, the sign with the time variable was insignificant in this study, meaning that there is no positive/negative trend in investors' reactions like in other studies, which often report a positive trend. The absence of a positive trend in standardized abnormal returns for the ZSE sample can be explained by the fact there were no tectonic changes in reporting frameworks or platforms during the analysis period as it was in other countries. Thus for example, positive trends in other countries are related to the implementation of Sarbanes-Oxley Act - SOX in the US (Beaver et al. 2018), switch to set of better accounting standards - IFRS in Australia (Truong, 2012) and start of use of online reporting platform in Turkiye (Ahlatcioglu & Okay, 2019). The research results indicate to the capital market regulators in Croatia that there is a practical justification for quarterly financial reporting because investors react to the publication of quarterly earnings numbers. On the other hand, results implicate that listed companies should be aware that investors read their quarterly reports and that these reports should be of the highest quality if companies want to reduce information asymmetry through transparency and high-quality reporting. Knowing that abnormal returns occur on the day of the earnings release and a few days later, investors can adjust their investment decisions to optimize their returns.

The remainder of this paper is structured in the way that the second part of the paper analyses the most relevant early and contemporary papers, which explore the topic of the information content of accounting earnings. The third section

describes the sample selection procedures, event study approach, variables, data sources and all required equations. Most important empirical results are presented in the fourth section, followed by the conclusion.

## 2. LITERATURE REVIEW

Academic research about investors' reactions to earnings publication has a long history starting with papers of Ball & Brown (1968) and Beaver (1968). Ball & Brown analyzed US data (period 1946-1966) and found that share prices reacted to annual earnings announcements (classified as good or bad news). However, Ball & Brown's research also revealed that share prices reacted much earlier and that 80-85% of abnormal returns occurred before the month of annual earnings release. Beaver (1968) introduced the term "information content of earnings" which means that earnings possesses information content if its publication triggers the change in the equilibrium value of the current market price. Beaver used US data in the period 1961-1965, analyzed the weekly reaction of returns and traded volumes. In contrast to Ball & Brown, he avoided the separation of earnings announcements into good or bad news by deploying U statistics based on squared abnormal returns from the market model. Research revealed that stock price volatility was significantly larger (67%) in the annual earnings-reporting week in comparison with non-reporting period.

The theoretical foundation for studies of earnings information content is the semi-strong form of efficient market hypothesis - EMH (Fama, 1965; Fama, 1970). If the semi-strong form of EMH holds then investors cannot make abnormal returns from the earnings announcement because the stock price incorporate all publicly available information. Otherwise, if empirical data indicate abnormal returns around the earnings publication, this confirms the informational content of the earnings and that market is not semi-strong efficient according to the EMH. After early papers, later studies (Kiger, 1972; Morse, 1981; Patel & Wolfson, 1984; Bamber, 1986; Ziebart, 1990) used different US data sets and revealed similar findings, confirming the information content of earnings announcements.

The global importance of this research topic is evident since papers from many other countries reveal international evidence on earnings information content. Thus, for example, Rippington & Taffler conducted a similar study in the UK (1995), Odabasy in Turkiye (1998), Pellicier & Rees in Spain (1999), Gajewski & Quere in France (2001), Sponholtz in Denmark (2008), Pervan, Arneric & Malcak in Croatia (2011), Melgarejo, Montiel & Sanz in Chile and Peru (2016), Syed & Ba-

jwa in Saudi Arabia (2018), Prasad & Prahbu in India (2019), etc. Contrary to other research Angelovska (2017) reports that in the period 2008-2009, investors from Macedonian Stock Exchange did not react to annual earnings releases. Namely, empirical findings did not confirm any impact on abnormal returns or volumes, which is explained by investors' fears caused by the global economic crisis. DeFond, Hung & Trezevant (2007) in a cross-country study (26 states) revealed that annual earnings have more information content in states with better earnings quality or higher quality of enforcement of insider trading rules. However, annual earnings were less informative in states with more frequent interim reporting. Dreassi, Kaucic & Valentinuz (2017) analyzed the information content of earnings for EU insurance companies and concluded that half-year earnings and annual earnings result in a larger and more persistent impact on abnormal returns in comparison with quarterly earnings.

Findings from several studies (Collins, Maydew & Weiss, 1997; Francis & Shipper, 1999, etc.) from the end of the 1990s indicated a decline in the value-relevance of annual earnings during the time, which triggered a new wave of information contents studies. A new course of research was focused on the longitudinal change of information content of earnings. Landsman & Meydew (2002) used US data in the period 1972-1998 and found that quarterly earnings did not lose information content during that time. Namely, the authors presented evidence of the increase in the information content of reported earnings. Troung (2012) conducted a longitudinal analysis of New Zealand firms' data in the period 1994-2009. The sign with the time trend variable from the estimated regression was positive, indicating the increase in the information content of earnings during the time. It is important to point out that the adoption of IFRSs contributed to the progression of earnings importance for investors.

Beaver, McNichols & Wang (2018) examined the time trend of the importance of quarterly earnings of US firms in the period 1971-2011. Empirical findings also indicated a positive trend in earnings information content, especially after 2001 and the enforcement of the Sarbanes-Oxley Act (SOX). Besides time trend variable authors report that abnormal returns were related to reporting of losses, firm size, and analyst coverage. Ahlatcioglu & Okay (2019) reported similar findings, i.e. positive time trend of earnings information content for the listed firms at Borsa Istanbul, Turkiye. The authors also provided some evidence that the implementation of the new online disclosure platform contributed to the increased importance of earnings numbers. Latest paper of Beaver, McNichols & Wang (2020), which used the US dataset from 2001 to 2016 provides evidence of an increasing trend in earnings information content. As the main contributing factors for such an increase, the authors point out increased disclosure by management and analyst forecasts.

### 3. RESEARCH DESIGN

#### 3.1. *Sample selection*

The research sample incorporates data for listed firms at Zagreb Stock Exchange. More than 120 firms are listing their shares at ZSE, but many of these shares were not actively traded. A joint analysis of data for firms whose shares are actively traded with firms whose shares are traded sporadically would lead to distorted conclusions. Namely, if there is no active trading (usually due to very low free float), it means that there is no significant investor interest and demand for earnings announcements. To ensure a more homogenous set of data, incorporating only actively traded firms the first selection criteria is focusing on analyzing investors' reactions to quarterly earnings publication for only those firms whose annual shares turnover was more than 3,0 mil. €. In the next step, sampling procedure excluded data for former Agrokor Group subsidiary firms which were involved in potentially fraudulent financial reporting and for which is trial currently undergoing. Additionally, as proposed by other authors (Sponholtz, 2008; Troung, 2012; Beaver et al. 2018) observation elimination criteria were a minimally 1/3 of trading days in the estimation period and trading of minimally three days ( $t-1$ ,  $t=0$ ,  $t+1$ ) during the event period. After removal of outliers and missing data the final sample incorporates 409 earnings announcements from 26 firms. All required data (dates of financial statements' public publishing, share prices, and market returns - CROBEX) was obtained from the Zagreb Stock Exchange - ZSE ([www.zse.hr](http://www.zse.hr)). Financial statements were also available from the EHO - online disclosure platform of the ZSE ([www.eho.zse.hr](http://www.eho.zse.hr)).

#### 3.2. *Research methodology and variables*

To capture investors' reactions to quarterly earnings releases this paper uses the event study approach. The event study approach can be found in many papers (Dolly, 1939; Fama, Fisher, Jensen & Roll, 1969; Jarrell & Poulsen, 1989, etc.) which analyze the effect of specific corporate event (stock splits, dividends, M&A, restructuring, equity issuance, etc.) on shares' abnormal returns or cumulative abnormal returns. Accounting academic literature indicates that after Ball & Brown (1968) and Beaver (1968) many other papers (Sponholtz, 2008; Troung, 2012; Angelovska 2017; Ahlatcioglu & Okay, 2019, etc.) utilize event studies for exploring earnings information content. The event study approach also allows inspecting

how quickly a new piece of information incorporates into share prices, i.e. how fast abnormal returns diminish after the earnings release. Speed of share price adjustment indicates the level of capital market efficiency.

Data set was split into two periods, reporting period ( $t-7, t=0, t+7$ ) and the estimation period ( $t-108; t-8; t+8; t+108$ ), where  $t=0$  represents earnings announcement day. In order words, in reporting period abnormal returns were calculated 7 days before and 7 days after the earnings release. Inspection of abnormal returns 7 days before announcement enables capturing possible information leakages or speculative trade, while inspection of abnormal returns 7 days after gives the opportunity to analyze market efficiency and speed of price adjustment. Data from estimation period (non-reporting period) was used to estimate parameters  $\alpha_i$  and  $\beta_i$  in market model, which is required to calculate normal returns:

$$\widehat{R}_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}; E(\varepsilon_{it}) = 0; Var(\varepsilon_{it}) = \sigma_\varepsilon^2 \quad (1)$$

$R_{mt}$  – return of market portfolio (CROBEX) in estimation period

$\varepsilon_{it}$  – model error

$Var(\varepsilon_{it})$  – model error variance

Parameters  $\alpha_i$  and  $\beta_i$  are estimated by application of linear regression model, where actual stock return  $R_{it}$  is dependent variable, while market return  $R_{mt}$  is explanatory variable. Abnormal returns ( $AR_{it}$ ) in event period for each observation  $i$  in day  $t$  is difference between actual returns ( $R_{it}$ ) and normal returns from market model:

$$AR_{it} = \varepsilon_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \quad (2)$$

In order to avoid mutual cancellation of abnormal returns due to different signs (positive or negative) it was necessary to square all abnormal returns. If investors perceive that quarterly earnings do not convey new useful information abnormal returns in reporting period should be equal to zero. On the contrary, if investors think that earnings provide price-sensitive information abnormal returns should be positive and statistically significant. The following formula was used to standardize the abnormal return volatility ( $ARV_{it}$ ):



$$ARV_{it} = \frac{\varepsilon_{it}^2}{\sigma_i^2} \quad (3)$$

$ARV_{it}$  - abnormal return volatility of share  $i$  in day  $t$

$\varepsilon_{it}$  - model error = abnormal return of share  $i$  in day  $t$

$\sigma_i^2$  - model error variance (from estimation period)

In contrast to Beaver (1968), who determines the existence of abnormal returns in the reporting period by relating it with the average abnormal returns from the non-reporting period, a more sophisticated approach was used in this study. Namely, the assumption is that the variable of standardized abnormal returns  $ARV_{it}$  has normal distribution due to the large sample and long time series. Such an approach enables formal statistical testing according to which the  $ARV_{it}$  value is treated as different from zero only if the t-value of the t-test is more than 1.96 ( $p < 0.05$ ).

The average abnormal return volatility of all included earnings announcements on day  $t$  was averaged across announcements.

$$AARV_t = \frac{1}{N} \sum_{i=1}^N ARV_{it}; \quad (4)$$

$AARV_t$  - the average volatility of abnormal returns of all shares on day  $t$

$N$  - the number of firms for each individual earnings announcement within the year

Building on previous research (Truong, 2012; Poretti, Schatt & Bruynseels, 2018) it was necessary to develop a variable required for measurement of the longitudinal change of earnings information content - 3DARV (Three-Day Abnormal Returns Volatility). 3DARV represents the natural logarithm of the ratio between the sum of abnormal returns during the three days ( $t-1$ ,  $t=0$ ,  $t+1$ ) in the reporting period and abnormal return variance from the non-reporting period. 3DARV for firm  $i$  in announcement quarter  $q$  is calculated by the following formula:

$$3DARV_{i,q} = \ln \sum_{t=-1}^{t=1} \frac{\varepsilon_{it}^2}{\sigma_i^2} \quad (5)$$

In developing the 3DARV variable a decision was made to use the natural logarithm because previous empirical evidence indicated a non-normally distribution of the variable. Since the main goal of this paper is to determine the longitudinal change in the information content of the quarterly earnings, it is necessary to define an independent variable that measures the passage of time. Given that study is focusing on analyzing quarterly earnings announcements, the TIME variable indicates the number of months passing between two announcements. Accordingly, at the beginning of the time series (Q2 2010), the value of the TIME variable is set to 1, and it increases by 3 (month) in each subsequent quarter.

Findings from early (Landsman & Meydew, 2002; Troung, 2012) and recent longitudinal studies (Beaver et al. 2018; Ahlatcioglu & Okay, 2019, Beaver et al. 2020) might indicate that one should expect positive sign with the TIME variable. However, it must be noted that the reported increase in earnings information content is also supported by some other specific variables like an increase in transparency and disclosure requirements (SOX), implementation of an online reporting platform, adoption of IFRS, etc. Taking into account the fact that Croatian listed firms started in 1992 with use of IAS and in 2005 with IFRS, there was not any tectonic change in the basic financial reporting framework in the period 2010-2022. Although disclosure requirements for Croatian listed firms were at an unsatisfactory level up to end of 2008 (Pervan, Horak & Vasilj, 2010) regulatory framework was significantly improved since 2009. Namely, disclosure requirements for listed firms were harmonized with EU regulation, providing a comprehensive set of publicly available information for investors. Disclosure requirements from 2009 onward assured that all price-relevant information, including financial statements, were publicly available during the period 2010-2022 on the websites of ZSE and capital markets regulator Hanfa ([www.hanfa.hr](http://www.hanfa.hr)).

Given that some earlier research confirmed that other factors could affect abnormal returns in addition to the TIME variable, it is necessary to control for additional independent variables. Among the first authors who used the size variable was Atiase (1985), who hypothesized that the amount of unexpected information caused by the earnings announcement should be inversely proportional to the firm size measured by market capitalization. In other words, larger firms have a richer information environment and provide more useful information (before announcing earnings) than smaller firms. Similar findings about the negative impact of the size variable on abnormal returns are confirmed by some later studies (Shores, 1990; Troung, 2012; Beaver et al. 2018). However, Ahlatcioglu & Okay (2019) report mixed results, with an insignificant or even positive sign with the size variable depending on the period of analysis. Size variable is measured as the natural logarithm (ln) of market capitalization (LN-MCAP).

In the event study approach, when analyzing the reaction of investors to the publication of earnings the reaction may be greater the bigger the earnings sur-

prise (Landsman & Meydew, 2002; Troung, 2012; Ahlatcioglu & Okay, 2019). Therefore, modelling included the variable earnings surprise with the expectation that the variable should have a positive sign. Earnings surprise is the absolute value of earnings change between two quarters divided by the book value of equity. To normalize the variable (LN-ESAV), the natural logarithm was applied. Comparable studies (Troung, 2012; Poretti et al. 2018; Ahlatcioglu & Okay, 2019) based on study of Givoly & Hayn (2000) often use market to book to ratio (M/B) as proxy variable for accounting conservatism. Namely, observed increasing value of M/B over time is indicator of accounting conservatism and inability of accounting standards and earnings to capture important intangible value drivers such as human capital, research activities, new technology, etc.

Given that research by Hayn (1995) showed that investors do not react equally to the announcement of profit and loss, an additional control variable in similar studies (Landsman & Meydew, 2002; Troung, 2012; Poretti et al. 2018) is the LOSS variable. Research of Hayn (1995) confirmed hypothesis that investors have a liquidation option and losses therefore are not expected to perpetuate. Therefore, the expectation is that the reaction of investors to the announcement of a loss will be of smaller effect than the reaction to the announcement of positive earnings. LOSS is a binary variable and can take the value of 1 for negative earnings or 0 for positive earnings announcement.

### *3.3. Descriptive statistics*

Descriptive statistics for all regression model variables, dependent variable (3DARV) and independent variables are shown in Table 1. The mean value of 3DARV is equal to 0.87, which is according to one sample t-test significantly larger than zero (p-value < 0.01) and indicates that quarterly earnings cause investors' reactions at Zagreb Stock Exchange. The standard deviation for 3DARV was large (1.30) and six outliers were removed from the dataset (difference from the mean by more than 2 standard deviations). After removing the outliers, the standard deviation decreased to 1.23, which in relation with mean of 0.91 suggests that in the sample of companies from the ZSE, there are significant variations in the reaction of investors to the publication of quarterly earnings.

Table 1:

## VARIABLES SUMMARY STATISTICS

Variables	Obs.	Mean	Std. Dev.	Min	Max
3DARV	570	0.911	1.226	-2.44	4.30
TIME	570	64.840	42.584	1	148
LN-MCAP	570	21.115	1.353	17.56	24.51
LN-ESAV	409	16.578	1.673	8.57	21.54
M/B	565	1.247	3.195	-38.89	41.63
LOSS	570	0.280	0.449	0	1

Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

The TIME variable was based on the research sample which incorporates data for 50 quarters (period from Q2 2010 until Q3 2022) and it has a range between 1 (Min) and 148 (Max). The size variable (LN-MCAP) has a mean of 21.12, while the earnings surprise variable (LN-ESAV) has a mean of 16.58. Both variables are transformed by the natural logarithm and considering their means and standard deviations, they show small dispersion. The variable M/B has high dispersion and varies from -38.89 to 41.63, with a mean of 1.25. The average for LOSS equals 0.28, which means that 28% of earnings announcements were losses, while 72% of earnings announcements were profits.

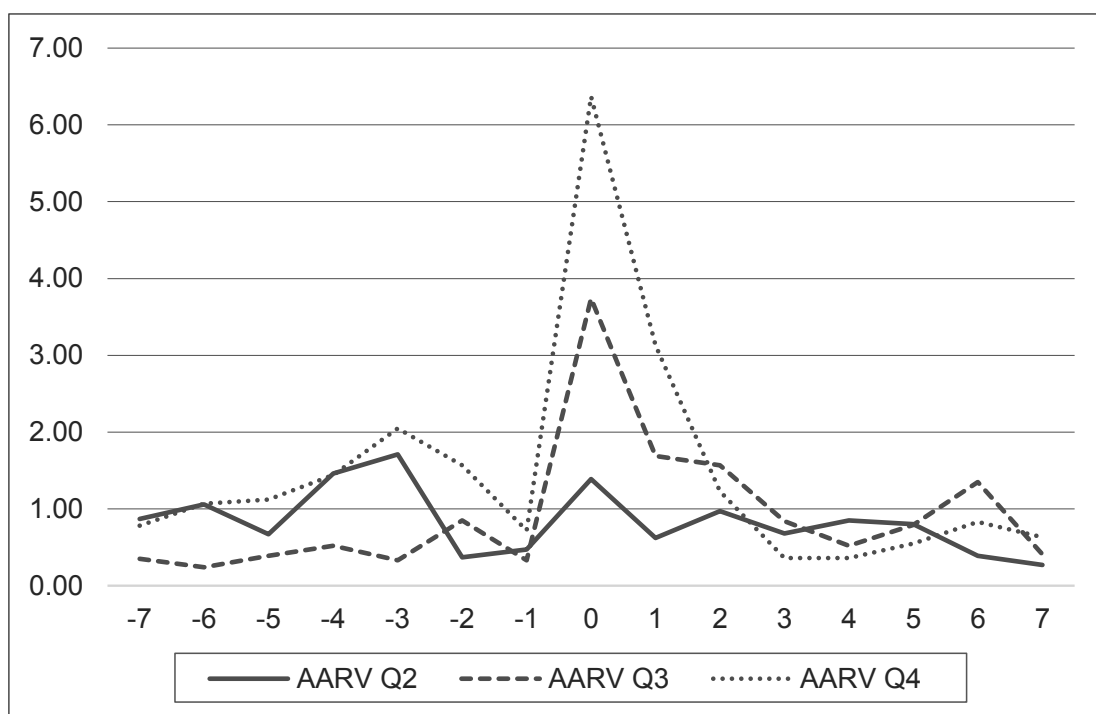
#### 4. RESEARCH RESULTS

To explore the reaction of ZSE investors to the publication of quarterly earnings, firstly it was necessary to calculate abnormal returns ( $ARV_{it}$ ) according to formulas 1, 2 and 3. Standardized abnormal returns were then averaged (AARV<sub>t</sub>) across announcements for each year separately according to formula 4. Figure 1 shows the reaction of ZSE investors to the publishing of three quarterly earnings in 2010 (Q2, Q3 and Q4). Considering the way abnormal returns are tested for being different from zero, the conclusion is that investor reaction exists if the AARV value is greater than 1.96. The reaction of investors is evident for Q3 and Q4 on the day of publication of quarterly earnings ( $t=0$ ), while there was no investors' reaction for Q2. Furthermore, for the announcement of earnings in Q4, it is observed

that the reaction of investors lasts for one more day after the announcement (t+1), while in Q3, no reaction occurs on day t+1.

Figure 1:

AVERAGE OF STANDARDIZED ABNORMAL RETURNS VOLATILITY IN Q2, Q3 AND Q4 (2010)



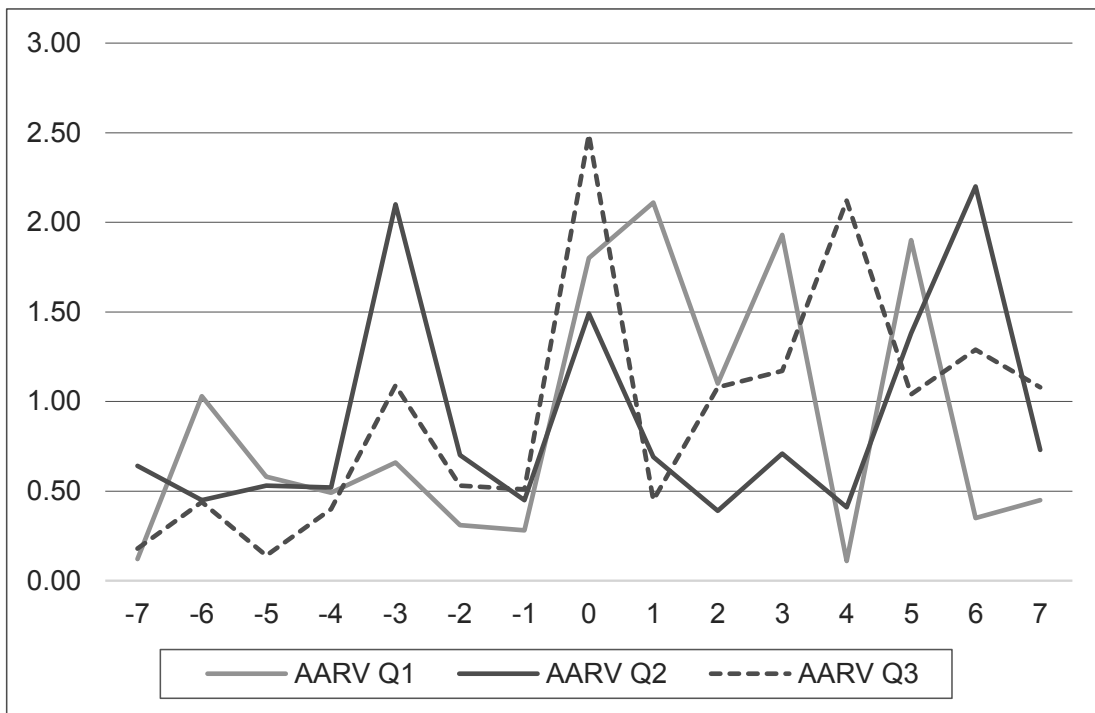
Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

The same analysis of investors' reaction to the publication of quarterly earnings was done for all other years included in the research, while Figure 2 presents the reaction of investors in the last year (Q1, Q2 and Q3 in 2022). Here, the standardized abnormal returns were significant only for Q3 on the day of publication of quarterly earnings (t=0), while there was no reaction of investors for Q1 or Q2. For Q1, a delayed reaction of investors is noticeable because a significant abnormal return is evident one day after the announcement (t+1), after which the reaction no longer occurs. In the case of Q2, the reaction occurs two days before the public announcement of earnings (t-2), there is no reaction on the day of the earnings release (t=0), while the reaction is observed again on the sixth day (t+6). Abnormal returns

before the official publication of earnings can be the result of information leakages or speculative trading, while occurrence of standardized abnormal returns after the public release of earnings is associated with a lower degree of efficiency of the capital market in Croatia.

Figure 2:

AVERAGE OF STANDARDIZED ABNORMAL RETURNS VOLATILITY IN  
Q1, Q2, AND Q3 (2022)



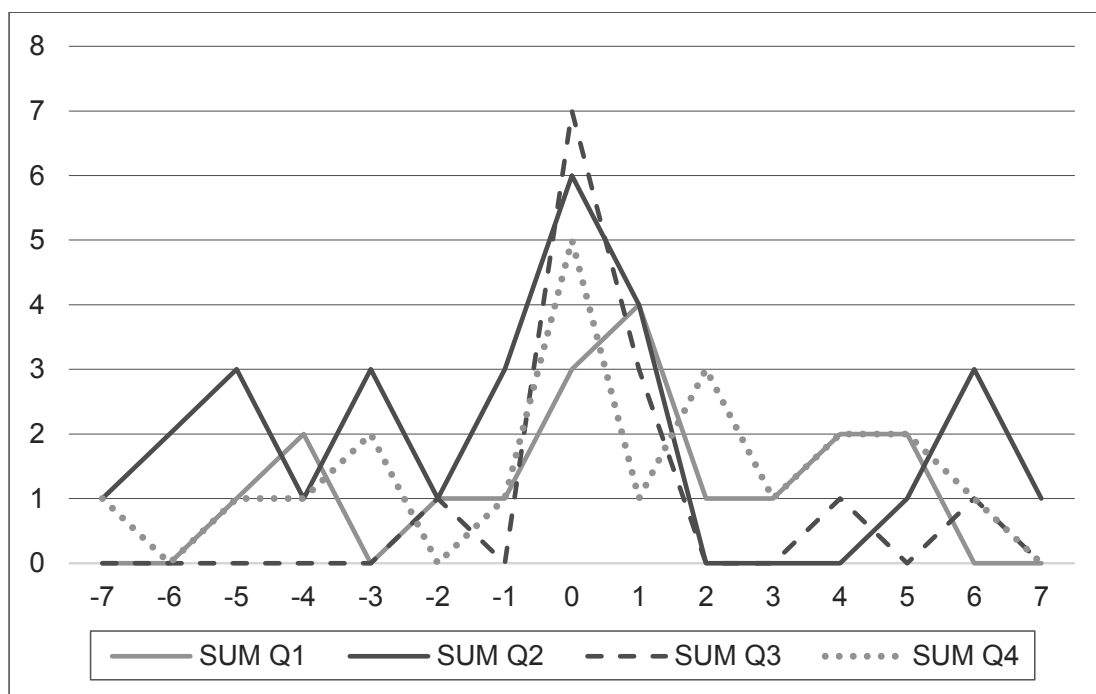
Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

Given that the analysis of abnormal returns related to the announcement of quarterly profits by each of 12 years (2010-2022) included in the analysis reveals diverse reactions by quarters, it was interesting to compare the reactions by each quarter. Is there a quarter in which standardized abnormal returns ( $AARV_t > 1.96$ ) are more common compared to other quarters? According to Figure 3, it is clear that the highest number of standardized abnormal returns (7) on the day of earnings announcement ( $t=0$ ) is related with Q3, followed by Q2 with 6 abnormal returns. Q4 has 5 abnormal returns on day  $t=0$ , while Q1 has only 3 abnormal

returns. Extension of such analysis for all 15 days ( $t=0$ ;  $t=\pm 7$ ) in reporting period with application nonparametric Friedman test indicates that there is a statistically significant difference between quarters (p-value is 0.046). Calculated mean ranks show that quarter Q2 has the highest number of abnormal returns. Additionally, on earnings publication day ( $t=0$ ), the number of standardized abnormal returns is the highest (22), as compared with other days in the reporting period. Findings from Figure 3 clearly indicate that Croatian capital market is not semi-strong efficient since standardized abnormal returns are evident on earnings announcement day ( $t=0$ ) and up to six days ( $t+6$ ) after quarterly earnings announcement.

Figure 3:

SUM OF THE NUMBER OF STANDARDIZED ABNORMAL RETURNS  
 ( $AARV_T > 1.96$ ) BY QUARTERS IN EVENT PERIOD



Note: Friedman test Mean Ranks: SUM Q1 = 2.53, SUM Q2 = 3.03, SUM Q3 = 1.83, SUM Q4 = 2.60; Chi-Square = 7.992; p-value 0.046

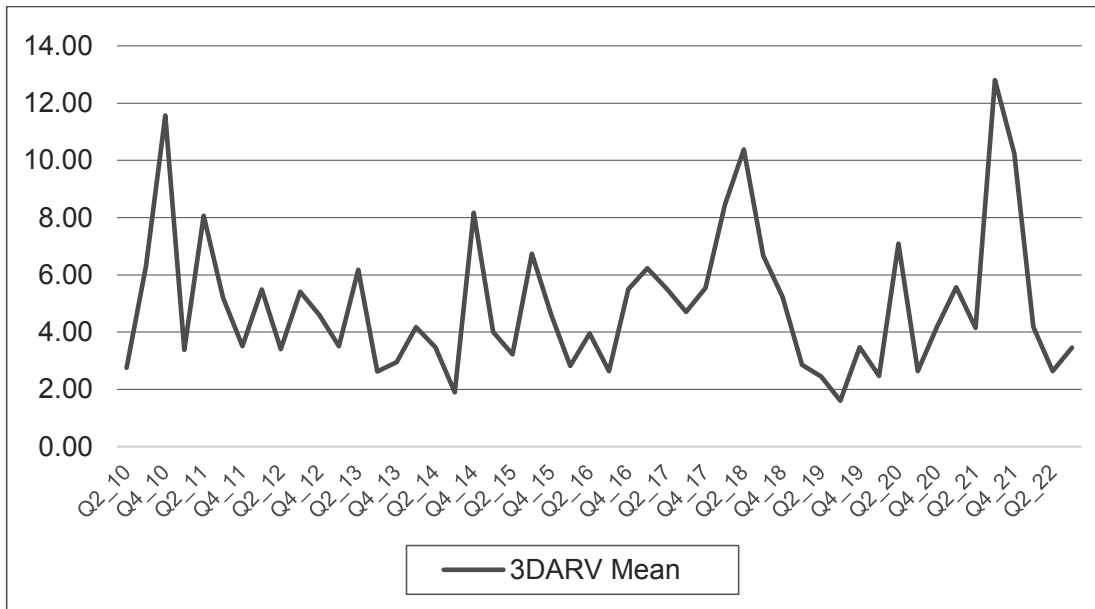
Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

The second research question was whether the market reaction to quarterly earnings was stable or increasing/decreasing during the time. To capture the inves-

tors' reaction to the publication of quarterly earnings during the time, the 3DARV variable was created according to formula 5. To achieve the normality of the distribution of 3DARV variable the natural logarithm was applied. According to One-Sample Kolmogorov-Smirnov test (p-value 0.200) 3DARV variable distribution is normal. The longitudinal change of 3DARV means in period Q2 2010 - Q3 2022 is presented in Figure 4. Visual inspection of the time series does not indicate the existence of a significant positive or negative trend in the observed period.

Figure 4:

#### THE LONGITUDINAL CHANGE OF 3DARV MEANS



Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

The final goal of this research is to determine which firm specific independent variables significantly affect standardized abnormal returns for listed firms at ZSE. The first step in this part of empirical analysis is to estimate the adequate statistical model. For this panel data set, the dependent variable 3DARV does not vary across time, i.e. it is stationary. Instead of the static panel data model, the pooled regression analysis was chosen as the most appropriate. Pooled data occur when data set consists of "time series of cross-sections," but the observations in each cross-section do not necessarily refer to the same unit. Pooled regression



increases the number of data points and the model dimensions resulting in higher accuracy with increasing statistical power and reduced estimation bias (Baltagi, 2013; Wooldridge, 2010). Moreover, similar empirical studies have shown that pooled regression analysis remains a robust and consistent method, providing reliable estimates of coefficients (Troung, 2012; Ahlatcioglu & Okay, 2019; Beaver, McNichols & Wang, 2020).

The results of the pooled regression models are shown in Table 2. F-test results reveal that all three estimated models are significant at 0.05 level. Durbin-Watson statistics are close to the value of 2.0 what means that there is no problem of autocorrelation of residuals. The potential problem of multicollinearity was evaluated based on Variance Inflation Factors (VIF). Since all VIF coefficients were less than 5 estimated models do not suffer from multicollinearity problem.

According to the observed movement of 3DARV over time from Figure 3, the estimated regression model confirmed that the coefficient with the TIME variable is close to zero and statistically insignificant. Such finding contradicts findings from similar studies (Landsman & Meydew, 2002; Troung, 2012; Beaver et al. 2018; Ahlatcioglu & Okay, 2019, Beaver et al. 2020) which report positive sign with the TIME variable. Nevertheless, it must be pointed out that the reported increase in investors' reactions is often accompanied by change in other independent variables (implementation of SOX, online reporting platform, switch of IFRS, etc.). Since significant changes in financial reporting regulation and online reporting platforms in Croatia occurred in 2009 in the period 2010-2022 there was not any significant change that might trigger the increase in the quality of financial reporting at ZSE. Since the TIME variable was statistically insignificant it was omitted from models 2 and 3.

In accordance with the theoretical expectations and findings from similar studies (Atiase, 1985; Shores, 1990; Troung, 2012; Beaver et al. 2018), the size variable (LN-MCAP) has a negative sign and it was statistically significant in all three evaluated models. Here it is confirmed that larger firms generally produce a richer information set and consequently earnings announcements are relatively less important than in smaller firms. Sign with earnings surprise variable (LN-ESAV) was positive and statistically significant and in all model specifications, indicating that abnormal returns are positively related to bigger earnings surprise. Such a result is comparable with results from comparable studies (Landsman & Meydew, 2002; Troung, 2012; Ahlatcioglu & Okay, 2019). Dummy variable LOSS has a negative sign, which is stable and significant in all estimated pool regression models. Here it can be concluded that investors have a lower reaction to firms that report quarterly losses than to firms that report quarterly profits. The proxy variable for accounting conservatism was insignificant in models 1 and 2.

Table 2:

## POOLED REGRESSION MODELS (DEPENDENT VARIABLE 3DARV)

Variables	Model 1	Model 2	Model 3
TIME	0.0001 (0.854)	-	-
LN-MCAP	-0.098* (0.053)	-0.097* (0.054)	-0.092* (0.065)
LN-ESAV	0.120** (0.002)	0.120** (0.002)	0.119** (0.002)
M/B	0.014 (0.409)	0.014 (0.408)	-
LOSS	-0.280* (0.077)	-0.284* (0.072)	-0.276* (0.079)
CONST	1.041 (0.305)	1.032 (0.308)	0.956 (0.343)
N	409	409	409
R <sup>2</sup>	0.027	0.027	0.025
F test (p-value)	0.049	0.026	0.016
Durbin- Watson	1.936	1.936	1.936

Note: Collinearity statistics VIF<5 for all models and variables

Significances in parentheses: \* p < 0.10; \*\* p < 0.05

Source: author's calculation; data collected from Zagreb Stock Exchange ([www.zse.hr](http://www.zse.hr))

## 5. CONCLUSION

This research focus was on investigating the investors' reactions to the release of quarterly earnings for a sample of companies with actively traded shares at the Zagreb Stock Exchange. The event study approach revealed that investors react to the publication of quarterly earnings. Detailed insight into standardized abnormal returns indicates that investor reaction is not equal for all four quarters. Namely, the Friedman non-parametric test leads to the conclusion that the standardized abnormal returns are most frequent for earnings releases from the second quarter.

Event study methodology enables testing of the efficiency of capital markets and the occurrence of abnormal standardized returns on earnings publication

day suggests that the semi-strong efficient market hypothesis does not hold for the Croatian capital market. Moreover, data also provide evidence of post-earnings-announcement drift, since after earnings release share prices gradually adjust to zero. Longitudinal analysis of the 3DARV variable covering 50 quarters revealed that investors' reactions are stable and that there is no trend. The finding was also confirmed by the estimated pool regression model. Although the finding that passage of time does not increase investors' reactions at ZSE is opposite to findings from recent studies in other countries, the explanation can be found in high quality and stable financial reporting environment. Additionally, the estimated pool regression model in all three specifications confirmed that some firm characteristics influence the standardized abnormal returns related to the release of quarterly earnings. Earnings surprise as theoretically expected has a positive effect on investors' reactions, meaning that larger earnings surprises result in larger standardized abnormal returns. The firm size variable sign was negative as expected, indicating that larger firms produce richer information set, releasing more information besides earnings than smaller firms do. Consequently, quarterly earnings publications are less important for larger firms than for smaller firms. As predicted by existing theory reporting of losses in comparison to reporting of profits decreases investors' reactions.

Several limitations of this research should be pointed out. One limitation might be a relatively small sample (409 firm-year observations) in comparison with similar studies. Findings about slow price adjustment after the day of earnings release might be challenged by the occurrence of other price-sensitive information (M&A deals, R&D news, launching of new products, new important customers, etc.). The inclusion of such variables into an event study modelling might result in different findings related to the existence of post-earnings announcement drift. Some future research might improve findings by use of additional independent variables, like management analysis and analyst forecast, which could shed new light on the quarterly earnings information content at ZSE. The highest number of investors' reactions to Q2 earnings is puzzling since the structure and scope of all quarterly reports are identical, and that issue should be addressed in future research.

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## REAKCIJE ULAGAČA NA OBJAVE TROMJESEČNE DOBITI NA ZAGREBAČKOJ BURZI: TRENDovi I UTJECAJNE VARIJABLE S RAZINE KOMPANIJE

### Sažetak

Ovaj članak istražuje reakcije ulagača na objavu tromjesečne dobiti za kompanije sa Zagrebačke burze. Empirijsko istraživanje temeljeno na studiji događaja i 409 opservacija potvrđuje da investitori reaguju na objavu tromjesečne dobiti, dok Friedmanov test ukazuje da su reakcije najčešće na objave dobiti iz drugog tromjesečja (Q2). Pojava abnormalnih standardiziranih povrata na dan objave sugerira da hipoteza efikasnih tržišta u polujakom obliku ne vrijedi za hrvatsko tržište kapitala. Štoviše, postoje dokazi o postupnoj prilagodbi cijena dionica nakon dana objave dobiti. Longitudinalna analiza za razdoblje 2010-2022. pokazala je da su reakcije ulagača stabilne te da nema trenda rasta ili pada standardiziranih abnormalnih povrata. Ocijenjeni regresijski model otkrio je da nekoliko karakteristika kompanije utječe na informacijski sadržaj tromjesečne dobiti. Varijabla iznenađenja dobiti pozitivno utječe na standardizirane abnormalne povrate, dok varijable veličina kompanije i objava gubitka negativno utječu na standardizirane abnormalne povrate. Rezultati istraživanja potvrđuju regulatorima tržišta kapitala praktične koristi od tromjesečnog financijskog izvještavanja, listanim kompanijama da mogu koristiti tromjesečne financijske izvještaje za smanjenje informacijske asimetrije, a ulagačima da nakon objave tromjesečne dobiti postoji mogućnost ostvarenja abnormalnih povrata. Ograničenje ovog istraživanja je relativno mali uzorak u usporedbi sa sličnim istraživanjima. Nalazi o sporij prilagodbi cijena dionica nakon dana objave dobiti mogu biti dovedeni u pitanje zbog objave drugih cjenovno osjetljivih informacija. Neka buduća istraživanja mogla bi poboljšati nalaze korištenjem dodatnih nezavisnih varijabli, kao što su analize menadžmenta i predviđanja analitičara, što bi moglo baciti novo svjetlo na sadržaj tromjesečne dobiti na Zagrebačkoj burzi.

**Ključne riječi:** računovodstvena dobit, informacijski sadržaj, studija događaja, Hrvatska