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The reaction of investors to analyst recommendations of stocks listed on the WIG20 index

1. Introduction

This paper studies the impact of analyst recommendations of markings from the most-fluent stocks quoted on the Warsaw Stock Exchange. The main goal of the research is to check which of the recommendations significantly influence stock prices and what factors affect price reaction (besides the level of recommendation).

Among other information, analyst recommendations set a very interesting group. Assuming that recommendations are formulated on the grounds of publicly available information, they should not set unexpected events. Nonetheless, a variety of brokerage firms and houses spend a lot of money and effort on working out detailed recommendations of stocks. This can suggest that professional analysts employing advanced analytical methods in constructing their assessments usually have greater knowledge than ordinary investors, and their recommendations can be valuable to others. An additional question that could be researched is whether or not the integrity of analysts who have business connections with specific issuers may intentionally spread manipulated information. Moreover, after compiling (but before publishing) a recommendation, analysts can be considered as insiders who possess some privileged information. The presence of excess returns directly before the publication can be interpreted as a sign of potential illegal insider trading. All of the aspects mentioned above make analyst recommendations an interesting subject of study.

The impact of analyst recommendations of stock prices has been researched by many authors, who have also endeavored to locate factors that influence the strength, direction, and duration of such an impact. Among others, Elton et al.

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(1986), Stickel (1995), Womack (1996), Lin and McNichols (1998), Barber et al. (2001), Yazici and Muradoglu (2002), Jegadeesh et al. (2004), Jegadeesh and Kim (2006), Gurgul and Majdosz (2004), Glezakos (2007), Loh and Stulz (2009), Jegadeesh and Kim (2010), Murg et al. (2014), and Murg and Zeitlberger (2014) have studied this subject based on daily data. Kim et al. (1997), Busse and Green (2002), and Green (2006) focus on intraday returns, checking the occurrence of instantaneous market reactions to analyst recommendations. The results received by the authors vary depending on the researched market, the period under study, and the research approach.

The aforementioned studies suggest that analyst recommendations significantly influence the price-formation process on developed markets, and the direction of price changes is consistent with the information contained in the news. BUY recommendations are followed by positive abnormal returns, while SELL recommendations lead to negative abnormal returns observed on the day of the publication or the following day (Stickel, 1995; Womack, 1996; Jegadeesh and Kim, 2006; Murg and Zeitlberger, 2014). Beyond an immediate reaction to the recommendation, some researchers find a drift in prices that continues in the subsequent months after the event (Womack, 1996; Jegadeesh and Kim, 2006). Reactions of small and emerging markets are not so unequivocal. Glezakos (2007) and Gurgul and Majdosz (2004) do not find any visible reaction to recommendations on the Athens Stock Exchange and Warsaw Stock Exchange, respectively. Jegadeesh and Kim (2006) confirm a dependence on the strength of the reaction and the size of the market, convincing us that a developed market reacts stronger, while Murg and Zeitlberger (2014) show the opposite (via examples of the Austrian and German stock markets): abnormal returns on the smaller market are higher.

Jegadeesh et al. (2004) suggest that the research should not only involve the level of recommendation but also the change from its previous level, as it has more robust explanatory power than the level alone. The impact of recommendation is especially strong when there are the most-extensive changes, such as an upgrade to BUY from SELL or a downgrade to SELL from BUY (Stickel, 1995; Murg et al., 2014; Murg and Zeitlberger, 2014). Some authors consider additional factors that influence investor reaction; one of which the size of the company. Results obtained by Womack (1996), Barber et al. (2001), Murg and Zeitlberger (2014), and Murg et al. (2014) suggest that the strongest reaction to recommendations is observed in the case of small- and medium-sized companies.

On the U.S. equity market, Womack (1996) analyzes long-run returns for BUY and SELL recommendation changes stratified by the size of the firm (measured by market capitalization) and graphically shows the differences among companies of different sizes. Also on the U.S. equity market, Barber et al. (2001) group firms into portfolios according to their consensus analyst recommendations and focus on the profitability of investment strategies that involve this consensus. As a part of the research, they partition portfolios according to the size of the firm. They find that the difference between returns for the most highly rated and least-favorably recommended stocks is the most expressive in the group of small- and medium-sized firms. Studying companies from the Austrian and German equity markets, Murg and Zeitlberger (2014) construct a linear regression model with the absolute abnormal return as the independent variable and the market capitalization (MC) of the firm as an explanatory variable representing the size of the firm. All MC coefficients are negative, suggesting that the reaction of smaller companies is stronger. A similar analysis is performed on the Austrian market by Murg et al. (2014), who consider a model with the same endogenous variable but with more exogenous variables; one of which being MC. They also find that analyst recommendations have a stronger impact on smaller firms. As mentioned by Barber et al. (2001), this relationship between company size and investor reaction is reasoned. The smaller is the firm, the less informed the public is about it (and as a result, the more unexpected the recommendation).

Another factor that can potentially influence investor reaction is the reputation of the brokerage house issuing the recommendation. Stickel (1995) and Jegadeesh and Kim (2006) verify that the reaction is stronger when the recommendation is prepared by analysts with better reputations and from larger brokerage houses for stocks from U.S. market and G7 countries, respectively. To that end, the authors implement different regression models with categorical variables. Some other authors conclude that leading analysts avoid giving a SELL recommendation to maintain good relations with clients. Moreover, they recommend BUY too often when they have some business connections with a specific issuer (Womack, 1996; Lin and McNichols, 1998; Barber et al., 2005). This leads to an asymmetric reaction of the market to different types of recommendations. Lin and McNichols (1998) researched that, on the US market, a HOLD recommendation leads to a negative reaction of the market when it is suggested by leading analysts, because investors suspect that SELL should be warranted. Barber et al. (2005) prove that the implementation of NASD Rule 2711 in 2002 (which obligates analysts to display the percentage of particular types of recommendation [BUY, HOLD, or SELL]) effectively reduced the number of BUYs (which had previously been too many).

From the Efficient Market Hypothesis point of view, most of the studies demonstrate that the market is not semi-strong form efficient in the researched countries (not only because there is a post-recommendation drift in prices). On some markets, significant abnormal returns are observed directly before the publication of a recommendation, which suggests some information leakage and the presence of preferred customers (Yazici and Muradoglu, 2002; Gurgul and Majdosz, 2004; Murg and Zeitlberger, 2014).

The impact of analyst recommendations on stocks listed on the Warsaw Stock Exchange is researched inter alia by Gurgul and Majdosz (2004), Mielcarz et al. (2007), Podgórski and Mielcarz (2008), and Buzała (2012). All of the aforementioned authors make an inference based on event-study methodology but assuming different models. Conclusions derived from their studies are not consistent.

Gurgul and Majdosz (2004) consider the sample of 139 BUY, HOLD, and SELL recommendations for stocks listed on the WIG20 Index published from 1996 to 2003. They do not observe any significant abnormal returns after publications regardless of the type of recommendation, but significantly negative average excess returns appear directly before the publications of SELL recommendations. This can be interpreted as some leakage of information. Mielcarz et al. (2007) analyze only positive recommendations (BUY and ACCUMULATE) from the 1st of January 2005 to the 31st of December 2006. Their sample consists of 246 events. In contrast to Gurgul and Majdosz (2004), they determine two recommendation issue dates: the day when the recommendation was provided to commercial customers and the day when the recommendation became public on the Internet. Their results are opposite to those obtained by Gurgul and Majdosz (2004) and show that BUY recommendations create significantly positive abnormal returns on both assumed days of the event. According to this research, the second type of positive recommendation (ACCUMULATE) has no impact on stock prices. Podgórski and Mielcarz (2008) study only neutral and negative recommendations (for a change); cumulatively, 319 events. They analyze the same period as Mielcarz et al. (2007) and define issue dates likewise. They conclude that negative events show an immediate reflection in stock prices, as significantly negative abnormal returns are observed both on the day of delivering the recommendation to commercial customers and the day of the official publication on the Internet. They do not find any influence of neutral recommendations on the price-formation process.

Another study in the area of recommendation impact on stock prices on the Warsaw Stock Exchange is the research of Buzała (2012). 1185 recommendation dates gathered by the author cover the period from January 2010 to December 2012. Recommendations concerning stocks listed on the WIG20 Index are systematized in a five-point scale: BUY, ACCUMULATE, HOLD, REDUCE, and SELL. Issue dates are defined in two ways, like in Mielcarz et al. (2007). In addition to the research of price reaction to the five aforementioned types of recommendations, Buzała (2012) checks if changes in the level of recommendation are informative. Thereupon, he distinguishes among event upgrades and downgrades. In the group of upgrades, he additionally specifies upgrades to BUY, and in the group of downgrades, he itemizes downgrades to SELL. His findings indicate that both a first issue of an extreme recommendation (BUY or SELL) to a limited group of customers as well as its official publication influence stock prices. For other types of recommendations, there are no visible price reactions. Significant price changes also appear in groups of upgrades and downgrades. The strongest reaction can be observed in groups of upgrades to BUY and downgrades to SELL. In the case of recommendations that are initially delivered to a narrow audience, the second public issue is less significant. Post-event drift appears in the cases of the most-extreme recommendations (BUY and SELL) as well as in the situation of level changes. Significant abnormal returns consistent with the direction of the recommendation appear before the day of the event, even in the case of the first issue. This is an argument for some leakage of information that leads to a rejection of the semi-strong effectiveness of the Polish equity market.

In this paper, the effect of analyst recommendations on security prices is explored. Recommendations that are researched involve the most-fluent companies quoted on the Warsaw Stock Exchange from January 2012 to September 2015. The first part of the study concerns price reaction to positive, neutral, and negative recommendations. Subsequently, the impact of changes in recommendation levels on investor reaction is tested. The tests are conducted with the use of the event-study methodology. Finally, additional factors that could affect price reactions are studied.

The study extends foregoing research from the WSE relating to this subject. First, it covers the period that has not been the object of such a study as of yet, as the last known research on this issue was conducted by Buzała (2012) and covers the period of 2010–2011. (this period is analyzed in additional research to check if the employed method gives results similar to those acquired by Buzała). Second, it examines not only investor reaction to a given level of recommendation but also to level changes. To the best of this author's knowledge, only the research of Buzała attempted to investigate this issue until now. However, this research is more detailed than that made by Buzała, as it regards various possible level changes, not only upgrades and downgrades. Moreover, all of the aforementioned authors employing event-study methodology use parametrical test statistics. The validity of the parametrical test is addicted to the fulfillment of strict assumptions that very often go unfulfilled. In this research, the problem is resolved by subsidiary use of a non-parametrical rank test, which requires less-restrictive assumptions. Lastly, as distinct from previous studies, additional factors that could influence investor reaction are researched. Next to changes in recommendation levels, the size of the company and reputation of the brokerage house are analyzed as potential explanatory variables. These factors are pointed out as influential by research from other countries. Conterminously with Murg and Zeitlberger (2014) and Murg et al. (2014), a linear regression model is employed, but it differs significantly from those used by the aforementioned authors. First and foremost (as the information is not immediately reflected in security prices), a proper independent variable is chosen. Furthermore, the model contains different dependent variables; particularly, the size of the firm is represented by the natural logarithm of company shares in the WIG20 Index.

The structure of the paper is as follows: Section 2 describes the data and methodology applied in the research; empirical results are demonstrated and discussed in Section 3; and Section 4 concludes the paper. The appendix contains results from the period of 2010–2011 as a comparison to the research conducted by Buzała (2012).

2. Data and methodology

The dataset contains 576 analyst recommendations for 28 companies listed in the WIG20 Index from the 1st of January 2012 to the 1st of September 2015. Recommendations are taken from the database available at www.bankier.pl, which contains information about the date of the publication, level of the recommendation, actual price, target price and price at date of publication, change-in-price potential, and name of the issuing institution.

Recommendations can be expressed in one of two scales. An absolute recommendation is prepared by analysts who estimate a target price and then compare it with the current market value. Then, on the basis of underestimation or overestimation, they formulate a recommendation such as BUY, ACCUMULATE, HOLD (or NEUTRAL), REDUCE, or SELL. When the target price is compared with the current valuation of companies from a specified segment or comparative group, the recommendation is then relative. Possible recommendations in this group are in line with the market, below the market, above the market, or similar. From the initial set of 1470 recommendations, 1245 absolute recommendations were selected. The number was then reduced to 576 by removing the events that were too close in terms of the event-study methodology. Recommendations qualified for the final sample were categorized into three major groups: positive (BUY or ACCUMULATE), neutral (HOLD), and negative (REDUCE or SELL). Table 1 contains the number of recommendations in each of these groups.

To test if analyst recommendations have an impact on security prices, the event-study methodology was applied. Daily log-returns of the stocks were employed, computed from closing prices available on www.gpwinfostrefa.pl. Since the data does not contain information about whether or not a particular recommendation was previously delivered to privileged customers, the date of the event (designated by $t = 0$) is defined as the day of the publication named in the database. For each of the recommendations, pre-event and event windows are defined. Following others

(Gurgul and Majdosz, 2004; Murg, Zeitlberger, 2014), we define a pre-event window that covers 30 days (from $t = -35$ to $t = -6$). The event window contains 11 days around the date of the event. It starts five days before the publication ($t = -5$) to capture potential price changes that could indicate information leakage and end five days after it ($t = 5$) to evaluate the speed of price reaction.

Table 1

The number of absolute analyst recommendations included in the study. All recommendations relate to companies listed in the WIG20 Index from the 1st of January 2012 to the 1st of September 2015

Year	Total number of recommendations	Positive		Neutral HOLD	Negative	
		BUY	ACCUMULATE		REDUCE	SELL
2012	135	40	9	54	9	23
2013	145	33	5	71	7	29
2014	170	66	5	66	6	27
2015	126	24	9	61	3	29
SUM	576	163	28	252	25	108

For each day in the pre-event and event windows, abnormal returns are calculated as the difference between the actual return and its expected value:

$$AR_{i,t} = R_{i,t} - E\left(R_{i,t}\right)$$

$R_{i,t}$ is a logarithmic rate of return of *i*-th company on day t. Expected returns are calculated with the classical market model from the estimation window:

$$R_{i,t} = \alpha + \beta R_{m,t} + \varepsilon_{i,t}$$

where $R_{m,t}$ is a logarithmic rate of market return represented by WIG20 return and $\varepsilon_{i,t}$ is an error on a given day. Parametric tests drawn on the model assume a normal distribution of residuals, lack of the autocorrelation, and homoskedasticity. Cumulatively, 24% of the data does not satisfy at least one of these assumptions.

Despite the fact that assumptions are not achieved in all cases, estimators received from the least-squares method are consistent. Nonetheless their effectiveness may be not satisfactory (Gurgul, 2006), and the applied parametrical test may not have assumed t-distribution. Previous research shows that applying more-complicated models does not necessarily improve results of the classical market model (see Brown and Warner, 1980; Murg et al., 2014). To support the results of the parametric test, a non-parametric rank test (which does not require the assumption of abnormal return normality) is employed. For each event, abnormal returns are divided by the standard deviation from the pre-event window, and thus, are standardized:

$$SAR_{it} = AR_{it} \;/\; S\left(AR_i\right)$$

where

$$S\left(AR_i\right) = \sqrt{\frac{1}{29}\sum_{t=-35}^{-6} AR_{it}^2}$$

Figure 1 shows the cross-sectional variance of standardized abnormal returns separately in the three defined groups of events. One can notice that there is a significant increase of volatility in the event window. This phenomenon is frequently observed (Corrado, 2011) and demands cross-sectional variance adjustment. Following Corrado and Zivney (1992), adjusted standardized abnormal returns are computed; namely:

$$SAR'_{it} = \begin{cases} SAR_{it} & t = -35,\ldots,-6 \\ SAR_{it} \;/\; S\left(SAR_t\right) & t = -5,\ldots,5 \end{cases}$$

where

$$S\left(SAR_t\right) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(SAR_{it} - \overline{SAR_t}\right)^2}$$

and N is the number of stocks in the sample.

Cross-sectionally adjusted *t*-test statistic has the form as in Corrado and Zivney (1992):

$$T_a\left(t_0\right) = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} SAR'_{it_0}$$

while the non-parametric rank test proposed by Corrado (2011) is defined as:

$$T_{CZ}\left(t_0\right) = \frac{1}{\sqrt{N}}\sum_{i=1}^{N}\frac{\left(\operatorname{rank}\left(SAR'_{it_0}\right) - \frac{n+1}{2}\right)}{\sqrt{n\left(n+1\right)/12}}$$

n is the length of the pre-event window, while $\operatorname{rank}\left(SAR'_{it_0}\right)$ is the rank of the adjusted standardized abnormal return of day t_0 in the group of 31 standardized abnormal returns: 30 from the pre-event window, and the remaining 1 from day t_0 that is SAR'_{it_0}. The T_{CZ} statistic is asymptotically normally distributed.

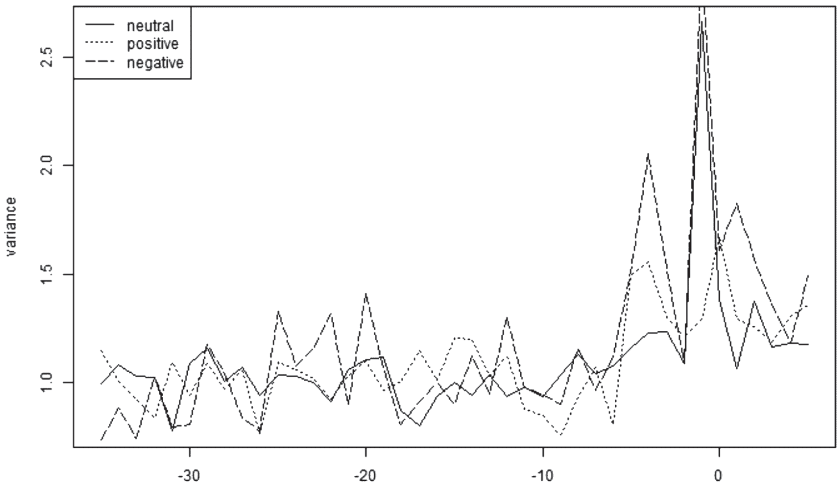

Figure 1. Cross-sectional variance of standardized abnormal returns in the pre-event and event window, separately in three groups of recommendations: positive, neutral, and negative

3. Empirical results

3.1. Results from analysis of the standard levels of recommendations

In the first step, the recommendations were divided into three clusters: positive, neutral, and negative events (as detailed in Table 1). In each of the groups separately, the impact of recommendations on security prices was tested with the parametric *t*-test and nonparametric rank test. Mean-adjusted standardized abnormal returns $\left(\overline{SAR'}\right)$ and *p*-values for both test statistics in the event window are presented in Table 2. The number of events in each group is also detailed in the table.

The strongest reaction of prices can be observed in the case of positive recommendations. Both test statistics are significantly positive at the 5% level on the day of publication and at the 1% level the following day. Two days after the issue of recommendation, prices are still influenced by the event (as suggested by the significance of the statistics at the 5% level). Adjusted standardized abnormal returns remain positive to five days after the event, and the non-parametric test statistic is significant also on the fourth and fifth days after the recommendation. This suggests that the market reacts strongly to positive analyst recommendations. Price adjustment is not immediate, but it lasts a few days. The parametrical test indicates a statistically significant abnormal return five days before the event; but as the sign of the return is negative, this is probably triggered by some confounding events.

In the group of neutral events, abnormal returns remain negative from three days before the recommendation to one day after it. However, test statistics around the event day are insignificant. This can be a signal to a tentative interpretation that hold recommendations have no impact on security prices. Only four days before the event and five days after it is the T_{CZ} statistic significantly positive; but this seems to have no direct connection to the publication of the recommendation.

Negative recommendations are marked with negative abnormal returns that continue from one day before the recommendation to five days after it. Nonetheless, only one of the two test statistics (namely, the parametric *t*-test statistic) is significantly negative at the 5% level on the day of recommendation. The non-parametric T_{CZ} statistic has the lowest value of the post-event window, but it is not significant.

Table 2

Reaction of daily returns to particular types of analyst recommendations (positive, neutral, and negative) issued between the 1st of January 2012 and the 1st of September 2015

t	**Positive recommendation (Buy/Accumulate)**			**Neutral recommendation (Hold)**			**Negative recommendation (Sell/Reduce)**		
	$\overline{SAR'}$	***p*-value**		$\overline{SAR'}$	***p*-value**		$\overline{SAR'}$	***p*-value**	
		T_a	T_{CZ}		T_a	T_{CZ}		T_a	T_{CZ}
	191 events			**252 events**			**133 events**		
–5	–0.176	**0.021**	0.104	–0.007	0.396	0.115	–0.072	0.282	0.389
–4	0.068	0.257	0.082	0.060	0.252	**0.043**	0.017	0.390	0.085
–3	0.039	0.344	0.175	–0.004	0.398	0.228	–0.071	0.285	0.367
–2	–0.056	0.295	0.360	–0.006	0.397	0.382	0.109	0.181	0.054
–1	0.068	0.256	0.099	–0.088	0.150	0.385	–0.062	0.307	0.247
0	0.291	**0.013**	**0.000**	–0.009	0.394	0.489	–0.238	**0.010**	0.112
1	0.210	**0.006**	**0.000**	–0.037	0.336	0.423	–0.153	0.085	0.159
2	0.151	**0.045**	**0.015**	0.017	0.384	0.096	–0.105	0.190	0.124
3	0.011	0.394	0.083	–0.060	0.255	0.368	–0.020	0.388	0.416
4	0.095	0.170	**0.030**	0.042	0.319	0.109	–0.029	0.377	0.494
5	0.076	0.229	**0.026**	0.045	0.307	**0.046**	–0.037	0.363	0.490

The results are contrary to those obtained by Gurgul and Majdosz (2004) but are consistent with the research of Mielcarz et. al (2007) and Podgórski and Mielcarz (2008). The market seems to react more strongly to positive events than to negative ones. Neutral recommendations seem to have no impact on stock prices.

3.2. Results from the analysis of changes in recommendation level

Research conducted by other authors suggests that an analysis of changes in the level of recommendation is much more informative than an analysis of a pure recommendation level (e.g., Stickel, 1995; Womack, 1996; Jegadeesh et al., 2004; Murg and Zeitlberger, 2014). To check this assumption, recommendations are divided into nine clusters (as detailed in Table 3). In 526 out of 576 events, it was possible to assess the previous level of recommendation and define the change. Only changes from one of the three defined groups (positive, negative, neutral) to another are studied (e.g., from positive to negative). Changes inside the group (such as the change from ACCUMULATE to BUY or from SELL to REDUCE) are not researched. The number of recommendations in each of these groups is presented in Table 3. The most numerous is the group of neutral recommendations that were previously also neutral (121 events – 23%). They are followed by positive events with no change (106 events – 20.2%). The least numerous are the most-extensive changes: from a positive to negative recommendation (19 events – 3.6%) and from a negative to positive one (13 events – 2.5%).

Table 3

Recommendation changes. Only changes from one of three defined levels to another one are studied. Changes within the specified group (e.g., the change from SELL to REDUCE) are lost

		Previous recommendation			**Sum**
		positive	neutral	negative	
Current recommendation	positive	106	50	13	169
	neutral	66	121	47	234
	negative	19	45	59	123
	Sum	191	216	119	526

Results from the analysis of recommendation changes are presented in Table 4. The table contains mean-adjusted standardized abnormal returns $\left(\overline{SAR'}\right)$ and *p*-values for both test statistics in the event window for nine groups of events.

It can be noticed that positive recommendations are marked with a positive $\left(\overline{SAR'}\right)$ from the day of the event to two days after it, regardless of the level of the previous recommendation. However, the strongest reaction is observed in the case of recommendations that were also previously positive. The T_{CZ} statistic is significant at the 5% level on the day of the event as well as three other days in the post-event window. The parametric *t*-statistic is significantly positive only two days after the recommendation. This indicates that new information is not immediately incorporated into the price but needs a few days to process. In the group of positive events that were previously neutral, only the nonparametric statistic is significantly positive at the 5% level on the day of the recommendation as well as the following day. Nevertheless, nonparametric test results are more reliable (as pointed out in Section 2). Changes from negative to positive do not show an immediate reaction to the information, as test statistics are insignificant on the days around the event. Only the T_{CZ} statistic is significant at the 5% level four days after the recommendation. However, the size of the group (13 events) is too small to make conclusions on the basis of asymptotic distribution of this statistic. Results from the first three groups of recommendations can be summarized as follows: the better the previous recommendation, the stronger positive reaction to the following one that is positive. This can be a signal that investors do not trust analysts if they change the recommendation upward to a positive one. However, if an analyst issues a second positive recommendation, this is interpreted as a credible sign of good company position.

The impact of the neutral event on security prices varies depending on the level of the previous recommendation. A neutral recommendation preceded by a positive one is interpreted as a strongly negative signal. In this group of events, both test statistics are significantly negative at the 1% level on the day of the recommendation. Nonetheless, returns reveal counter movements in the post-event window, as they are positive on three days. The nonparametric test statistic is significantly positive at the 5% level on the second and fourth days after the event. It seems that investors overreact to this kind of change in a recommendation level. Stickel (1995) and Murg and Zeitlberger (2014) also find overreaction to some changes in the level of recommendation on other stock markets. A second neutral recommendation does not influence security prices. Test statistics are insignificant in the whole event window. As might be expected, a neutral recommendation occurring after negative one is interpreted as positive change. $\overline{SAR'}$ are positive on the day of the event as well as the two following days. The significance of test statistics appears on the first and second days after the recommendation, which indicates that the information is gradually incorporated into the prices. The analysis of neutral recommendations conducted in the previous subsection suggested that a HOLD recommendation is indeed neutral and has no impact on prices. Research of the recommendation changes above shows that such a conclusion is too hasty and that the interpretation of a neutral recommendation depends on the previous recommendation level. If it was lower, the recommendation is interpreted as positive; if it was higher, the recommendation has a negative tenor.

Table 4

Reaction of daily returns to analyst recommendations issued between the 1st of January 2012 and the 1st of September 2015. Groups of events were defined depending on the change in the recommendation level

PART A. Current recommendations: positive (BUY/ACCUMULATE)

t	Previous recommendation								
	Positive (Buy/Accumulate)			Neutral (Hold)			Negative (Sell/Reduce)		
	$\overline{SAR'}$	p-value		$\overline{SAR'}$	*p*-value		$\overline{SAR'}$	*p*-value	
		T_a	T_{CZ}		T_a	T_{CZ}		T_a	T_{CZ}
	106 events			50 events			13 events		
–5	–0.203	**0.046**	0.079	–0.257	0.078	0.130	–0.027	0.389	0.394
–4	0.098	0.238	0.147	0.239	0.097	0.068	–0.079	0.375	0.269
–3	0.070	0.306	0.115	–0.197	0.151	0.105	–0.261	0.247	0.239
–2	–0.035	0.373	0.374	–0.094	0.317	0.399	–0.176	0.316	0.220
–1	0.120	0.184	0.081	0.074	0.345	0.240	–0.139	0.342	0.313
0	0.147	0.127	**0.013**	0.241	0.094	**0.027**	0.077	0.376	0.230
1	0.149	0.123	**0.023**	0.222	0.117	**0.043**	0.235	0.268	0.096
2	0.201	0.048	0.014	0.056	0.367	0.202	0.375	0.156	0.132
3	0.027	0.382	0.237	0.053	0.370	0.091	–0.204	0.294	0.335
4	0.087	0.266	0.071	0.033	0.386	0.487	0.474	0.095	**0.035**
5	0.134	0.155	**0.033**	0.044	0.378	0.202	–0.136	0.344	0.431

Table 4

PART B. Current recommendations: neutral (HOLD)

t	Previous recommendation								
	Positive (Buy/Accumulate)			Neutral (Hold)			Negative (Sell/Reduce)		
	$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value	
		T_a	T_{CZ}		T_a	T_{CZ}		T_a	T_{CZ}
	66 events			121 events			47 events		
–5	0.149	0.191	**0.036**	–0.157	0.091	0.209	0.049	0.375	0.115
–4	0.037	0.380	0.217	0.031	0.376	0.276	0.100	0.313	0.067
–3	–0.018	0.393	0.494	–0.026	0.382	0.432	0.036	0.385	0.262
–2	0.089	0.306	0.201	–0.046	0.351	0.308	0.027	0.390	0.330
–1	–0.055	0.359	0.247	–0.110	0.190	0.256	–0.104	0.307	0.424
0	–0.377	0.005	0.001	0.015	0.393	0.215	0.217	0.131	0.135
1	–0.149	0.191	0.283	–0.026	0.382	0.428	0.250	0.092	**0.039**
2	0.168	0.157	**0.038**	–0.172	0.068	0.136	0.350	0.025	0.008
3	–0.039	0.378	0.363	–0.012	0.395	0.276	–0.216	0.133	0.170
4	0.124	0.238	**0.049**	–0.064	0.310	0.301	0.021	0.393	0.289
5	0.063	0.349	0.185	0.010	0.396	0.230	0.040	0.382	0.188

Table 4

PART C. Current recommendations: negative (SELL/REDUCE)

t	Previous recommendation								
	Positive (Buy/Accumulate)			Neutral (Hold)			Negative (Sell/Reduce)		
	$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value	
		T_a	T_{CZ}		T_a	T_{CZ}		T_a	T_{CZ}
	19 events			45 events			59 events		
–5	–0.005	0.394	0.443	–0.156	0.228	0.291	–0.074	0.337	0.375
–4	0.158	0.308	0.297	0.012	0.396	0.174	0.131	0.238	0.083
–3	–0.242	0.222	0.315	–0.029	0.389	0.429	–0.087	0.317	0.342
–2	0.312	0.156	0.146	0.085	0.337	0.321	0.082	0.325	0.123
–1	–0.008	0.393	0.362	–0.062	0.363	0.268	–0.042	0.377	0.295
0	–0.359	0.117	0.177	–0.238	0.112	0.246	–0.134	0.233	0.359
1	–0.339	0.132	0.123	–0.290	0.062	0.076	–0.009	0.396	0.337
2	–0.088	0.365	0.423	–0.268	0.080	0.059	0.045	0.374	0.370
3	0.366	0.112	0.061	–0.317	0.044	0.020	0.091	0.311	0.214
4	0.352	0.122	0.057	–0.157	0.226	0.174	–0.016	0.394	0.485
5	–0.078	0.371	0.362	0.095	0.323	0.221	–0.113	0.271	0.331

Negative recommendations are, on the whole, marked with a negative $\overline{SAR'}$ on the day of the event as well as the following day. In the group of changes from a positive recommendation to a negative, there are no significant values of test statistics. This group with the most extensive changes is simultaneously one of the least numerous, which precludes us from drawing reliable conclusions. In the case of negative recommendations preceded by neutral ones, $\overline{SAR'}$ are negative to the fourth day after the recommendation. On day $t = 3$, both test statistics are significantly negative at the 5% level. Negative information about the downgrade of a recommendation level seems to need a few days to be incorporated into the price. A second negative recommendation does not significantly influence returns, which suggests that investors expected the repetition of negative information about the security.

Analysis of recommendation changes confirms the assumption that changes in the level of recommendation poses more-important information for investors than a pure recommendation level. Downgrades are interpreted as negative events and generally lower security prices, while upgrades constitute positive information and lead to an increase in returns. This finding is consistent with the research of Buzała (2012). Excluding positive recommendations, events marked with no recommendation change have no impact on prices.

As an addendum of this research, an analogous one was conducted for the period analyzed by Buzała (2012), namely 2010–2011. The results are presented in the appendix.

3.3. Results from the linear model with categorical variables

To research the occurrence of other factors that could influence a price reaction to the recommendation, a linear regression model with categorical variables is fitted as follows:

$$CAR_i\left(0,2\right) = \alpha_0 + \alpha_{1,j_1} \cdot \chi_{j_1}\left(CHANGE\right) + \alpha_{1,j_2} \cdot \chi_{j_2}\left(CHANGE\right) + \alpha_2 \cdot SHARE + \\ + \alpha_{3,k_1} \cdot \chi_{k_1}\left(RANKING\right) + \alpha_{3,k_2} \cdot \chi_{k_2}\left(RANKING\right)$$

Since price reaction to the recommendation can be generally noticed not only on the day of the event but also on the following days, the dependent value in the model is chosen as $CAR_i(0,2)$, which stands for cumulative abnormal returns from the day of the event to the second day after it:

$$CAR_i\left(0,2\right) = \sum_{i=0}^{2} AR_{it}$$

CHANGE is the variable defining the change in the recommendation level. When we assign a value of 1 to a positive recommendation, a value of 0 to a neutral recommendation, and a value of 2 to a negative recommendation, then CHANGE ranges from form –2 to 2 (e.g., CHANGE = –2 in the case of a positive recommendation preceded by a negative one). Only the movements between the three defined groups of positive, negative, and neutral events are analyzed (e.g., if the current recommendation is BUY and the previous was ACCUMULATE, the variable takes a value of 0). The variable SHARE stands for the natural logarithm of the company's share in the WIG20 Index. RANKING is the variable that determines the reputation of the brokerage house issuing the recommendation. The variable is set to 2 when the brokerage firm is in the top position (from first to tenth) in both of two annual rankings conducted by Polish Forbes Magazine: the ranking created by individual investors and that made by institutional investors. A value of 1 is assigned to firms that are in the top position in only one of those two rankings. When the brokerage firm is not listed in either of the aforementioned two rankings or is positioned outside the top ten in both of them, the variable takes a value of 0. Function $\chi_i(x)$ means an indicator function that is:

$$\chi_i(x) = \begin{cases} 1, & x = i \\ 0, & x \neq i \end{cases}$$

The model is fitted separately to positive, neutral, and negative recommendations. In effect, variable CHANGE takes only three values in each of the groups.

The model researches significant changes in the levels of the categorical variable with reference to one fixed level. For this reason, two sub-models should be employed in each group of events to capture the potential significance of all possible level changes.

Intercept α_0 corresponds to the situation in which both categorical variables are on the reference level. Then, coefficients α_{1,j_1} and α_{1,j_2} inform us how the intercept changes when CHANGE goes to levels j_1 and j_2, respectively. Analogously, coefficients α_{3,k_1} and α_{3,k_2} represent the change in the intercept when variable RANKING goes from the reference level to levels k_1 or k_2.

Fitted linear models are presented in Table 5. In the group of positive events, two coefficients are statistically significant at the 1% level. Intercepts suggest that positive recommendations are generally seen as good news. A negative coefficient related to a variable SHARE implicates that the smaller the firm, the stronger its reaction to the recommendation. Neither the reputation of the brokerage house nor change in the level of recommendation seems to have a significant impact on the studied cumulative abnormal returns. Linear models do not confirm the remark from the event-study analysis that the reaction is the strongest in the case of the repetition of a positive recommendation.

Table 5

Coefficients of linear regression models with categorical variables fitted to positive, neutral, and negative recommendations separately. In each group, two sub-models were employed to capture potential significance of all possible level changes

Positive recommendations					
Reference levels: CHANGE: 0, RANKING: 0.			Reference levels: CHANGE: 2, RANKING: 2.		
Coefficient	**Estimate**	**p-value**	**Coefficient**	**Estimate**	**p-value**
α_0	0.0228**	0	α_0	0.0245**	0.0046
$\alpha_{1,1}$	–0.0001	0.9787	$\alpha_{1,0}$	–0.0028	0.7344
$\alpha_{1,2}$	0.0028	0.7321	$\alpha_{1,1}$	–0.0029	0.7321
α_2	–0.0087**	0.0005	α_2	–0.0087**	0.0005
$\alpha_{3,1}$	–0.0017	0.07219	$\alpha_{3,0}$	0.0011	0.8337
$\alpha_{3,2}$	–0.0011	0.8337	$\alpha_{3,1}$	–0.0006	0.9135
Multiple R^2: 0.0759					
Neutral recommendations					
Reference levels: CHANGE: –1, RANKING: 0.			Reference levels: CHANGE: 1, RANKING: 2.		
Coefficient	**Estimate**	**p-value**	**Coefficient**	**Estimate**	**p-value**
α_0	–0.0063	0.2274	α_0	0.0078	0.1967
$\alpha_{1,1}$	0.0002	0.9580	$\alpha_{1,-1}$	–0.0202**	0.0007
$\alpha_{,2}$	0.0202**	0.0007	$\alpha_{1,0}$	–0.0200**	0.0003
α_2	0.0036	0.1159	α_2	0.0036	0.1159
$\alpha_{3,1}$	–0.0023	0.6072	$\alpha_{3,0}$	0.0061	0.2675
$\alpha_{3,2}$	–0.0061	0.2675	$\alpha_{3,1}$	0.0037	0.5082
Multiple R^2: 0.0714					
Negative recommendations					
Reference levels: HANGE: –2, RANKING: 0.			Reference levels: CHANGE: 0, RANKING: 2.		
Coefficient	**Estimate**	**p-value**	**Coefficient**	**Estimate**	**p-value**
α_0	–0.0432**	0.0003	α_0	–0.0099	0.2793
$\alpha_{1,-1}$	–0.0022	0.1742	$\alpha_{1,-2}$	–0.0135	0.1742
$\alpha_{1,0}$	0.0135	0.8304	$\alpha_{1,-1}$	–0.0157*	0.0379
α_2	0.0144**	0.0008	α_2	0.0144**	0.0008
$\alpha_{,1}$	0.0160*	0.0428	$\alpha_{3,0}$	–0.0198*	0.0393
$\alpha_{,2}$	0.0198*	0.0393	$\alpha_{3,1}$	–0.0038	0.6670
Multiple R^2: 0.1312					

*, ** – significant at the 1% and 5% levels, respectively

In the group of neutral events, variable CHANGE is the only one explanatory variable that influences cumulative abnormal returns. Coefficients related to this variable are significant at the 1% level. Fitted models affirm the results from the previous subsection: the perception of neutral recommendation depends on the previous level of the recommendation. There is a significant difference in investor reaction to a HOLD recommendation when it represents a decrease from BUY or ACCUMULATE as compared to the situation when it states an increase from SELL or REDUCE. Firm size represented by its share in the WIG20 Index as well as the reputation of the brokerage firm seem to have no explanatory power.

The most statistically significant coefficients appear in models fitted to the group of negative recommendations. A negative intercept in the model with CHANGE at a reference level equal to −2 and with variable RANKING at level 0 indicate that, in such a situation, SELL or REDUCE induces a negative price reaction. Assuming that negative recommendations are generally associated with negative returns, coefficient α_2 that is positive and statistically significant at the 1% level confirms the hypothesis that smaller firms react more strongly (the bigger is the firm, the less negative the cumulative abnormal returns). Coefficients related to variable RANKING are statistically significant at the 5% level and suggest that the reputation of the brokerage house is an important factor that influences reaction to the recommendation. It does not matter whether the brokerage firm takes the top place in only one of the two considered rankings or in both of them, but the reaction is significantly different if the firm is not one of those with the best reputation. Interestingly, cumulative abnormal returns are more negative (the reaction is stronger) when the recommendation is prepared by firms with worse reputations. These findings do not confirm the results from other markets (Stickel, 1995; Jegadeesh and Kim, 2006). Since the relationship between price reaction and reputation of the brokerage firm was not proven in the two aforementioned groups of events, an unambiguous conclusion cannot be drawn. A more-detailed analysis of this topic should be conducted. In the model with variable CHANGE at a reference level equal to 0 and variable RANKING equal to 2, one more statistically significant coefficient appears; namely $\alpha_{1,-1}$. Coefficient $\alpha_{1,-2}$ is not significant, which indicates that the reaction to a negative recommendation is similar when the previous recommendation was positive and when it was neutral. If, however, the previous recommendation was also SELL or REDUCE, the negative reaction is significantly weaker. Results from the event-study analysis conducted in the previous subsection also show a dissimilarity of investor reaction to negative events according to the level of the previous recommendation. Conclusions were slightly different, but it should be noticed that the test statistics were significant on the third day after the event, while in regression models, only two days after the recommendation are counted.

To sum up, results from the linear regression model are generally consistent with those from the event-study analysis. Additionally, they confirm the findings from other markets (Womack, 1996; Barber et al., 2001; Murg and Zeitlberger, 2014; Murg et al., 2014) that the reaction to the recommendation depends on the size of the company and is stronger in the case of smaller firms. A direct and clear relationship between brokerage house reputation and reaction to the recommendation was not found.

4. Conclusions

In this paper, the impact of analyst recommendations to the prices of stocks listed on the Polish WIG20 Index is researched. The data covers the period of January 2012 to September 2015. To investigate the strength and the speed of the reaction, an event-study analysis is employed. Abnormal returns are calculated with the use of a market model based on daily data. Additionally, a linear regression model with categorical variables is employed to investigate potential factors that influence investor reaction to recommendations.

An initial study of recommendations clustered in three levels (positive, neutral, and negative) shows that the sign of abnormal returns around the day of the event is generally consistent with the information contained in the recommendation, and that the strongest reaction is observed in the group of positive recommendations. Test statistics in this cluster are significant to the fifth day after the event, which suggests that prices do not incorporate information immediately. In the case of negative events, abnormal returns remain negative to the fifth day after the recommendation. Nonetheless, the reaction is weaker than in the case of positive events, as most of these abnormal returns are statistically insignificant.

The analysis of level changes confirms the hypothesis that change in the level of recommendation (regarding the previous one) is the informative factor that influences investor behavior and, as a consequence, stock prices. Reaction to a positive recommendation is the strongest when the recommendation was also previously positive. This can be a sign that investors trust analysts more when they confirm their previous positive recommendation than when they raise their recommendation to positive. When the initial analysis does not prove any significant reactions to neutral recommendations, the study of level changes shows that reaction to this kind of event depends strongly on the level of the previous recommendation. HOLD preceded by SELL or REDUCE sets a positive event, while a previous recommendation of BUY or ACCUMULATE results in a reaction to a subsequent HOLD that is negative.

Negative recommendations do not influence stock prices as strongly as positive ones (although, they generally lead to negative abnormal returns). Statistically, nonzero abnormal returns three days after the event are found only in the group of negative events that were previously neutral.

A linear regression model with categorical variables employed separately to positive, neutral, and negative events confirms the conclusions from the event study. Particularly, the model demonstrates that the level of the previous recommendation has a strong impact on the reaction to a neutral recommendation. Furthermore, the model discloses that the size of the firm (represented by its shares in the WIG20 Index) sets an important factor in the analysis of reaction to a recommendation, as the reaction is stronger when the company is smaller. A counter-intuitive relationship between brokerage firm reputation and the reaction to a recommendation was found in the group of negative events. Results suggest that a worse reputation leads to a stronger price reaction. Since such a relationship does not appear in other groups of events, the subject needs more detailed research. A direct and clear conclusion that the reputation of a brokerage house influences reaction to its recommendation cannot be drawn.

5. Appendix

5.1. Study of the period previously researched – comparison of applied methods

To check whether the method applied in this research supports the results from foregoing studies, the period of 2010–2011 previously analyzed by Buzała (2012) is additionally researched. The dataset contains 441 absolute analyst recommendations for 23 companies listed in the WIG20 Index from the 1st of January 2010 to the 31st of December 2011.

Despite the fact that expected returns are calculated identically as those made by Buzała (2012) (with the classical market model), the studies differ significantly. Buzała (2012) analyzes average cumulative abnormal returns (ACAR) from 15 days before the recommendation to 30 days after it and checks their statistical significance. He considers nine types of events: five of them represent the recommendation level (SELL, REDUCE, HOLD, ACCUMULATE, BUY), and the other represent level changes: upgrades, downgrades, and additionally specified upgrades to BUY and downgrades to SELL. His sample is much more numerous (1185 recommendations). In this study, the sample is cut down to 441 events to eliminate those that are too close in terms of event study methodology.

5.2. The analysis of three standard recommendation levels

The results from the analysis of three standard recommendation levels are presented in Table 6. For positive and negative events, the immediate reaction of the market can be observed, which is consistent with the information contained in the recommendation. Both test statistics are significantly positive at the 1% level on the day of the publication. For positive recommendations, the non-parametric statistic in also significant at the 1% level on the following day and five days before the event. This positive reaction before publication of the recommendation could be a signal of potential information leakage, but from fourth to second days before the event, mean adjusted standardized abnormal returns $\left(\overline{SAR'}\right)$ are negative (one of them is even statistically significant in terms of the parametrical test), which suggests that there could be some confounding events. For negative recommendations, all $\overline{SAR'}$ in the event window are negative; but besides the day of the recommendation, a non-parametric test indicates abnormal returns statistically significant at the 5% level only on the fifth day after the event.

In the group of neutral events, the sign of $\overline{SAR'}$ changes again and again. The parametric test indicates statistically significant abnormal returns only before the recommendation: positive (at the 1% level) on the fifth day before the event and negative (at the 5% level) one day before it. A non-parametric test that, as previously mentioned, is more credible suggests only a positive reaction (at the 1% level) five days before the event, on the event day, and three days after it. The results from the non-parametric test could be interpreted as information that neutral recommendations are perceived as positive. However, negative returns that are not significant but still appear between those that are positive seem to deny such a conclusion. These inconsistent results are not surprising. As presented in Chapter 3 (for the period of 2012–2015), the reaction of investors to neutral recommendation can depend strongly on its previous level, and the analysis of level changes will probably lead to more-transparent results.

The aforementioned results are partly consistent with those obtained by Buzała (2012). He does not observe any market reaction to neutral events (HOLD) but finds a strong reaction to BUY and SELL recommendations (consistent with the information contained in the recommendation). For these two most-extreme levels, Buzała (2012) also observes a permanent accumulation of ACAR that starts 10 days before the event and lasts until about the 15th day after it. This drift appearing before the publication of recommendation is interpreted as a signal that recommendations were previously known to some group of investors who affect the market. Examining recommendations separately with the first submission to a limited group of investors, he finds a statistically significant ACAR even before this first publication. However, in the case of such recommendations, the reaction to their subsequent publication on the Internet is weaker. In our study, we do not observe such a significant and unequivocal market reaction anticipating the event date. Nevertheless, in the case of negative events, all $\overline{SAR'}$ are negative (although not statistically significant), which can be perceived as supporting Buzała's results.

Table 6

Reaction of daily returns to particular types of analyst recommendations (positive, neutral, and negative) issued between the 1st of January 2010 and the 31st of December 2011

t	Positive recommendation (Buy/Accumulate)			Neutral recommendation (Hold)			Negative recommendation (Sell/Reduce)		
	$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value		$\overline{SAR'}$	p-value	
		T_a	T_{CZ}		T_a	T_{CZ}		T_a	T_{CZ}
	189 events			190 events			63 events		
–5	0.110	0.0639	**0.001**	0.178	**0.0063**	**0.001**	–0.045	0.3657	0.178
–4	–0.073	0.1781	0.469	0.024	0.3727	0.078	–0.100	0.2787	0.277
–3	–0.133	**0.0276**	0.261	–0.025	0.3588	0.472	–0.139	0.1482	0.258
–2	–0.019	0.3758	0.269	0.036	0.3400	0.070	–0.046	0.3721	0.437
–1	0.018	0.3812	0.118	–0.142	**0.0310**	0.247	–0.091	0.2526	0.340
0	0.206	**0.0078**	**0.000**	0.137	0.0680	**0.006**	–0.477	**0.0006**	**0.001**
1	0.102	0.1499	**0.006**	–0.069	0.2524	0.399	–0.111	0.2706	0.494
2	0.044	0.3328	0.158	–0.037	0.3484	0.266	–0.075	0.3333	0.403
3	–0.033	0.3586	0.353	0.096	0.1656	**0.009**	–0.007	0.3967	0.365
4	–0.006	0.3969	0.113	–0.130	0.0798	0.313	–0.124	0.2460	0.333
5	0.067	0.2615	0.081	0.038	0.3466	0.271	–0.256	0.0541	**0.044**

5.3. The analysis of changes in the recommendation level

The research conducted for the changes in the recommendation level differs significantly from the corresponding study of Buzała (2012). In this research, only three recommendation levels are defined (BUY and ACCUMULATE as well as SELL and REDUCE are gathered in joint groups defined as positive and negative events, respectively), and only changes between the three levels are studied. Buzała (2012) takes into account all five recommendation levels (for a change), but he does not consider each of the possible changes separately. As previously mentioned, he jointly researches all upgrades as well as all downgrades and then additionally considers upgrades to BUY and downgrades to SELL. Hence, for example, the change from ACCUMULATE to BUY is assigned by Buzała to upgrades, while in this research, such an event is clustered in the group of positive events that were previously also positive (so, to the group with no level change). Such substantial differences in definitions of recommendation levels and their changes significantly hinders a comparison of the results.

For all groups of level changes, Buzała (2012) observes progressive accumulation of statistically significant cumulative abnormal returns that starts about 5 days before the first issue of the recommendation and lasts even to the 30^{th} day after it. The sign of the return is, in each case, consistent with the information contained in the recommendation. The reaction is the strongest in the groups of upgrades to BUY and downgrades to SELL. Moreover, the values of CARs suggest that negative events (SELL and downgrades) influence prices more significantly than positive ones (BUY and upgrades).

Detailed results from conducted analysis of recommendation-level changes are not presented here since the article would be too long, but these can be provided upon request. In general, they confirm Buzała's results that stock prices react to changes in the recommendation level and that the reaction is consistent with the direction of the change. Nevertheless, they do not show clear evidence of a significant reaction before the recommendation issue and do not lead to the inference that the reaction is stronger in the case of downgrades. A direct comparison comes up against difficulties associated with differences in the applied methods of research.

An analysis of the whole period of 2010–2015 was also conducted by the author. The results do not vary considerably from those discussed in this paper and can be presented upon request.

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