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DAY-OF-THE-WEEK EFFECT AMONG THE SMALLEST ENTERPRISES LISTED ON WSE

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Abstract

The text touches on the subject of the financial markets in the context of behavioral theories. The author attempts to verify the occurrence of one of the popular calendar effects, the day-of-the--week effect, on the Polish stock market. Another limitation of the study area of the research is to include in the analysis only small companies. Many voices from the mainstream of behavioral finance say that the presence of anomalies listed is more evident in the case of small companies, which are not the focus of the majority of investors. In the proposed study, the data used contained companies in the Stock Exchange in Warsaw, with a maximum capitalization of 10 million PLN. Research sample includes quotations of these companies during the period January 2010-April 2014. In order to verify the hypothesis of the occurrence of the day-of-the-week effect among these companies the author used ARCH modeling. In the course of the analysis the author verified negatively the occurrence of the effect of weekdays in the proposed research sample.

JEL classification: G14
Keywords: stock markets, stock anomalies, calendar anomalies, Warsaw Stock Exchange

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Introduction

The capital market is an integral part of a developed economy and a very important element of it. Due to the nature of its functioning and the possibilities of earnings for the investors, it is an interesting subject of research, which aims at discovering schematics and mechanisms of the variability of stock prices. To achieve this goal, a number of research trends and specified studies indicating the existence of certain relationships between the selected factors and price changes were made. Multithreading considerations on this issue has led to many theories which tried to explain the causes of volatility on a different ground. One of the fields that has undertaken this subject is behavioral finance, which in an interesting way connects economics and financial knowledge with the achievements of psychology. This trend introduced a classical approach to economics on a completely new level, enriching it with a range of distortions and problems caused by the fact that man is not an economic being as claims the classical approach, but, as Veblen (Veblen, 1898) stated; a human is „a coherent structure of propensities and habits". This approach is still a matter of controversy and it created a dividing line between enthusiasts and opponents of behavioral theories. However, it gives the basis for the search for market relations that are very reluctantly admitted in the classical approach due to their „non-statistical" character.

One of the subjects that behavioral finance deals with are the market anomalies that indicate the presence of specific mass behaviors that result in specific price movements. One of the basic types of market anomalies are the calendar anomalies and among them, several best described, which are: the January effect, the distribution of the monthly rates of return, the effect of the turn of the month, or the subject of this publication, day-of-the-week effect. At this point it is worth mentioning the concept of anomalies. In relation to capital markets, the most popular are two definitions:

The anomaly, as „the situation which allows an investor to achieve positive, above-average rates of return" (Peters, 1997, p. 36), and the anomaly as a „technique or strategy that is contrary to the assumptions of the theory of efficient markets" (Czerwonka & Gorlewski, 2008, p. 51).

The first definition, proposed by E. Peters (Peters, 1997), defines the anomaly as a change in stock prices partially possible to predict, thus giving the opportunity to achieve a higher profit than projected in the capital assets pricing model. The E. Peters definition does not recognize profit itself as anomaly. Anomaly is only the „excess" profit above the average level, which cannot be explained with the theory of efficiency. This definition also does not specify whether achieving such gains must be permanent or one-time to determine it as an anomaly. The definition of Cowels and Jones (Jones & Cowels, 1937) emphasizes the role of the investors' strategy in deliberations on the anomaly. In this conception, he can invest on the stock market in contradiction to the theory of an efficient market and thereby achieve above-average returns. We can therefore say that the anomaly is a phenomenon excluded from the hypothesis of efficiency. Jones, also like Peters, has not unambiguously defined a time criterion and the stability of investor profits, which makes the definition remain fluid. In fact, the stock market anomalies are known and accepted in the capital markets by its participants. A possible reason for the existence of such a situation is the desire to make profits based on their occurrence, while it should be sought how to minimize this type of phenomenon. However, there is still a lot of confusion on this issue, as mentioned earlier even not specifying the durability of extraordinary profits, which should be followed and explored in the markets, at least in order to obtain a more clear definition.

Referring to the day-of-the-week effect, its causes are still a source of dispute among researchers. An interesting paper in this field was published by French, who in his analysis noted that Monday's returns are lower and the phenomenon is repetitive. His further work showed similar behavior of prices on Fridays (French, 1980). He claimed that the abnormal volatility is caused by accumulating information and emotions of investors around the weekend. Since Saturday and Sunday are days without a session, any information that appears at this time cannot be discounted at the current prices. Thus, on Friday there appears increased uncertainty and the tendency to believe on Friday and Monday is a cumulative time investors react to events and information from the weekend. French's explanations seem to have a lot of sense, but their unequivocal confirmation is still a major difficulty for researchers due to the enormity of informPation that reaches the market and the need to select those factors that uniquely affect the variability of prices. The problem is also the fact that French's explanation do not apply to schemes which may appear

for other days of the week.

In this publication, the author additionally limits the research sample only to companies listed on the WSE. The reason for this additional assumption is a proposal which was published in the article „Firm size, Common Stock offering announcements returns period" in which the authors claim that calendar effects, especially the January effect, are more noticeable in the case of small cap companies (Hull, Mazachek & Ockree, 1998). The author wishes to verify the correctness of this in relation to the shares of the Polish Stock Exchange. So the hypothesis in this paper is that at the Stock Exchange in Warsaw, among the companies with small capitalization, the day-of-the-week effect is noticeable. Verification of this hypothesis will be carried out with econometric modeling. The survey sample includes quotations for companies with capitalization of less than PLN 10 million PLN in the period 01.2010 - 04.2014.

Literature analysis

One of the most unusual factors that might determine the rate of return on stock market values is undoubtedly the day of the week. However, the analysis of this relationship has become an interesting subject for studies due to probable various reasons of this type of connection and research that indicated the fact of this relation taking place in the real market. In 1980 French noted that around the weekend, i.e. on Friday and Monday, the prices tend to be more volatile and the returns are unusually higher on Friday and lower on Monday (French, 1980).French worked on the data of American and several other world markets, but he did not observe similar relationships everywhere in the world. An example is Jaffe and Westerfield, who in a similar study showed that for the Australian and Japanese markets there occurred negative and low rates of return on Tuesdays (Jaffe & Westerfield, 1985). The conclusion about Tuesdays was later confirmed in many other countries in Europe and Asia. Soon after, another publication appeared which indicated that the reported effects are variable in time and sometimes disappear. These types of conclusions are claimed by Smirlock and Starks (1986), Johnston, Kracaw, and McConnell (1991), Gay and Kim (1987) or Chang and Kim (1988). Unfortunately, none of them gives a clear cause of these phenomena. In the past 30 years, since the existence of the relationship between the day and the rate of return was discovered, numerous attempts to final clarification of this compound have been created. French claimed as reason to unnatural movements a theory he called "the closed market hypothesis", in which the basis for the variable price movements would be investors preparing for the weekend information, which cannot be discounted on a regular basis, but only on Monday. Gibbons and Hess (1981) proposed as the reason for price change the restructuring of the portfolios of investors at the close of the week and at the beginning of a new one. The same argument was raised by Lakonishok and Levi in their publication (1982).On the other hand Keim and Stambaugh (1984) looked quite differently on this matter. In their point of view the main cause of this situation are the errors in perception of investors and their calculation of rates of return. A simpler explanation has been offered by Damodaran (1989), according to which, the increased volatility of prices on certain days is a result of investors' reactions to current information that is published regularly and on certain days, and their tone generates important signals for investors. Flannery and Protopapadakis (1988) sought the basis of the problem in market practices of large institutions that adequately plan, forecast and restructure their portfolios in a certain way. In Lakonishoka and Maberly (1990) the thesis appears coincident with French in that the observed phenomenon is a behavioral substrategy for investors who calculate on the basis of their own beliefs and assumptions, how the market situation might look like after the weekend. Condoyanni (1987) based his conclusion on the thesis that large global markets strongly influence each other, and because of the different time sessions on important markets in different parts of the world, there are specific moments in which investors in the stock market are discounting behavior of other stock exchanges. He called that process the "time zones theory".

Referring to the behavioral effects observed among investors, companies noted that the information with the negative connotation should be published on Friday, so that the period of negative emotions and panic fell on the weekend and days without session, which was aimed at weakening the negative effects of bad news for the stocks. Dyl and Maberly (1988) and Damodaran (1989) emphasize that these actions have a very strong impact on the negative returns on Mondays. In the course of attempts to explain the negative trend on Monday Li and Erickson's (1997) publication appeared with results that if the fourth and fifth week of the month is excluded from

the analysis, the Monday returns are not significantly different from those achieved on other days.

Considerations on the causes of the so-called Tuesday effect in markets apart from the American exchanges continue to remain very poorly described in literature. Condoyanni (1987) tried to argue the existence of this effect outside the United States in his theory of time zones, arguing that global markets adequately react to the closing of the NYSE on Monday. Ziemba and Schwartz (1991) also suggested that the Tuesday effect of European exchanges is an echo of the Monday effect on the American stock exchanges. Another aspect of the study on the effect of the weekend is presented by Agrawal and Tandon (1994) and it is the relationship between the rates of return on Fridays and Mondays following after them. They noted that in this case there is a strong correlation. They noted also that the negative Monday effect disappears when the market grew in the preceding week.

Due to the fact that the day-of-the-week effect is considered unstable in time, more research about it is conducted. Wider analysis of nineteen stock markets has been presented by Byar and Kan. In their study, the general conclusion is that in the markets analyzed, rates of return are decreasing in the second half of the week (Byar, Kan, 2002). Also the highest volatility is observed on Mondays. The authors claim that there are differences in these conclusions in different countries which is useful for building a global investment portfolio.

Research methodology

The analysis proposed in this paper focuses on the identification of a systematic relationship between the rates of return of selected listed companies and the various days of the week. In the course of the study the answer to the question as to whether the day of the week can affect the rate of return is being sought. Consistent with an earlier article „Firm size, common stock ..." the author's interest will be relatively small companies whose capitalization is not greater than 10 million PLN. According to the article cited hypotheses, companies of this type are less present in media and the amount of market information which may affect their price is much lower, so that they may be more susceptible to the influence of biases, such as calendar anomalies. In the group of companies meeting the criteria adopted there were 35 companies listed on the Warsaw Stock Exchange at the time of the survey. A list of companies for which the

Table 1: List of the analyzed companies with their market capitalization

Name	Capitalization (mln PLN)	Name	Capitalization (mln PLN)
ABMSOLID	4 284 630,00	INTERBUD	9 822 400,00
ADVADIS	2 014 560,00	IZOLACJA	7 980 000,00
ALTERCO	4 376 960,00	KCI	1 091 790,00
AMPLI	2 920 980,00	MEDIATEL	8 311 890,00
B3SYSTEM	5 379 260,00	MEWA	3 183 880,00
BUDOPOL	6 240 000,00	MIRACULUM	6 719 120,00
CASHFLOW	5 475 000,00	MOSTALEXP	6 683 820,00
DGA	8 047 590,00	MUZA	9 839 040,00
DRAGOWSKI	7 380 000,00	ONE2ONE	1 472 000,00
DREWEX	6 272 770,00	PBOANIOLA	5 459 400,00
EFH	7 916 400,00	PRIMAMODA	4 608 000,00
ENERGOPLD	709 720,00	QUANTUM	6 071 100,00
EUIMPLANT	4 576 420,00	REGNON	2 692 040,00
GANT	7 174 980,00	REINHOLD	4 480 000,00
GREENECO	3 936 160,00	RESBUD	6 174 000,00
GREMMEDIA	8 185 560,00	SKYLINE	9 700 000,00
IDEON	6 869 820,00	UNIMA	7 030 240,00
INTAKUS	225 000,00		

Source: Data downloaded from bankier.pl: http://www.bankier.pl/narzedzia/skaner (05/18/2014)

research hypothesis will be verified is included in Table 1. The sample includes daily returns for all listed companies between 01.01.2010 and 04.31.2014.

From the point of view of previously described causes of the effect of days of the week, Monday and Friday seem to be especially interesting days, so the author of the article began by examining the relationship between the rate of return and binary variables indicating the Monday and Friday in the research sample. Because the normality test showed the need to reject the hypothesis of the variable distribution normality, to study the correlation between proposed variables, the Spearman rank correlation test has been applied. Correlation analysis is, however, only the secondary element of the study, the core of which is the regression analysis.

Due to the nature of economic processes characterizing the price volatility on the WSE, modeling OLS classic is inefficient. Unstable variance results in underestimation or overestimation of the model parameters. This led to the necessity to create a new class of models which take into account the above problem. ARCH-class models have been developed to describe phenomena in which there is the problem of heteroscedasticity, which makes them well suited to test hypotheses posed in the study. In order to determine the applicability of ARCH models to show the relationship between rates of return and the days of the week, after the initial modeling using OLS for each of the companies the author used the ARCH effect test, the results of which are presented in the Annex. The tests performed indicate that in the case of EFH, INTERBUD and INSULATION this class of models should not be used, while in other cases they are justified. For this reason, in further analysis an ARCH standard model were used with delay -1. The general form of the model of this type is presented by the formula (1) and (2) (Brzeszczyński & Kelm, 2002, p.45-46):

$$\xi_t^2 = \gamma_0 + \sum_{s=1}^{s} \gamma_s \xi_{t-s}^2 + \eta_t \qquad (1)$$

$$h_t = \gamma_0 + \sum_{s=1}^{s} \gamma_s \xi_{t-s}^2 \qquad (2)$$

To verify the hypothesis a simple regression was used, in which the only exogenous variables are binary variables representing days of the week. The general model form of the proposed analysis is shown below (3).

$$R = f(PN, WT, SR, CZ, PT) \qquad (3)$$

Where:
R – Rate of return of the valor
PN – 0/1 variable representing Monday
WT - 0/1 variable representing Tuesday
SR - 0/1 variable representing Wednesday
CZ - 0/1 variable representing Thursday
PT - 0/1 variable representing Friday

This is standard procedure for the verification of a claimed problem that can also be found in Plamen's studies (Plamen, Lyroudi & Kanaryan, 2003) or Kirwins' (Kirwins, Niendorf & Beck, 2013) whose publications are taking up the same theme. An additional element of the analysis is to calculate the ratio R^2 to illustrate the extent to which the function of return is determined by days-of-the-week variables. Finally, based on the estimation made, the stated hypothesis will be verified and final conclusions will be formulated.

Results

In the first place, worth noting is the size of the correlation between changes in prices and Friday and Monday, as the specific days in French's theory. Analyzing the relationships presented in Table 2, the conclusion is that his study of the American market is not finding references in Polish conditions. The correlation between the day of the week and the rate of return does not exceed 6% for Monday and only slightly exceeds this threshold in the case of Friday. An additional problem for inference is the fact that the correlations are not unambiguous directionally among the analyzed companies on both Monday and Friday. In conjunction with a negligible relationship between variables we can conclude no significant relationship between these variables.

Moving on to the analysis of the results of econometric modeling we obtain similar conclusions. After the estimation individually for each company we received a set of models with a consistent form, but with very ambiguous results, which are presented in Table 3 in the Annex.

In the first place it is worth paying attention to the previously described Monday and Friday. In the case of Monday, in 26 companies of a total of 35 in the

Table 2: Correlations between Monday, Friday and rates of return on these days

Company	Monday	Friday	Company	Monday	Friday
ABMSOLID	-0,4%	-0,9%	INTERBUD	-3,9%	0,3%
ADVADIS	-4,0%	2,6%	IZOLACJA	-4,3%	-0,3%
ALTERCO	-5,5%	-0,5%	KCI	1,8%	3,6%
AMPLI	-0,2%	1,9%	MEDIATEL	0,2%	3,5%
B3SYSTEM	4,2%	-6,1%	MEWA	-0,4%	2,5%
BUDOPOL	-5,9%	-0,3%	MIRACULUM	0,6%	0,5%
CASHFLOW	-3,7%	2,5%	MOSTALEXP	5,4%	5,8%
DGA	-1,7%	1,8%	MUZA	-3,1%	3,4%
DRAGOWSKI	1,5%	-3,1%	ONE2ONE	-0,9%	0,6%
DREWEX	-4,2%	5,0%	PBOANIOLA	-2,0%	-3,7%
EFH	-5,0%	5,4%	PRIMAMODA	-2,2%	4,3%
ENERGOPLD	-3,0%	1,6%	QUANTUM	-1,4%	-2,0%
EUIMPLANT	-1,7%	4,0%	REGNON	-1,4%	2,0%
GANT	0,1%	3,3%	REINHOLD	-1,2%	4,5%
GREENECO	-1,8%	3,6%	RESBUD	1,4%	-2,5%
GREMMEDIA	-5,3%	0,2%	SKYLINE	-0,2%	3,6%
IDEON	7,8%	-5,9%	UNIMA	-3,9%	-1,7%
INTAKUS	-6,7%	0,5%			

Source: Own elaboration with usage of GRETL

sample, the coefficient is determined with an acceptable probability of error (max 10%) and in these 7 cases, in 1 set the coefficient is positive. According to the author the number of companies for which we obtained the desired effect is far too small to determine the explicit impact of Monday on achieved returns. The situation is even less clear considering Friday. The β coefficient takes a negative value in 16 companies, while the other 17 are positive (only three companies failed to indicate a statistically significant parameter). The author finds that the result denies the influence of Friday itself as an important variable affecting the stock prices with a small capitalization on the Warsaw Stock Exchange.

Analyzing the anomaly of weekly rates of return distribution, as a whole, including all days of the week, it should be noted that in the examined group this phenomenon is absent. In the course of the study the author failed to obtain a clear and repeatable results in a significant group of companies covered by the survey. For the remaining days of the week, i.e. Tuesdays, Wednesdays and Thursdays we do not observe repetitive patterns in the total sample. According to the inference that arises in existing studies it should be noted that the specificity of the functioning of the stock exchange in Warsaw does not cause specific behaviors associated with the day of the week. We are thinking, for example, of the daily session break in the Japanese market. Of course, for the Polish market there are also specific periods / days, such as the "Day of three witches" in which futures contracts are settled, which usually causes a supernatural stir among investors. But these are not weekly, systematic and explicit moments that could affect the courses and they do not have a nature similar to the fact that the day like Monday itself can affect prices.

However, as shown in Table 3, negating the hypothesis of the existence of the day-of-the-week effect in the total sample, representing small companies listed on the Warsaw Stock Exchange, does not necessarily mean that this effect does not occur. According to the author, only to conclude that the sample created based on accepted criteria the effect is negligible, which does not rule out the of existence in other, separate niches in the market or individual companies. As the confirmation of this, the estimations for several firms in the sample, namely for ADVADIS and INTAKUS can be shown. In the case of these two companies the author succeeded in indicating the significance of the three variables described in the study, although in each company those are not the same

variables. However, this gives basis to the conclusion that such relationships can carry useful information for investors, though in a very small scale, due to the low level of description of the price change by the proposed variable and a high degree of individualization of the analyzed phenomenon.

Conclusions

The analysis conducted on the prevalence of the day-of-the-week effect among companies with low capitalization listed on the Warsaw Stock Exchange indicated that this type of dependencies in the given group of companies does not exist. The analysis carried out on

a sample of 35 companies showed great inconsistency of the results for the correlation and regression analysis. According to the particular company we get a different set of relevant variables influencing the share price, in many companies the author could not achieve significance for any variable representing the days of the week. This result leads the author to verify the negative hypothesis initially wagered. It should be emphasized that this is the result confirming the research made by Patev (2003) in this field, who along with his research team studied this issue for the major market indices: Romanian, Hungarian, Lithuanian, Czech, Slovak, Russian and Polish. In his work, he pointed out that the Polish and Slovak index shows no effects associated with the days of the week while it can be indicated the importance of the individual, but different days in other markets. Past research on the analyzed topic results in very different conclusions. Depending on the adopted methodology, timing and place of the study, the researchers obtain different results of the analysis, which shows that the phenomenon is not clear and it does not have a general character.

This publication is an extension of the very few publications on this subject on the Polish market. The main value added is the development of the days of the week effect in

a specific study group of companies. The author's aim is to verify the theory presented by French on the example of the Polish market in the group of companies with the lowest capitalization. The obtained results allow clarification of the possible utility of the theory described, in the market reality, even to construct an investment strategy. The negative test results presented indicate that investors should not treat this anomaly as an important element of decision-making in general, while they are able to complement their actions on the information it brings in specialized cases, but this is likely to require an individual testing within a particular company.

The obtained results are similar to those conducted in other countries on wider groups of companies or indexes mostly stating that the day-of-the-week effect is an anomaly existing in the markets periodically or in very specific groups of stocks. Depending on the methodology used in the research, the authors received different conclusions, but most of them claim that the effect is very hard to capture for investing purposes.

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Appendix

Table 3: The results of the estimation of ARCH models (1) for individual companies included in the study[1]

Company significance of the variable	PON	WT	ŚR	CZW	PT	R^2
ABMSOLID	-0,119886	0,396548	-0,609122	-0,298598	-0,141491	
p-value	0,78685	0,3661	0,16908	0,49941	0,74493	0,26%
ADVADIS	0,787069	0,547933	**3,84959**	**3,18743**	**3,24583**	
p-value	0,62323	0,72581	0,01412 (**)	0,04621 (**)	0,03978 (**)	0,36%
ALTERCO	**-1,04421**	-0,583779	-0,0165302	0,0989698	-0,288415	
p-value	0,00927 (***)	0,14046	0,96683	0,80574	0,47001	0,50%
AMPLI	-0,105836	-0,224423	-0,0438275	-0,0849924	-0,0137085	
p-value	0,68236	0,3777	0,86367	0,73995	0,95703	0,04%
B3SYSTEM	-0,0022743	-0,246029	0,0669099	-0,0783001	**-0,729672**	
p-value	0,99353	0,37859	0,80807	0,78055	0,00964 (***)	0,49%
BUDOPOL	**-0,636222**	-0,402386	**0,537839**	-0,0256723	-0,0782963	
p-value	0,04782 (**)	0,20262	0,08823 (*)	0,93566	0,80477	0,36%
CASHFLOW	-0,44575	-0,0759363	-0,293651	0,332365	0,295835	
p-value	0,11813	0,79204	0,2924	0,24738	0,2981	0,56%
DGA	-0,277814	-0,177755	-0,0118858	0,078481	0,0313059	
p-value	0,26369	0,46963	0,96109	0,7518	0,89934	0,14%
DRAGOWSKI	0,0279459	-0,309514	0,306937	0,08265	-0,313638	
p-value	0,92031	0,26267	0,26476	0,76668	0,25689	0,36%
DREWEX	**-0,878954**	-0,543226	0,716259	-0,647359	0,602779	
p-value	0,08462 (*)	0,27701	0,1473	0,19447	0,22724	0,85%
EFH (MNK)	**-0,675407**	-0,312243	0,367593	-0,563318	0,414528	
p-value	0,06146 (*)	0,38133	0,3005	0,11696	0,24743	0,78%
ENERGOPLD	-0,636458	-0,344132	-0,228338	0,670762	0,300232	
p-value	0,39071	0,63424	0,75288	0,35874	0,6805	0,20%
EUIMPLANT	-0,266212	**-0,969234**	-0,0476053	0,128445	0,143418	
p-value	0,44283	0,00486 (***)	0,89053	0,71302	0,67851	0,67%
GANT	-0,192377	**-0,660809**	0,150745	-0,368859	0,133941	
p-value	0,5309	0,02982 (**)	0,61691	0,22488	0,66026	0,49%
GREENECO	-0,536482	-0,519947	-0,0707447	-0,123504	0,181325	
p-value	0,12077	0,13012	0,83523	0,72144	0,60003	0,30%
GREMMEDIA	**-0,535906**	0,0356329	-0,158407	0,016011	-0,0827377	
p-value	0,01721 (**)	0,87228	0,46967	0,94279	0,70776	0,41%
IDEON	**1,08663**	-0,655174	0,61443	0,0780155	-0,652133	
p-value	0,06767 (*)	0,27018	0,29194	0,89418	0,26809	0,64%
INTAKUS	-0,346263	**3,79616**	**3,01264**	**4,4929**	2,01705	
p-value	0,83767	0,02207 (**)	0,07055 (*)	0,00732 (***)	0,23034	0,50%

1 With the values p-value in the parentheses in the table there are "*" added to determine the significance of particular variable levels, respectively (*) - significance at 10% (**) - at the level of 5% (***) - Level 1 %

INTERBUD (MNK)	-0,484601	0,201964	-0,286842	-0,131557	-0,143253	
p-value	0,12534	0,51641	0,35255	0,67343	0,64729	0,31%
IZOLACJA (MNK)	-0,314805	-0,133353	0,245558	0,097502	-0,0312334	
p-value	0,18034	0,56639	0,28637	0,67791	0,89331	0,32%
KCI	-0,0367156	-0,24432	-0,199456	-0,296055	0,163567	
p-value	0,88234	0,32269	0,41715	0,23761	0,51383	0,21%
MEDIATEL	-0,201965	-0,26409	**-0,95885**	-0,0981308	0,435454	
p-value	0,55612	0,4362	0,00457 (***)	0,77497	0,20627	0,81%
MEWA	-0,0371726	**-0,682383**	0,177777	-0,115145	0,232481	
p-value	0,91368	0,04619 (**)	0,60069	0,73858	0,50263	0,43%
MIRACULUM	-0,0566284	0,051016	0,175932	-0,519419	-0,0684522	
p-value	0,87737	0,88756	0,62362	0,15284	0,85022	0,20%
MOSTALEXP	0,383251	-0,327442	**-0,610996**	-0,402961	0,530732	
p-value	0,28519	0,35157	0,08043 (*)	0,25586	0,13517	0,78%
MUZA	-0,295329	-0,286453	0,187768	-0,103376	0,0962228	
p-value	0,13479	0,14269	0,33462	0,59803	0,62442	0,47%
ONE2ONE	**-0,74099**	**-0,779823**	-0,215114	-0,0150906	-0,282531	
p-value	0,03107 (**)	0,02279 (**)	0,52073	0,96469	0,40298	0,37%
PBOANIOLA	-0,10211	-0,246239	-0,100984	-0,170199	**-0,578985**	
p-value	0,77367	0,47743	0,76933	0,62551	0,09826 (*)	0,19%
PRIMAMODA	-0,0963653	-0,19792	-0,0222242	-0,250036	0,218945	
p-value	0,64966	0,34581	0,91552	0,23912	0,29871	0,29%
QUANTUM	-0,204656	-0,0365788	-0,042982	0,0407879	-0,174056	
p-value	0,317	0,85483	0,82993	0,84009	0,38484	0,10%
REGNON	0,531353	-0,357335	-0,549346	**1,94382**	1,66397	
p-value	0,61509	0,73218	0,59571	0,06552 (*)	0,11797	0,44%
REINHOLD	-0,497889	0,188388	**-0,685057**	-0,470235	0,251728	
p-value	0,18973	0,61627	0,06521 (*)	0,21339	0,50005	0,50%
RESBUD	0,0449473	-0,0735259	0,199044	-0,453749	-0,571675	
p-value	0,90227	0,83854	0,5806	0,21611	0,11314	0,31%
SKYLINE	-0,075747	0,02365	0,14497	**-0,46108**	0,268548	
p-value	0,77231	0,92694	0,5699	0,0739 (*)	0,29668	0,44%
UNIMA	-0,194191	-0,0412401	0,103994	0,028536	-0,121061	
p-value	0,17984	0,77218	0,46213	0,84155	0,39712	0,26%

Source: Own elaboration with usage of GRETL

Table 4: The test results for the ARCH effect for rates of returns for the analyzed companies

Company	Arch test results	Arch Effect
ABMSOLID	Test: LM = 115,465 / p = 6,22549e-027	Yes
ADVADIS	Test: LM = 115,465 / p = 6,22549e-027	Yes
ALTERCO	Test: LM = 51,2175 / p = 8,268e-013	Yes
AMPLI	Test: LM = 68,2025 / p = 1,47537e-016	Yes
B3SYSTEM	Test: LM = 40,8214 / p = 1,66794e-010	Yes
BUDOPOL	Test: LM = 9,46444 / p = 0,00209493	Yes
CASHFLOW	Test: LM = 140,064 / p = 2,57786e-032	Yes
DGA	Test: LM = 12,1254 / p = 0,000497394	Yes
DRAGOWSKI	Test: LM = 8,5453 / p = 0,00346415	Yes
DREWEX	Test: LM = 50,3146 / p = 1,30968e-012	Yes
EFH	Test: LM = 0,165917 / p = 0,683766	No
ENERGOPLD	Test: LM = 25,1799 / p = 5,22248e-007	Yes
EUIMPLANT	Test: LM = 18,8534 / p = 1,4116e-005	Yes
GANT	Test: LM = 4,17949 / p = 0,0409159	Yes
GREENECO	Test: LM = 55,8714 / p = 7,73706e-014	Yes
GREMMEDIA	Test: LM = 28,5901 / p = 8,94366e-008	Yes
IDEON	Test: LM = 22,5556 / p = 2,04148e-006	Yes
INYESUS	Test: LM = 20,1624 / p = 7,1138e-006	Yes
INTERBUD	Test: LM = 2,58275 / p = 0,108034	No
IZOLACJA	Test: LM = 0,977526 / p = 0,32281	No
KCI	Test: LM = 26,3909 / p = 2,78853e-007	Yes
MEDIATEL	Test: LM = 56,1344 / p = 6,76811e-014	Yes
MEWA	Test: LM = 54,4911 / p = 1,56157e-013	Yes
MIRACULUM	Test: LM = 5,24027 / p = 0,0220699	Yes
MOSTALEXP	Test: LM = 10,7668 / p = 0,00103338	Yes
MUZA	Test: LM = 46,4527 / p = 9,38565e-012	Yes
ONE2ONE	Test: LM = 129,269 / p = 5,92377e-030	Yes
PBOANIOLA	Test: LM = 28,4518 / p = 9,60587e-008	Yes
PRIMAMODA	Test: LM = 38,5846 / p = 5,24323e-010	Yes
QUANTUM	Test: LM = 25,4109 / p = 4,63291e-007	Yes
REGNON	Test: LM = 42,029 / p = 8,99301e-011	Yes
REINHOLD	Test: LM = 54,3207 / p = 1,70299e-013	Yes
RESBUD	Test: LM = 195,396 / p = 2,1115e-044	Yes
SKYLINE	Test: LM = 2,71512 / p = 0,0994018	Yes
UNIMA	Test: LM = 8,1647 / p = 0,00427136	Yes

Source: Own elaboration with usage of GRETL