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Can the publication of annual financial reports become an opportunity for insider trading?

1. Introduction

Financial markets struggle with the problem of market abuse behaviors, such as insider trading and market manipulation. Supervisory authorities that control the market should detect and consistently penalize all actions that are illegal in terms of local capital market law.

Under the name of market manipulation, we comprehend all actions that lead to security price changes or to a change of perception of market participants on security itself. The actions may be caused by the spread of misleading information (information-based manipulation) or by making transactions (market-based manipulation). In each case, the aim of market manipulators is to draw attention to their operations and to trigger a desired reaction in others. For this reason, market manipulation has a greater chance of being detected than insider trading, which is hidden by insiders. Insider trading relies on making transactions based on privileged or inside information that is not available to other participants of the market. The research on profits from insider trading behavior can be treated as part of the study on the hypothesis of efficient market formulated by Fama (1970). In its strong form, the hypothesis postulates that even privileged information is fully reflected in security prices, and that having knowledge of it cannot lead to superior profits. Penalties that are imposed by supervisory authorities for insider trading do not enforce the strong form of market efficiency. Researchers assume that insider trading leads to unusual security price changes observed ahead of an announcement, which has an impact on prices. Increased trading volume may be noted simultaneously. Meulbroek (1992) states that this can be caused by uninformed investors who follow insiders and empower the changes

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in trading. The so-called herd-effect on the Polish stock market is studied by Gurgul and Majdosz (2007).

In the European Union, regulations related to market abuse were included in Directive 2003/6/EC. This document gives definitions and regulations that are homogeneous across all member states. Moreover, in April 2014, the European Council accepted applications recommended by European Commission that will unify the notion of market crime and penalties for it. In spite of a clear definition of prohibited actions and a severe system of punishment, the scale of market abuse will not be whittled down if its methods of detection are not efficient. As it is still not easy to detect and prove market abuse, more research on this problem required.

In the literature, several methods of detecting insider trading can be found. One of them is proposed by Monteiro et al. (2007). In 2001, the Financial Services Authority (FSA) of the United Kingdom introduced the Financial Services and Markets Act (FSMA). The document simplifies procedures for prosecuting market abuse and gives the FSA a wider scope of activities in case of various types of abuse. Monteiro et al. (2007) try to answer the question if the introduction of the FSMA significantly minimizes the number of market crimes. They focus on insider trading that may take place as a result of two kinds of announcements - public takeover announcements and trading statements of the issuer of FTSE350. Using event-study analysis and bootstrap methods, they have found statistically significant announcements that have had an impact on security prices. Afterwards, in this restricted set of events, they look for the ones preceded by informed price movement. The assumption is that a significant change in the price of a security observed directly before the announcement can be a signal of insider trading. Additionally, apart from price analysis, they also search for abnormal volumes before the events. The results suggest that the scale of insider trading did not decrease after the FSMA introduction, but only after the FSA brought the first insider trading enforcement case under the new regime. The analysis of Monteiro et al. (2007) enables us to search for potential insider trading cases; however, it has one weakness – the research can be conducted only after the announcement that is suspect of market abuse, so it is unable to detect insider trading in real time.

The endeavor of creating a procedure that allows us to detect market abuse in real time was undertaken by Minenna (2003). He defines four diffusion processes that describe the behaviors of elementary variables related to security: returns, trading volumes, statistic concentration of the market, and dynamic concentration of the market. The procedure operates on a daily basis; the parameters are updated each day. Minenna (2003) constructs a confidence interval for each of the variables, and using daily data collected over a relatively short period

of time, he makes predictions of the variables for the next day. On the day when the variables are outside the interval, he signals the alert. He assumes that a trading day is anomalous when there is an alert on at least three of four tripwires. In his research, Minnena (2003) appeals repeatedly to the supervisory experience of the Consob – the government authority of Italy responsible for regulating the Italian securities market. Quoting Consob's studies, his main assumption is that volumes as well as returns and concentration measures can be well-described in discrete time by an autoregressive process AR(1) whose continuous-time version is an Orstein-Uhlenbeck diffusion process. The validity of this fundamental assumption is open to doubt, as it is known that e.g., a time series of returns may be characterized by serial correlation as well as heretoskedasticity. The verification of goodness of the fit should be executed before the application of the procedure. As the information necessary to construct market concentration measures is not public, the method proposed by Minenna (2003) can be held only by the authorities who have access to it.

Market abuse detection on the Polish equity market is researched inter alia by Cholewiński (2009), who proposes a model founded on real-time analysis. He draws on the prediction intervals used by Minena (2003) and on the market model proposed by Monteiro et al.(2007). Additionally, he introduces time-varying parameters to the expected returns equation and estimates them using a Kalman filter. Another method of detecting insider trading has been proposed by Park and Lee (2010). Using high-frequency data, they demonstrate that, when an insider transaction occurs, a time series of intraday returns follow the ARMA(1,1) process. They define tree criteria for detecting insider trading under this assumption and validate them by constructing appropriate tests. Olmo et al. (2011) constructed consistent timing structural break tests to detect insider trading behavior. Adopting an extended capital asset pricing model to a security return time series, they claim that this type of market abuse leads to structural change in the intercept of the model.

In this paper, I discuss market abuse behavior on the Polish equity market. I investigate whether or not publications of annual financial reports of issuers may cause opportunities for insider trading. On the basis of daily returns of securities incorporated in WIG index, I search for informed price movements before the date of disclosure of annual financial results of a company. The data was collected from January 2010 until May 2014. Each announcement that might be suspect of insider trading is additionally analyzed for the presence of abnormal trading volumes.

The structure of the paper is as follows: data and methodology applied in the study are described in Section 2. Empirical results of the analysis are discussed in Section 3. Section 4 concludes the paper.

2. Data and methodology

In this article, I devote my attention to annual financial reports published by issuers of companies listed in the WIG index. Publications of companies' results are seen as significant to the market, which should be reflected in price changes. Price movements observed ahead of the publication could indicate potential insider trading. Annual reports were selected for the research, although their impact on prices may be not as significant as that of the reports published more frequently (and therefore containing information more difficult to predict). The choice was dictated by the methodology applied in the study. The GARCH process that was used requires at least one hundred daily returns to be well suited, while estimation windows consisting of these returns in event study analysis should be disjointed. Quarterly or even semi-annual reports do not meet these requirements.

In my research, I gathered information on the publication dates of annual reports from the period between 1 January, 2010, and 29 May, 2014, which are available on www.gpwinfostrefa.pl. Because most of the reports appear in the first half of the year (mostly in March and April), I took into account companies listed in the WIG index at the beginning of the year and after the first adjustment of the index in a given year. Due to the facts that not all of the dates were available and that, in some cases, the data did not meet the assumptions of the model, the initial number of the companies' announcements decreased.

The number of announcements researched each year is presented in Table 1.

Table 1

Number of annual financial reports of WIG issuers studied in the research

Year	Number of announcements
2010	206
2011	220
2012	252
2013	222
2014	225
SUM	**1125**

In order to investigate the occurrence of informed price movements, event study methodology is used. Formalized by Fama et al. (1969), it is still a prevailing

method applied to assess the reaction of standard market variables to unantici-
pated events. For each announcement, pre-event and event windows are defined.
If we denote the day of the announcement by t = 0, then the pre-event window
(lasting 200 days and ending eight days before the announcement) is t = –208, ... ,
t = –8. The pre-event window is as long as possible to avoid a situation where it
includes the period around the announcement published the previous year and
the days directly before the announcement (when prices could be influenced by an
expected release). The event window covers four days, from t = –2 to t = 1.

For each day in both the pre-event window and the event window, I calculate
abnormal returns, which are the differences between actual returns and expected
returns defined by the model:

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

where $R_{i,t}$ is the logarithmic rate of return of i-th company on day t.

The expected returns are calculated in four different ways, as proposed by
Monteiro et al. (2007). The starting model is the classic market model, namely:

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

where $R_{m,t}$ is the market return on day t, represented by the WIG return, and ε
is the error on a given day. I assume that errors are independent and identically
distributed with an expected value of zero and constant variance. The validity of
these assumptions is tested using the Durbin-Watson test of autocorrelation and
Engle's Arch Test of heteroscedasticity. When estimation errors are correlated,
lagged variables are added to the model:

$$R_{i,t} = \alpha + \beta_1 R_{m,t} + \beta_2 R_{i,t-1} + \beta_3 R_{m,t-1} + \varepsilon$$

In the case of heteroscedasticity, the assumption that the variance of the er-
ror is not constant is added to the first or second model, respectively. It follows
the GARCH(1,1) equation:

$$Var\left(\varepsilon_t\right) = a + b\,\varepsilon_{t-1}^2 + c\,Var\left(\varepsilon_{t-1}\right)$$

Initially, abnormal returns were calculated under the assumption that they
were normally distributed, but this hypothesis was rejected in about 90% of the
considered time series. The model with t-student distribution of errors turned
out to be well-specified. After calculating, abnormal returns were standardized so
that they could be comparable. Significant announcements and preceding price
movements were found in two ways.

The first part of the research is based on the method proposed by Monteiro
et al. (2007) with some modifications.

Monteiro et al. (2007) calculate four-day cumulative abnormal returns $CAR(-2,1)$, where:

$$CAR_i\left(t_1,\ t_2\right) = \sum_{t_1}^{t_2} AR_{i,t}$$

and compare them with 50,000 four-day abnormal returns drawn randomly from the estimation window. They assume that the event is significant at the 5% level, if the corresponding CAR(–2,1) is in the group of 2,500 most-negative simulated four-day CARs or in the group of 2,500 most-positive simulated four-day CARs.

In this research, I look for significant announcements using two-day CAR(0,1) instead of four-day CAR(–2,1). When a report brings an important piece of information to the market, the price of the security should change on the day of the event (or on the day after the release at the latest). The change in a price at the same direction one or two days before the publication of a report could be seen as informed price movement and would empower the significance of CAR(–2,1). Nonetheless, a report that is seen as positive news can be preceded by a negative event, not necessarily connected with the report. If this event causes a sharp slide in the price, four-day CAR(–2,1) could not differ significantly from zero or could even be significantly negative despite positive information in the report. Using two-day CAR(0,1) instead of four-day CAR(–2,1) prevents the publication of a report in the above situation from being defined as an irrelevant or significantly negative event.

I draw two-day cumulative abnormal returns 50,000 times randomly from the estimation window and define significant announcements in the same way as Monteiro et al. (2007) do using two-day CARs instead of four-day CARs. For each significant announcement, I calculate two-day CAR(–2,–1)* and repeat the bootstrap procedure used before. I compare CAR(–2,–1) with the previously-obtained set of 50,000 two-day CARs. I assume that the actual two-day CAR(–2,–1) is significant at a 5% level and presume that there is potential informed price movement before the announcement if the CAR(–2,–1) is within the 2,500 most-negative simulated two-day CAR and corresponding CAR(0,1) was significantly negative, or in the situation where it is within the 2,500 most-positive simulated two-day CAR and the corresponding CAR(0,1) was significantly positive.

Since the first procedure gives very few cases of potential informed price movements, I decided to expand the analysis to daily abnormal returns from seven days before an announcement. The event window is broadened and contains nine days, from $t = -7$ to $t = 1$ The model of abnormal returns is the same as in the first part of the research. Estimated errors are described by t-student distribution. When abnormal returns on day $t = 0$ and $t = 1$ are both higher (or lower) than an appropriate quantile of t-student distribution, or when only one of them is significantly different from zero, the event is defined as a significant

one. For a significant event, price movements observed over the period of seven days before a publication are found in the same way. There is a suspicion of informed price movement if a change in a price on the day of the event and on one of the preceding days have the same direction.

After the analysis of abnormal returns, I verify if potential informed price movements are accompanied by an increase in trading volume. Following Cready and Ramanan (1991), I use logarithmic transformation of raw volumes:

$$v_{i,t} = \ln\left(1 + volume_{i,t}\right)$$

In the estimation window, a trend line is determined based on trading volumes. Abnormal trading volumes are defined as the differences between the actual trading volumes and the levels of the volumes coming from a trend line. If there is no trend, they are calculated as the differences between the actual trading volumes and the mean of the trading volumes from the estimation window. I replace a zero trading volume with the mean trading volume from the estimation window. To abnormal volumes, I fit normal distribution or t-student distribution when the residuals are not normally distributed. Significantly-increased trading volumes are defined likewise in the case of returns.

3. Empirical results

3.1. General findings of the analysis of cumulative abnormal returns

General findings of the research conducted with the use of two-day cumulative abnormal returns are presented in Table 2. From the set of announcements used in the research in a given year, the number of significant news is detailed. The events that influence security prices constitute quite a low percentage of all of the announcements (from 9% in 2012 to 20% in 2013). This can be explained by the fact that the disclosure date of an annual financial report is set at the beginning of a year and is made public to all members of the market. What is more, the official version of a report is sometimes preceded by a publication of preliminary results. For this reason, the final statement may not be an unexpected event causing a strong reaction of the market.

From the group of significant announcements, I detailed potential informed price movements (IPMs), which are the events that reveal price changes one or two days before a report publication. These events are suspected to be marked by insider trading. The measure of IPMs is constructed as the quotient of the number of IPMs and significant announcements. The highest measure is obtained in 2014, where five out of the 23 significant announcements are preceded by a significant change in security price. From 2010 to 2013, there were only two

IPMs per year. The results do not indicate any trend. The significant news persists at a low level, with the exception of 2013, when its amount more or less doubled, but remained not high. Only a few out of the significant pieces of news constitute informed price movements. Cumulatively, about 12% of all announcements taken on board cause price movements, and in 10% of them, the change in a price appears before the publication of the news.

Table 2

The measure of potential informed price movements, obtained from the analysis of cumulative abnormal returns

Year	Number of announcements	Significant announcements	IPMs	Measure [%]
2010	206	20 (10%)	2	10
2011	220	21 (10%)	2	10
2012	252	23 (9%)	2	9
2013	222	44 (20%)	2	5
2014	225	23 (10%)	5	22
SUM	1125	131 (12%)	13	10

In order to elaborate the results, I divide the significant announcements into two groups: reports that raise the price of security and reports that lower the price. The results are presented in Table 3. In the former group, I single out the reports that are preceded by an increase in price (column "IPMs plus"), while in the latter, I search for a decrease in price before the announcement (column "IPMs minus").

Table 3

The measure of potential informed price movements, obtained from the analysis of cumulative abnormal returns. Distinction between positive and negative events

Year	Number of announcements	Significant		IPMs		Measure [%]	
		plus	minus	plus	minus	plus	minus
2010	206	12	8	2	0	17	0
2011	220	14	7	1	1	7	14
2012	252	11	12	1	1	9	8
2013	222	18	26	1	1	6	4
2014	225	9	14	3	2	33	14
SUM	1125	64	67	8	5	13	7

There is no considerable difference between the numbers of two kinds of announcements. A slight dominance of the reports that yield drops in prices can be noticed, but in the group of the positive events, the percentage of announcements preceded by price movement is higher.

3.2. Results from the analysis of daily abnormal returns

Since the analysis of cumulative abnormal returns detects quite a small group of desired price changes, I expand my research. One of the punished cases of insider trading in Poland took place in 2008. One week before publication of a quarterly financial report, a share price of a company plummeted. It turned out that sellers received privileged information about a company's worse-than-expected financial performance. This example suggests that not only the period of two days before a financial report publication should be traced for insider trading. Taking this into account, I extend the event window so that it begins seven trading days before a report publication and explore daily abnormal returns instead of cumulative ones. The results from the analysis, detailing drops and falls in security prices, are presented in Table 4.

Table 4

The measure of potential informed price movements for positive and negative events. Results from the analysis of daily abnormal returns

Year	Number of announcements	Significant		IPMs		Measure [%]	
		plus	minus	plus	minus	plus	minus
2010	206	19	16	2	8	11	50
2011	220	22	16	6	8	27	50
2012	252	18	17	4	6	22	35
2013	222	27	34	7	10	26	29
2014	225	24	34	7	12	29	35
SUM	1125	110	117	26	44	24	38
		227		70		31	

It is visible that considering daily abnormal returns instead of cumulative ones doubled the number of significant events, which is now about 20% of all announcements. The number of price movements ahead of the event increased greatly. The group of the announcements that cause price falls is slightly larger

than the one which causes price rises. Interestingly, there are more price falls before negative events than price rises before positive ones each year. In the last two years, the number of significant (especially negative) events is noticeably higher than in the previous years. As a result, there are more potential informed price movements. The measure of IMPs in the group of positive events remains at a level of slightly more than 20% (with the exception of the year 2011, when this measure is markedly lower). In the group of negative events, the measure is higher – from 29% in 2013 to 50% in 2010 and 2011.

The results obtained from the first and second methods were compared. Each price movement ahead of the publication of the report discovered in the analysis of cumulative abnormal return was also detected in the research of daily abnormal returns. The second method, as it was more detailed, was able to reveal more potential informed price movements.

As it was pointed out at the beginning of the article, price movement observed directly before significant news can be a signal of insider trading. This is, however, not the only possible explanation for price changes. These can also be caused by investors who speculate on the results of a company and who count a company's preliminary statements in their expectations. The cause of the movement can be many other different important publications that appear on the market as well.

Retrospectively, it is almost impossible to detect and properly define all potential reasons for changes in markings from the previous few years. It is likely that not all detected price movements are caused by insider trading. However, the analysis conducted here can be perceived as an attempt to estimate the scale of insider trading that precedes financial reports published by companies.

3.3. The analysis of abnormal trading volumes

The cases of price movements observed directly before the releases of annual financial statements were additionally checked for the presence of significantly-high trading volumes. As it was pointed out earlier, higher-than-expected trading volumes can be caused by uninformed investors who follow insider behavior. Simultaneous price and volume change is a signal that important information was delivered to the market. The results of the analysis of trading volumes are presented in Table 5.

From 70 cases of potential informed price movements, only 15 (21%) are marked with high trading volumes observed the same day. In this group, markings of each company are retraced in the search for the reasons for price and volume changes.

In 2010, the two companies that noted increases in prices and trading volumes ahead of the publication of annual financial reports publicized information

about signing letters of intent with potential US investors on the same day. In all probability, this was the real reason for positive changes in their markings. Interestingly, these companies revealed this information with a two-day delay, which was punished by the KNF – the Polish financial supervisory authority. A detailed analysis showed that, before revealing the information, one of the companies noted an increase in price while the latter noted an increase in volumes. These results suggest that the delay could be intentional and related to illegal insider trading.

Table 5

Number of publications that are marked with potential informed price movements as well as increased trading volumes. Results from the analysis of daily abnormal returns and volumes

Year	IPMs		High trading volume	
	plus	minus	plus	minus
2010	2	8	2	4
2011	6	8	1	1
2012	4	6	0	1
2013	7	10	1	1
2014	7	12	1	3
SUM	26	44	7	8

In 2014, the company with a positive price movement two days ahead of a reveal of annual report published information on the payments of dividends. The note about the forefront position in the group of companies listed on the Warsaw Stock Exchange was enclosed. That day, price and trading volumes rose. Another company, marked with a price decline, published the information on establishing a lien on the assets of a significant value.

Do the remaining cases bear association with insider trading? A detailed analysis of available news releases from the period under study does not bring any excuses for observed abnormal returns and volumes. Meulbroek (1992) as well as Cornell and Sirri (1992) show that such unexplained alerts appear on days marked by insider trading. Although they cannot pose any kind of statistical proof of market abuse behavior, they give an important signal for the financial supervisory authority that should closely monitors markings of the companies.

The analysis of penalties imposed by the KNF shows that none of the companies marked with potential IPMs was punished for insider trading. If we look

a few years back, it is really difficult to ascertain whether the frauds did not take place or if they remained undetected.

However, he method proposed here for detecting price and volume movement does not require such a time delay. It can be carried out directly after the release of a significant report to check if the report was preceded by informed price and volume movement. If the market is observed on line, it is feasible to notice inexplicable changes in markings that could be a signal of insider trading.

4. Conclusions

This paper analyses the detection of insider trading related to publications of financial reports made by companies. The occurrence of potential informed price movements ahead of such publications is checked with event study methodology. The research embraces annual financial reports of companies listed in the WIG index from January 2010 until May 2014. The analysis of cumulative and afterward daily abnormal returns reveals that most of the annual financial reports are not price-sensitive events. Only about 20% of them are marked with significant changes in prices. In this group, slightly more than 30% are preceded by potential informed price movement. The market seems to be more sensitive to negative information, and in this group of events, the number of price changes ahead of the report publication is greater. Every fifth case of premature price movement is accompanied by significantly-high abnormal trading volume – the signal confirming that important information was delivered to the market.

In most cases, simultaneous changes in price and volume preceding the release of annual financial reports are inexplicable. Although the noted abnormal prices and volumes cannot be treated as proof of insider trading, they give us a general overview of the potential scale of this phenomenon and suggest a positive answer to the question included in the title of the article. The results of the research alert that the publication of an annual financial report can become an opportunity for insider trading. However, to determine whether illegal trading preceded a particular announcement, further analysis should be conducted by an appropriate oversight agency.

The method applied in the research seems to be effective in anomalous trading detection; hence, it can be employed as a first step in detecting insider trading. The weakness of the method is that potential market abuse cannot be found in real time. However, if markings of a company as well as price-sensitive information coming on the market are monitored on line, the detection of the signals of insider trading has only a short delay.

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