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INFLUENCE OF RECOMMENDATIONS ANNOUNCEMENTS ON STOCK PRICES OF FUEL MARKET

Summary: In the article the author answers the question whether in accordance to effectiveness theory of capital market, recommendations of analysts have a linear influence on stock prices or maybe the results are closer to chaos theory and its combination of fractal analysis. Stock prices irrespective of the capital market sector are the reflection of the public information available on the market. Nevertheless investor decisions are commonly driven by individual needs, requirements and patterns of behaviour, very often irrational and not connected with public information. Chaos theory is offering an alternative to the classical approach towards the way capital market is functioning. From its perspective capital market is a nonlinear, dynamic system driven by deterministic chaos. According to E. Peteres there exists long-term influence of information from the past and tendency so as not to include fundamental information about the stock prices into market valuation. The tool used in the article to measure the impact of market influx of information on the stock prices is event analysis.

Key words: event analysis, estimation window, event window, abnormal rate of return, recommendation, *p*-value.

1. Introduction

In the article the author is answering the question whether in accordance with effectiveness theory of capital market, recommendations of analysts have a linear influence on stock prices or maybe the results are closer to chaos theory and its combination of fractal analysis. Stock prices, irrespectively of the capital market sector, are the reflection of the public information available on the market. Nevertheless investors' decisions are commonly driven by individual needs, requirements and patterns of behaviour, very often irrational and not being connected with public information. Chaos theory is offering an alternative to the classical approach towards the way the capital market is functioning. From its perspective capital market is a nonlinear, dynamic system driven by deterministic chaos. According to E. Peteres there exists long-term influence of information from the past and tendency so as not to include fundamental information about the stock prices into

market valuation [Szablewski, Pniewski, Bartosiewicz 2008, p. 213]. The tool used in the article to measure the impact of market influx of information on the stock prices is the event analysis.

2. The event analysis

A company is an institution participating in the market and being managed in order to create income for its owners. It is not an isolated unit but is prone to various outside and inside factors. Event analysis is an alternative way of testing the results of different factors on financial markets or results of decisions made inside the companies on their market value. It analyses closer and distant background of the organization. Figure 1 depicts main factors which cause stock prices variations. It is worth mentioning that inside factors such as splits, dividends or income forecasts may influence the prices stronger than outside political changes and different types of risk such as for instance interest rate risk. Inside factors are playing the role of hedge instruments, steps taken by company so as to hedge from outside independent factors. This relation depends on a company profile.

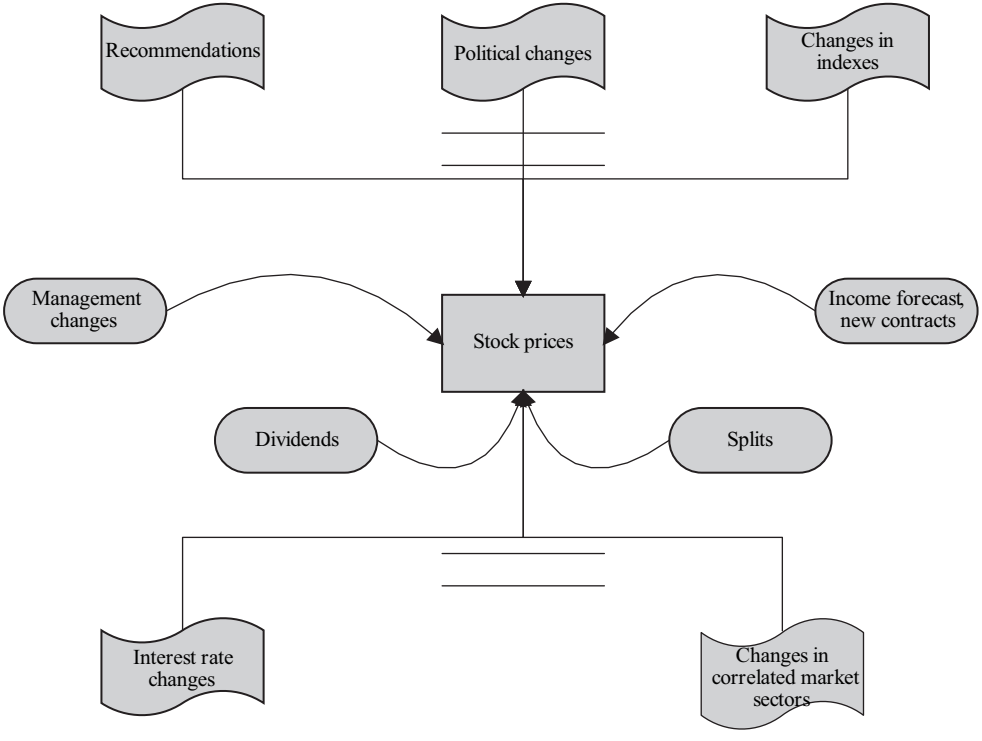

Fig. 1. Inside and outside factors changing value of stock prices

Source: own figure on the basis of [Gurgul 2006].

An advantage of this method is coming from its simplicity and few requirements, which makes it adjusted to various sectors and companies.

According to A. McWilliams and D. Siegel event analysis is consisting of the following steps [McWilliams, Siegel 1997, pp. 626-657]:

1. Definition of events providing new information for the company.
2. Economic theories research clarifying the influence of the particular events on the stock prices.
3. Creating the group of companies affected by the events.
4. Event window setting (required clarifications for windows longer than two days).
5. Elimination of companies affected by events not taken into analysis.
6. Statistical measurements of estimated and abnormal rates of return, and their significance level.
7. Simulating the results of negative abnormal rates of return in the sample and Wilcoxon test results.
8. Bootstrap analysis for small samples and its impact on the whole results.
9. Economic theories and zero hypothesis verification.
10. Attaching the list of companies taken into consideration in the analysis with dates of events listed.

The approach presented above is very often discussed as some points such as for instance very short event windows (suggested not longer than two days) may be not appropriate for all events. Event is defined as new public information available on the market which may be connected with plans or implemented actions within the companies affected [Gurgul 2006, pp. 33-34]. The information should fulfil the following requirements [Tabak, Dunbar 1999]:

1) it has to be explicit and precise,
2) public appearance on the market must be easy to identify,
3) information cannot be driven by market participant before its appearance,
4) information used in the event analysis is the only one for the time being available for the sector, company.

There are some disputable points in the event analysis such as the length of event window and window of estimation. The event window is a period in which the impact of information is analyzed. It can have fixed or flexible length but the fixed windows may be used only for appropriately large samples (due to the fact that only in considerably numerous samples effects of under- and overestimated events can be balanced). In the experiment fixed windows equal five days (two days before the event, the day of the event occurrence and two days after the event) are applied what will be further explained. General rule is that the event window should be as long as required so as to cover the whole event. It is also important to apply appropriate estimation window. As opposed to the event window, this is the window used for estimation parameters of the model for calculations estimated rate of return in event window. It is crucial to choose the estimation windows without

disturbing events. In reality it is difficult to choose periods for pre-event windows without an influence of other events and to decrease their impact but not omit them totally in the article the artificial variable z_i is used for days of estimation window:

$$z_i = \{0,1\}, \text{ where}$$

$$z_i = \begin{cases} 1, \text{ the date of event} \\ 0, \text{ the rest of the days} \end{cases}.$$

In the article estimated and abnormal rates of returns are used. Important step of the event analysis is connected with choosing the right dependence between market instrument (in the article WIG20 index) and the instrument analyzed (for instance stock prices). The most common model is market model [Gurgul 2006, p. 44]:

$$\hat{R}_{i,t} = \alpha_i + \beta_i R_{m,t},$$

where: $\hat{R}_{i,t}$ – rate of return on stock prices in period t,
α_i – free parameter,
β_i – sensitivity of market changes,
$R_{m,t}$ – rate of return on market instrument in period t (e.g. index WIG20).

Parameters of this model are estimated using OLS method:

$$\hat{\beta}_i = \frac{\sum_{t=1}^{T-1}(R_{i,t} - \bar{R}_i)(R_{m,t} - \bar{R}_m)}{\sum_{t=1}^{T-1}(R_{i,t} - \bar{R}_i)^2},$$

$$\hat{\alpha}_i = \frac{1}{T-1}\left(\sum_{t=1}^{T-1} R_{i,t} - \hat{\beta}\sum_{t=1}^{T-1} R_{m,t}\right),$$

where: $t = 1, ..., T - 1$ belongs to the group of indexes of observations in pre-event window. T is an index of first observation in the event window.

The model with artificial variable Z_i mentioned above is applied in this analysis:

$$\hat{R}_{i,t} = \alpha_i + \beta_i R_{m,t} + z_i.$$

Using artificial variable for abnormal rates of return estimation in pre-event window, the events with the same direction as the estimated one (buy, sell or keep the stock) are taken into analysis but do not have the considerable impact on the results.

Market model was checked by econometrical test for autocorrelation, heteroscedascity, normality of the residuals.

3. Data

The set of events for the analysis was prepared on the basis of announcements on the pages of stock market newspaper *Parkiet*. The assumption was made that recommendations which appear there are first recommendations, this meaning that they have not been available for market participants before. Only recommendations from the biggest trade houses such as DM BZ WBK, DM BH, DB Securities, ING Securities, Millennium DM, DI BRE BANK were analyzed. The sector which is analyzed in the article is fuel sector due to last time violations, considerable number of events and a share of the biggest fuel companies in market index WIG20 (for companies creating the index there is low probability that prices are the results of inside under the counter actions because these companies are intensively examined by investors, their fundamental information is analyzed thoroughly). Moreover, the correlation between the liquidity of the companies from this sector and possibility to manipulate with too optimistic or pessimistic recommendations is not high. The time horizon for analyzed stocks is from June 2006 till January 2009. Recommendations to buy, sell or keep were analyzed separately. The day of event was the day when the recommendations appeared for the first time. If there were other one-direction recommendations in the event window, they were ignored. In the pre-event window artificial variable for other one-direction recommendations was applied.

What was analyzed in the market model applied were daily rates of return (logarithmic) calculated according to the equation:

$$R_t = \ln(P_{t+1}) - \ln(P_t),$$

where: P_t – stock price in t period.

Additionally in the analysis the following hypotheses were tested [Gurgul 2006, p. 77]:

- recommendation BUY is a positive signal from the market and it generates increases of the stock prices;
- recommendation KEEP does not have any influence on the stock prices;
- recommendation SELL is a negative signal from the market and it generates decreases of the stock prices.

The fixed event window is applied with the length of five days (two days before the event, the day of the event, two days after the event). This length is suggested in literature of this subject as within five days the event has got considerable impact on the prices. In most cases two days before is the period when price changes are connected with inside trading, influx of information coming from inside of the company. Day of the event is the day when market verifies the price on the basis of information announced and two days after is the time when the impact of the event is decreasing. According to the definition of the event analysis only the days with visible event impact can be counted for analysis and that is why the win-

dow has got such length. It is checked if in the event window the abnormal rates of return are significant. Abnormal rates of return are calculated according to the equation [Gurgul 2006, p. 77]:

$$AR_{i,t} = R_{i,t} - E(R_{i,t} \mid \Omega_{EW}),$$

where: Ω_{EW} – set of information in event window.

Significance of estimated rates of return is checked on the basis of statistical Student test with ($N_k - 1$) degrees of freedom:

$$t_{stat} = \frac{\frac{1}{N_k}\sum_{t=1}^{N_k} AR_{i,t}}{\hat{\sigma}_{AR_t}},$$

$$\hat{\sigma}_{AR_t} = \frac{1}{N_k}\sqrt{\frac{1}{T'-1}\sum_{t=t_0}^{t_0+T'-1}(\overline{AR_t} - \overline{\overline{AR}})^2},$$

$$\overline{\overline{AR}} = \frac{1}{T'}\sum_{t=t_0}^{t_0+T'-1}\overline{AR_t},$$

where: N_k – number of event in k group (for k = 1: buy, for k = 2: sell, for k = 3: keep),

T' – the length of estimation window. The length of estimation window (pre-event) is equal to 20, 25 and 30 days – analysis is conducted for different lengths.

4. Empirical results

Firstly, the possibility to apply linear market model for the analysis was checked. The following tests were used:

– Durbin–Watson autocorrelation test,
– Goldfeld–Quandt heteroscedascity test,
– Doornik–Hansen normality of residuals test.

The analysis was prepared with the usage of GRETL. Results are shown in Table 1.

Irrespective of the pre-event window (20, 25 or 30 days of estimation) the linear model can be used. The great majority of each simulation in every class in each estimation window is showing the lack of autocorrelation, homoscedascity and normality of residuals.

In the tables 2, 3 and 4 below results of Student test obtained for every day in the event window are shown. Presented *AR* is the average abnormal rate of return used for the whole sample of events (N_k is the number of recommendations analyzed in each group in different estimation windows).

Table 1. Linear market model verification

Estimation window	Test	Linear model testing results		
		% of success in simulation		
		BUY	KEEP	SELL
30	GQ	84.21	100.00	83.33
	DW	84.21	90.00	66.67
	DH	78.95	90.00	100.00
25	GQ	89.47	100.00	71.43
	DW	84.21	91.67	71.43
	DH	89.47	91.67	85.71
20	GQ	66.67	92.31	85.71
	DW	75.00	92.31	85.71
	DH	66.67	84.62	85.71

Source: own calculations.

It is noticeable that in the first group BUY there is not significant influence of recommendations on the stock prices. Abnormal rates of return are insignificant. Very low effectiveness of recommendation can be connected with difficulties with interpretation, low level of confidence in analysts, risk aversion of the investors on fuel market. The biggest influence of the recommendation is visible two days before the event (day "–2") or, depending on the lengths of estimation window – at the day of the event (day "0"). Constructing models with the usage of shorter estimation windows is increasing the significance level of abnormal return in the day 0.

Table 2. Results in the group BUY

T'	N_k	T					
30	19		–2	–1	0	1	2
		t_e	0.453	–0.135	–0.202	0.044	–0.099
		AR	0.008	–0.002	–0.004	0.001	–0.002
		p-value	0.656	0.894	0.842	0.965	0.922
		T					
25	19		–2	–1	0	1	2
		t_e	–0.295	0.037	0.369	0.024	0.147
		AR	–0.005	0.001	0.006	0.000	0.002
		p-value	0.771	0.971	0.716	0.981	0.885
		T					
20	24		–2	–1	0	1	2
		t_e	–0.159	–0.041	0.359	0.12	0.145
		AR	–0.003	–0.001	0.006	0.002	0.002
		p-value	0.875	0.968	0.723	0.906	0.886

Source: own calculations.

Table 3. Results in the group SELL

T'	N_k	T					
30	19		–2	–1	0	1	2
		t_e	0.327	0.816	–0.526	0.339	0.027
		AR	0.006	0.016	–0.010	0.007	0.001
		p-value	0.757	0.452	0.621	0.749	0.980
		T					
25	19		–2	–1	0	1	2
		t_e	–0.370	0.281	–0.552	–1.718	–1.051
		AR	–0.021	0.016	–0.032	–0.100	–0.061
		p-value	0.724	0.788	0.601	0.137	0.334
		T					
20	24		–2	–1	0	1	2
		t_e	–0.067	0.452	0.169	0.182	0.227
		AR	–0.001	0.009	0.003	0.003	0.004
		p-value	0.949	0.667	0.871	0.862	0.828

Source: own calculations.

In the second group the results are also insignificant as above, however, considerably higher influence on stock prices is visible in this group. The significance is the highest on the day after the recommendation (p-value = 0.137). Optimal is the window for the pre-event period of 25 days.

Table 4. Results in the group KEEP

T'	N_k	T					
30	19		–2	–1	0	1	2
		t_e	0.036	0.186	–0.024	–0.188	–0.046
		AR	0.001	0.003	0.000	–0.003	–0.001
		p-value	0.972	0.857	0.981	0.855	0.964
		T					
25	19		–2	–1	0	1	2
		t_e	0.158	0.009	–0.287	0.021	0.303
		AR	0.003	0.000	–0.005	0.000	0.005
		p-value	0.877	0.993	0.779	0.984	0.768
		T					
20	24		–2	–1	0	1	2
		t_e	0.343	–0.327	–0.262	0.253	0.253
		AR	0.006	–0.005	–0.004	0.004	0.004
		p-value	0.738	0.749	0.798	0.805	0.805

Source: own calculations.

There is also, like in previous groups, insignificant impact of public announcements on stock prices. Results from this class are worse than in BUY and SELL ones. The significance is higher for shorter pre-event windows. Investors do not pay a lot of attention to this recommendation.

5. Conclusions

To sum up there is no ground on the basis of statistical test used for stating that recommendations of analysts have got a significant impact on changes reflected in stock prices (significance level for this test was 5%). The highest influence was visible in the group SELL. Results in this group showed that impact is visible after the event, however, it is not considerable impact. There is no influence of insider dealers. Announcements to BUY stocks is not being reflected in the prices. It can be, as stated before, the result of risk aversion and low confidence to financial institutions or can indicate that the market is so effective that every information available on the market has been already discounted and is embedded in the prices. Moreover, shorter estimation windows result in better reaction of recommendations on the stock prices.

The most difficult analysis was choosing the significant events. This also can be applied so as to improve the results and further assess the significance of the process more accurately by applying discrete wavelet transform which, on the basis of variation analysis, is reflecting changes in stock prices. Moreover, not every time series fixed event windows are correct. When sample is too small such mistakes like over- or underestimations cannot be eliminated. Also dynamic prices within the whole day, not only closing prices may be a good material for event analysis. This may also result in increasing significance of the announcements.

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ANALIZA WPŁYWU REKOMENDACJI ANALITYKÓW NA CENY AKCJI BRANŻY PALIWOWEJ

Streszczenie: Zbadano, czy zgodnie z teorią efektywności rekomendacje analityków w branży paliwowej przedstawione w trzech grupach: kupuj, trzymaj, sprzedaj, wpływają na kursy akcji.

Ceny i stopy zwrotu – wypadkowe informacji rynkowych i sytuacji makroekonomicznej – obarczone są mankamentami psychologicznymi. Inwestorzy, podejmując decyzje, opierają się nie tylko na informacjach fundamentalnych spółek, ale także na subiektywnych

przesłankach. Teoria rynku fraktalnego zakłada chaotyczność w mechanizmach rynkowych i brak wpływu rekomendacji analityków na graczy giełdowych.

Do analizy wpływu rekomendacji na ceny użyto zwyżkowej stopy zwrotu obliczonej za pomocą modelu rynkowego Sharpa oraz testu istotności Studenta.

Wyniki świadczą o małym wpływie rekomendacji analityków na ceny akcji, co jest zgodne z badaniami przedstawionymi w literaturze przedmiotu.