Investors' Perceptions and Stock Market Outcomes. Interdyscyplinary Approach

Investors' Perceptions and Stock Market Outcomes. Interdyscyplinary Approach

Editors
Olha Zadorozhna
Martin Dahl

Warsaw 2019

Cover design: Małgorzata Siwa
Executive editor: Anna Ładan

Title: *Investors' Perceptions and Stock Market Outcomes. Interdyscyplinary Approach*

Scientific editors: Olha Zadorozhna ORCID: 0000-0002-2160-6904 (Lazarski University, Warsaw Poland), Martin Dahl ORCID: 0000-0003-1978-7045 (Lazarski University, Warsaw Poland)

Reviewers: Constantin-Marius Apostoaie, PhD (Alexandru Ioan Cuza University of Iasi, Romania; ORCID: 0000-0002-3032-5426); Marcin Roman Czubala Ostapiuk, PhD (CEDEU Centro de Estudios Universitarios, Spain)

ISBN print: 978-83-64054-67-9
ISBN ebook: 978-83-64054-69-3
DOI: 10.26399/978-83-64054-69-3

Circulation: 50 pieces

sheets

PRICE 45 PLN

Typesetting: PanDawer
Print coordination: PanDawer

Contents

Introduction

Financial literature has been trying to figure out what affects the stock market prices for a long time now. A vast area of research has been dealing with the determinants of stock market outcomes trying to explain why prices change the way they do and to discover a general approach to predict them. However, there has been lack of consensus regarding these issues. One of the main reasons for that is the fact that stock market players – whether they are investors or stock market brokers – are people who are buying and selling securities located all over the world and each having their own individual objectives. Some may be similar, but very often they differ counteracting each other. Moreover, each player is affected by the myriad of events that push them to make certain market transactions and not always their decisions are rational as traditional research tends to assume. When one relaxes this assumption, you are immediately faced with so many potential factors that affect investors' decisions that they are basically impossible to incorporate into mathematical and econometric models. For example, how do you measure the mood of each market player who came to work to buy and sell some stocks? And the mood has been identified as one of the important determinants of investors' choices. Is it enough to build a general model that would work for all countries and securities if you use some proxies? Is it enough if you use a limited sample of people self-identifying their mood and submitting this information in a survey? For some niche research maybe it is enough, but definitely not to completely understand investors' decisions and perceptions. That is why most of the research has been 'pushed' into working with binding assumptions and models that limit the reality.

One of the most popular and well developed theories that financial literature uses to determine stock market outcomes is Efficient Market Hypothesis developed by Eugene Fama. The main idea behind it is that stock market uses all the available information in the price setting mechanism meaning that investors are rational and analyze closely everything that is happening around the security they are investing in. Moreover, having collected this information they make rational

choices that are profit oriented. Such set up allows for a close inspection of investors' perceptions and the determination and prediction of stock prices.

Event study methodology builds upon Efficient Market Hypothesis theory and uses its assumptions in order to estimate the effect of certain events of the stock market prices. It is able to measure and to attribute numbers to investors' perceptions and decisions. In this way one can evaluate if the event that affected the security in question has been perceived by the market in a positive, negative or neutral way. This methodology traditionally has been used in financial studies, but it gives especially interesting results if used in other areas of economic research. Papers in this book make use of the event study methodology in order to evaluate investors' perceptions not only of financial events such as the change of the CEO of the company or dividend announcements, but also to natural disasters and terrorist activities. This shows the great variety of non-financial topics that can actually use methodology that is built on the pillars of financial literature. And this makes this book very interdisciplinary in nature and allows to look at investors' perceptions from different angles.

The book consists of six students' theses. Each of them tells a unique story behind the decision-making process of stock market players. We start from the general approach and try to determine if the stock market outcomes affect economic growth in developing and developed countries. Then we move on to discuss if oil prices have an effect on the stock market indices. And finally we present papers that make use of the event study methodology and evaluate the effect of the Fukushima Daiichi nuclear disaster on oil companies around the world, of the terrorist attacks on the airline industry in the US, of the change of the CEO on firms traded on the Warsaw Stock Exchange, and finally of the dividend announcements of Polish companies on their stock returns. These papers analyze specific events and show how they affect investors of different companies. By going from general to specific, we try to shed light on understanding of the stock market outcomes and investors' perceptions around the world and throughout different industries.

In Section I called "The impact of capital market on economic growth: evidence from developed and developing countries" the role of the stock market in the economic lives of people is analyzed. Its results are important for understanding which part of the world to invest in and suggest if investing in certain markets may not only be profitable, but also change people's lives for better. It uses panel data set with 19 countries in it that represent different parts of the world, including Europe, North America, Asia and Africa. First, the OLS model is estimated and then its results are compared to ARCH model estimates as it is believed to perform better with high frequency data as the stock market one. The results

of the paper suggest that GDP growth is positively affected by the size of the financial market measured by the market capitalization. Market liquidity is also proved to influence economic growth. These results suggest that the bigger the financial market is, the more value it brings to the country as a whole. Of course one should be careful with this interpretation as there may be potential endogeneity driving the results and some more work may be needed to fully capture the interdependence between stock market and economic growth. However, this is a good starting point for our analysis of what actually drives investors' perceptions and why they make the decisions they do.

Section II of the book named "Empirical analysis of the impact of oil price shocks on stock markets" tries to understand if investors of both oil producing companies and companies that just use oil or products derived from oil, will react to fluctuations of oil prices. This topic gives one an understanding that everything is connected in this world and seemingly unrelated events to the security in question may affect investors' decisions about it. Methodology used in this paper is SVAR and is different from the methodologies used in other parts of the book as it allows to capture the effect of all the variables on each other. This research analyzes data for six developed and emerging economies and answers the question if one group of countries is more responsive to oil price shocks than the other one. It also looks into the length of time that these shocks remain for in the economy. As one would expect, the results suggest that the effect of the oil price shocks is different in different types of the markets – oil dependent countries will feel the impact of the oil price changes more profoundly than countries that do not depend on oil as much. However, the most important result here is that oil price shocks are responsible for 20–40% volatility of the stock market, which is huge and investors should invest into strategies that would hedge them against the oil price change risks.

The third section of the book is called "The impact of Fukushima Daiichi nuclear disaster on stock returns of oil corporations". With it we move on to a specific story of how the news of the nuclear disaster affected the decisions of investors of oil companies all over the world. Provided that nuclear energy is used or may be used as a substitute to energy generated using oil and oil by-products, a nuclear disaster may induce people to use less nuclear power and turn to more traditional ways of getting energy. Hence, investors of oil producing companies may perceive the news of the nuclear disaster as positive and expect to increase their profits as a result. However, it turns out that only investors of Norwegian oil producing companies reacted positively to what happened in Fukushima-Daiichi, and the rest of the investors analyzed in the paper perceived the news negatively.

With the next Section we move on to analyze "The impact of terrorist attacks on stock returns of airline industry: the example of the US airline companies". It examines the consequences of seven terrorist attacks for 14 US airlines from 1999 until 2013. This research uses the event study methodology and sheds light on how airline industry investors react to news about the terrorist activities. One of the most important features of this research is that terrorist attacks are sudden and are not known before they actually happen that makes the results robust to speculations that investors may have incorporated this information before the event and their reaction is not shown by the methodology. The results suggest that investors react negatively to the terrorist attacks, however, their reaction diminishes over time and is short-lived. It tends to go away quickly and firms manage to countereffect their losses in a matter of couple of days.

The next Section is called "The effect of announcements of CEO change on stock prices: an event study of the Warsaw Stock Exchange".We move on to examine investors' perceptions in a specific market framework. This paper uses an event-study methodology and tries to shed light on the importance of the CEO change for investors: do they care enough about the management change to cause significant changes of a firm's stock price? It turns out that the CEO change is mostly perceived as negative news by investors which is reflected in the downward drop in the cumulative abnormal returns of the companies.

In the final Section of the book we analyze "The effect of dividend announcements on stock returns of banking sector: evidence from the Polish stock market". It uses the data for 43 cash dividend announcements and 6 banks listed on the Warsaw Stock Exchange for the period from 2006 till 2015. The results suggest that investors take into account information related to dividend announcements and use it to make investment decisions: dividend increases tend to positively affect cumulative abnormal returns and dividend reductions tend to negatively affect them. These findings are especially relevant for financial management of the companies as they should understand the importance of their dividend decisions that may be reflected in the stock prices. Moreover, the paper is important as there is lack of similar research analyzing Polish banking sector.

The effect of investors' perceptions oo the stock market outcomes is a difficult, yet important topic to analyze. We feel that this book contributes to understanding the decision making process of investors from financial, economic and social perspectives and will bring value to both market players and research community.

Olha Zadorozhna, Ph.D.
Martin Dahl, Ph.D.

Chapter I.

The Impact of Capital Market on Economic Frowth: Evidence from Developed and Developing Countries

Viktoriia Danylenko, Deloitte Canada / Lazarski University
0000-0002-7130-5229

Recently, economists have devoted more attention to the connection between financial markets and economic development. The robust link between finance and growth have stimulated an extreme interest in identifying the influencing factors for economic growth, as has the presence of an extensive number of empirical studies. For instance, Robert G. King, R. Levine (1993) R. Levine and S. Zervos (1998) and, finally, Asli Demirguc-Kunt, Erik Feyen, and Ross Levine (2001).

The traditional growth-finance theory and its representatives like Nobel laureates Robert Lucas and Merton Miller consider finance as "too obvious" and "over-used" determinant of country development. However, the concept of this theory is reanalyzed and acquired a new meaning. "Financial intermediaries may reduce the costs of acquiring and processing information and thereby improve resource allocation" (Boyd and Prescott, 1986, p. 83). Without financial institutions, each investor would confront the huge expenses associated with assessing firms, managers, and economic conditions. By enhancing data on firms, managers, and economic conditions, intermediaries can promote economic growth. Stock markets might likewise stimulate the production of information about firms. As markets become larger and more liquid, agents may have noteworthy incentives to produce this valuable information and hence make more profit by trading on the market (Levine, 2000).

Financial market could be defined as a vital component of free-market economy; it provides financial services to households, entrepreneurs and other institutions. Stock market gives companies access to capital in return for giving investors a piece of ownership in the company.Performing a large number of duties, financial market, in fact, is an essential part of the economy of a country, in light of the fact that with productive markets for credit and capital, borrowing and investment will be restricted and the entire macro-economy can suffer.

Financial markets often fail in performance of their primary goals in less developed markets and state-planned economies, where amount of goods produced and sold, and its price are set by government (for instance, North Korea and Soviet Union). It explains a lower rate of investment and growth in those countries.

The primary goal of this paper is to address the issue of whether capital market performance matters for economic growth. According to different studies of countries there is a positive link between the stock market and rate of growth (King, Levine, 1993; Levine, Zervos, 1998; Kaserer, Rapp, 2014; Rousseau and Wachtel, 2000; Campbell, 2001; Andres, Hernando, Lopez-Salido, 1999). However, this study presents a new research conducted, using a different technique (ARCH model) and different individuals and time range chosen.

The following hypotheses are to be checked:

Hypothesis 1: Economies of developed countries are most exposed to the effect of stock market. In fact, the distinction of financial markets by a country stage of development was proposed by Asli Demirguc-Kunt, Erik Feyen, and Ross Levine (2001). They stated that high-income countries have bigger capital market; thus it is assumed that changes in market development (e.g. liquidity and size) of advanced economies will affect its economic growth to a great extent.

Hypothesis 2: Financial market size and liquidity is statistically significant for economic growth. This assumption is based on the fact that size and liquidity are main indicators of the financial market performance; thus it is suggested that these measures can indicate the level of market power, which is the major factor of economic growth.

The main aim of the following dissertation is to examine whether there is a link between stock market development and economic growth, using panel data analysis. The data sample consists of 19 countries over 25 years (1988-2012). Independent variables considered are market capitalization, turnover ratio, shares-traded ratio, gross capital formation, volatility index, foreign direct investment and bank credit. The list of the countries is presented in Table 1.

This research could be useful for analyzing economic environment and the role of financial market for both advanced and low-income markets as it demonstrates empirical evidence of market performance and economic situation in different countries. Finally, findings of this study could be applied in decision-making process to evaluate the situation of market in each type of economy in order to make appropriate steps to maintain its well-being and, as a result, control market effects for economic growth.

Table 1. Developed and developing countries.

Developed	Developing
United Kingdom	Turkey
United States	Bulgaria
Japan	Russian Federation
Denmark	China
France	Nigeria
Germany	South Africa
The Netherlands	India
Switzerland	Malaysia
Sweden	Romania
Norway	

The work is divided into three sections. The first chapter provides discussion of recent researches devoted to this topic, followed by theoretical background on capital market and brief overview of stock's market behavior during global financial market. Chapter 2 presents the data, model and methodology used in this study, including a discussion of the chosen indicators of the stock market development and volatility. Chapter 3 provides empirical results including presentation of panel estimation model. Finally, concluding remarks are made.

Literature Review

Economic growth and its fluctuations play a crucial role from the point of view of welfare of population and stable technological and political development of countries in the world. For instance, if, for the last century, the rate of growth of one of the most economically developed countries like Japan were lower by one percentage point so at the end of the 20th century, it would have GDP per capita as Czech Republic or Hungary (Tumanova, 2004). Thus, the "cost" for each percentage point of the current increase or decrease in real GDP is extremely high in the long run. Such a "loss" and "profit" may dramatically change the path of economic development of the countries and, ultimately, their role in the world economy and politics (Stolbov, 2008). Thereafter, one of the primary aims of both theoretical and applied economics is the identification of the factors of economic growth and its fluctuation, a comparison of their relevance to variety of countries at different stages of their development.

In the past two decades, attention of researchers was shifted toward institutions and instruments of financial market as a "new" factor of economic development.In details, in former times, Robert J. Barro and his followers were stuck to the concept of the banking system as a significant factor of economic growth, making it "over-focused on". However, attention of econometricians was directed to find new and considerable indicators. Financial market is quite large and its component as capital market never denoted as a driver of growth. Therefore, R. Levin, S. Zervos (1998), Asli Demirguc-Kunt (2001) conducted some studies to find the link between growth and capital market and on their way they studied out that stock market development indicators are statistically significant for economic growth.

Empirically, Robert G. King and Ross Levine (1993) show that stock market is a good predictor of long-run economic growth. Later on, Ross Levine and Sara Zervos (1998) used a cross-country growth regression (using data of 47 countries from 1976 to 1993) based on framework of Robert J. Barro. They tested the importance of measures of bank and stock market development for economic growth. Finally, R. Levin and S. Zervos concluded that both stock market liquidity and banking development indicators enter output growth regression significantly. They found that services provided by financial institution and markets are important for long-run growth.

In more recent research, C. Kaserer and M.S. Rapp (2014) in order to find the link between growth and finance, paid their attention to financial structure of the country (i.e. bank-based or capital market-based). In my opinion, this is a proper way to verify practicall, if countries with bigger financial markets are considered to have the high rate of economic growth; assumption about this is based on the earlier studies of R. Levine (2001).

In fact, one of main purposes of this study is an attempt to prove that developed countries need more financial markets in order to maintain economic growth that at one time was verified by Asli Demirguc-Kunt, Erik Feyen, and Ross Levine who presented a paper at a World Bank conference in 2001 entitled "Optimal Financial Structures and Development: The Evolving Importance of Banks and Markets". They observationally proved that as countries become wealthier and more advanced, they need markets more than banks. It implies that the financial system becomes more market-based at higher levels of income.

Besides, the finance–growth relationship has been found to be exceptionally strong. Levine (1997) provides a cross-country analysis to clarify how five capacities of financial market autonomously motivate intermediaries that provide these capacities, and it clarifies how they influence economic growth.Nevertheless, the

found link between finance and growth does not include test for causality. Empirically, Wachtel and Rousseau (2001) indicate the causality from finance-growth relationship by using cross section of countries from 1960 to 1995; they show that financial sector development and improved services of financial intermediaries accelerate rate of growth. However Andres, Hernando and Lopez-Salido (1999) did not find a robust correlation between finance and growth among OECD countries from 1961 to 1993; they studied out a strong inflation-growth relationship but did not indicate the reason properly. Haslag and Koo (1999) showed large effects of inflation on measures of financial depth in Greece, Spain and Portugal over 19 years (1980–1998). They found that inflation, which they took as a proxy for financial repression had a negative effect on financial depth and that the effect varied with the inflation rate. Such results appeared, as they defined, due to government legal restrictions (interest rate, high reserve requirements) which interfered financial institutions to work at their full capacity.

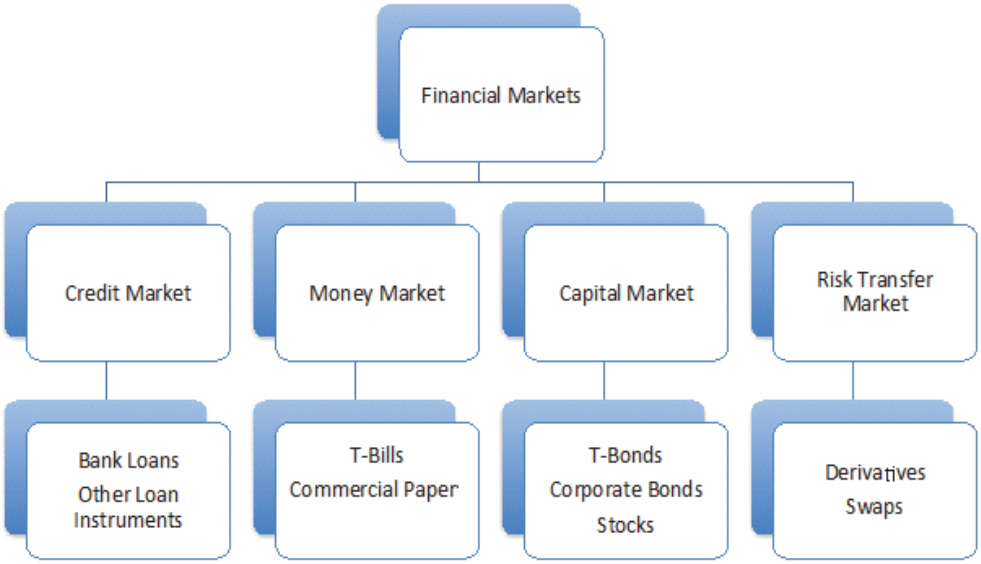
Furthermore, other research are unique due to new-added variables, for example volatility. Campbell (2001) suggests that stock market volatility is statistically significant for real GDP growth. However, Guo (2002) thinks volatility-growth relationship is not fully robust to deserve model specifications.

Finally, this study uses panel data analysis in order to extract more data for a richer picture of results, which could be useful for decision-makers to measure the role of financial market in specific country and its link to economic growth. In fact, the distinguishing feature of this paper is analysis of performance of stock market and its influencing factors for economic growth in low and high-income economies. However, it still could be more complex by applying VAR system, which pays more attention to the dynamic system and includes a high number of causal variables (P. Geoffrey Allen, Robert Fildes, 2001). This model is used in forecasting and Granger causality analysis.

Generally, financial market is a place where financial services are provided; it can be divided into a credit market, a money market, a capital market and a risk transfer market.

This structure is depicted in Figure 1. This paper focuses on the capital market concept.

Figure 1. Financial market classification.



Source: Maureen Burton, Reynold Nesiba, Bruce Brown, *An introduction to financial markets and institutions*. New York: M.E. Sharpe, 2010.

The stock market services are widely used: starting from ordinary people, investors and ending with the government. Besides being as an important component of raising capital for businesses through sold shares, it also helps government to raise fund through issuing bonds. Any investor who buys a bond becomes a lender for government, enjoying secured bonds and tax benefits. Exchange market provides trade of shares and allows investors, at the same time, to organize their savings to invest in high yielding economic sectors, resulting efficiency of that sectors and national economy either. However, it has to be taken into consideration that stock market is highly volatile and difficult to predict; thus people could successfully invest money and lose all of it as well.

Acquisition and mergers are other tools that used through stock market in order to maintain company's growth. M&A activity as a type of company restructuring can operate only through legal actions on stock market such as assets or equity purchases. M&A activity, itself, could lead to better rates of unemployment, because as many businesses are operating, as many work places are available; and as it is known unemployment rate is a robust determinant of economic growth.

Practically, the process of day-to-day buying and selling securities with its own price determines the size and performance of the market. As any other,

stock market has its biggest players, whose decisions could result in prospering as well as slowdown of financial market; consequently, it can affect the economy of the country to a great extent.

Everything mentioned above demonstrates the significanceof stock market and its real effect on the global economy. One of the weighty points is wealth effect: any disturbances in the stock market will lead to decline of the wealth of investors, as a result, it can change their financial perspective. The chance of losing money will hesitate people to invest; this can contribute for fall of businesses that mostly depend on external financing. The other one is price fluctuations effect. Often, share price movements are reflections of what is happening in the economy. Hence, the fear of recession and global slowdown can affect consumer confidence, discouraging them from spending. All alone it might not have much impact, but combined with falling house prices as it happened in the United States during global financial crisis, share prices can be an off-putting factor for the economy. However, there are times when the stock market crush can appear out of step with the rest of the economy.

Particularly, stock market is all about buying and selling. The price of stock is determined by demand and supply, basically, how much people buy and sell on the market. Dramatic price fluctuation of a financial instrument on the stock market determines volatility. It is found by calculating the annual standard deviation of daily change in price.

The formula of volatility is as follows:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}\left(r_i - r\right)^2}{N-1}}$$

Where:
N = number of observations
r = mean return
r_i = return at period i

In the case of dramatic price fluctuations over the short period of time, this security is considered to be highly volatile. A lower volatility implies that a security's value does not vary drastically but still changes in value at a consistent pace over time. Historically, the volatility of the stock market prices is roughly 20–22% a year and in both advanced and developing markets; however, volatility continues changing, so we experience times of high and low volatility.

Investors care about volatility for three reasons:

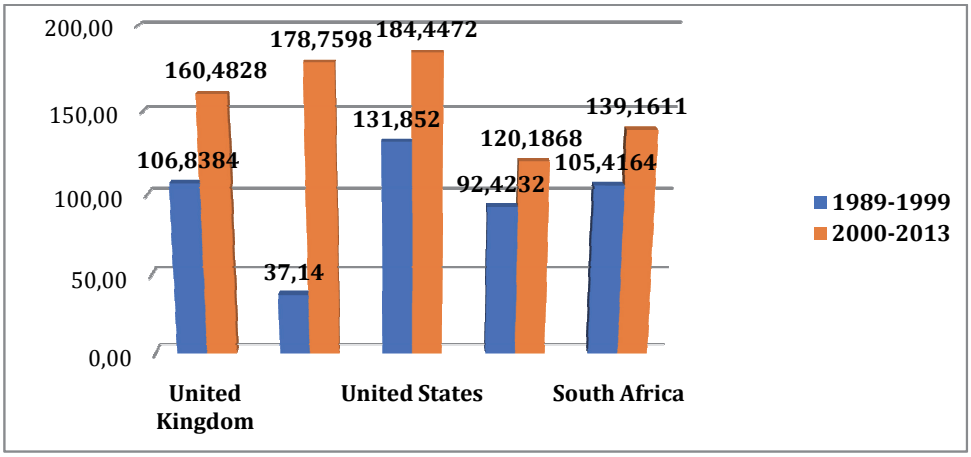
- Price volatility of a security can define its position in a portfolio;
- Information about volatility is used in investment risk analysis;

- Price volatility presents possibilities to purchase assets cheaply and sell when overpriced.

Eventually, stock market has an impact on two vital variables like unemployment and consumer spending, which directly influence the GDP growth. The following conclusion can be made, stock exchange is "barometer of the economy" – substantial and hard-controlling.

Worldwide financial markets are experiencing a fundamental change. First, overall size of the banking sector, "financial market depth" (according to World Bank Indicators, "this is financial possessions provided to the private sector expressed as a percentage of domestic GDP"), is steadily increasing, apart from the financial crisis period. In particular, Figure 2 represents the percentage of financial market depth in respect to GDP in three developed and two low-income countries used for statistical analysis in this paper. It is clearly seen that all countries experience a rapid increase in the size of banking sector last two decades. Specifically, the biggest increase, for 141 GDP percentage points is referred to Denmark, besides; UK and US increased the financial market depth in the range of 54 GDP percentage points from the nineties to the first decade of the twenty first century. Eventually, South Africa and China indicate the lowest growth among chosen countries equivalent to 34 and 28 GDP percentage points, respectively.

Figure 2. Financial market depth.

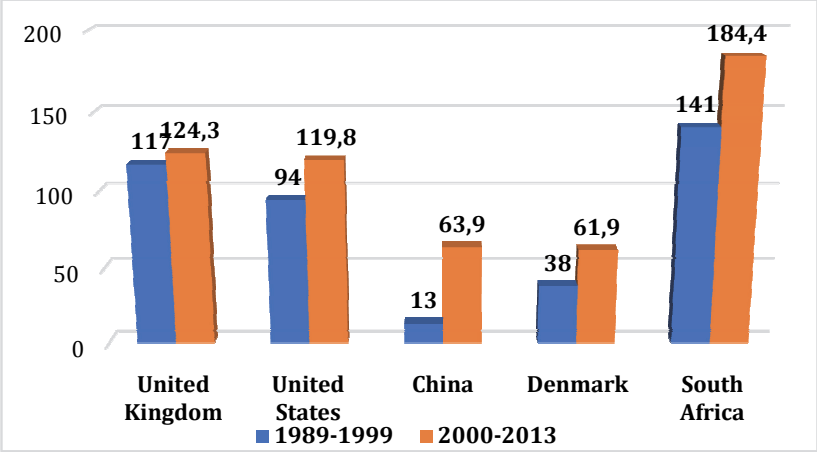


Source: http://data.worldbank.org.

Second, the financial structure is changing as well. Figure 2 illustrates all sections of financial market, thus, Figure 3 presents the position of capital market specifically in the economy. In order to capture the size of the stock market, there

are two measures can be applied: stocks traded as a percentage of GDP and market capitalization. In this paper, the capital market capitalization (capital market depth) is used as an indicator of market size, because in indicates the total value of all listed companies on the market and behavior those companies can influence the market performance. Focusing on this, it can be seen from Figure 3 that market capitalization takes a substantial part in respect to GDP, and the results are increased in the 21st century.

Figure 3. Capital market depth.

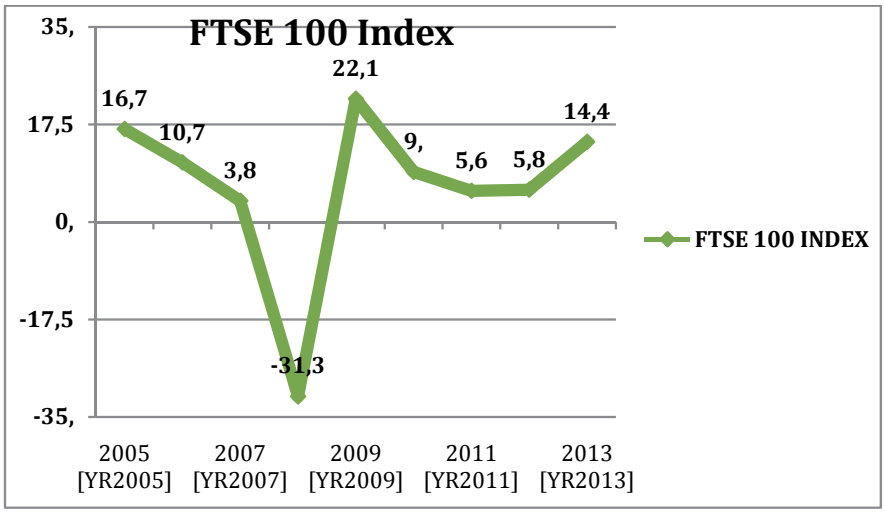


Source: http://data.worldbank.org.

Recent global economic downturns as financial crisis 2008 which have been shaken a whole world, was the reflection of stock market performance.

Global financial crisis in 2008 brought us failures of massive financial institutions in the United States and Europe resulted in a devaluation of several currencies and danger of the government bankruptcy. Being on the edge of collapse led to sharp reductions in the value of stocks and commodities worldwide. One of the major victims of financial crisis with the largest decline in retail sales was United Kingdom; by the way, this country is used for further analysis in this paper. 2008 became a panic year for some British banks as well as for investors. This economic and political occasion crowd a lot of businesses out the market in UK; thus, unemployment rate rose, especially, in groups of "young and ambitious". Furthermore, the tax revenues fell rapidly for government. All together, it led to bankruptcy of Northern Rock bank and, overall, the GDP growth fell by 2%, which means that country officially entered recession. There were some changes in the capital market too, particularly, the market capitalization of the UK stock exchange fell by more than 50%.

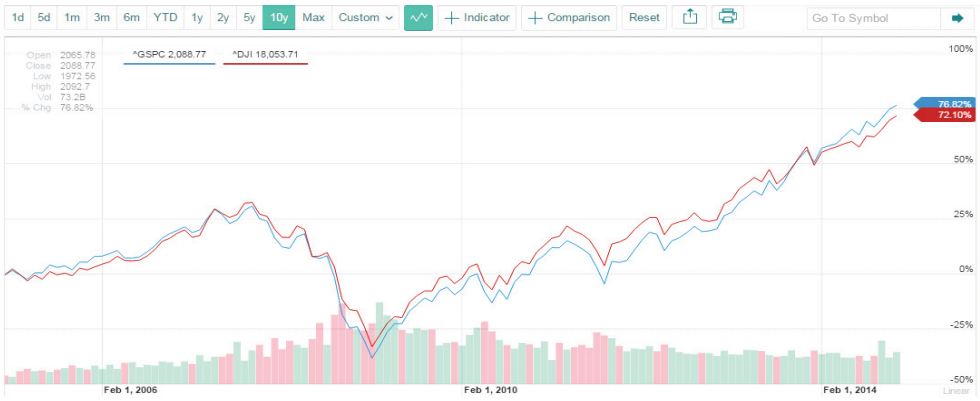
Graph 1. FTSE 100 Index performance



Source:https://www.google.com/finance.

FTSE 100, the biggest stock market index, which indicates the trading performance of 100 largest companies listed on the London Exchange market, was eliminated on 31.3% in its value. Moving forward, the situation of the global indices "left much to be desired" as well.

Graph 2. Global indexes performance.



Source: finance.yahoo.com.

For a whole week of the beginning of October, 2008, **the DJIA**[1] volume levels reached the peak. The Dow Jones index decreased by 1,874 points or 18%. Another most important stock market index, **S&P 500**[2] fell more than 20%. Besides stock indexes that showed impressive changes every day, the hardest hit was recorded by one the biggest bank in United States. September 15, 2008 became a fatal day in the life of **Lehman Brothers Holdings Inc.,** which is in the "top five" among largest investment banks in the US. Sharp losses in stocks and devaluation of its assets by CRA (credit rating agencies) lead to announcingbankruptcy of the firm, whereupon it turned into a symbol of Crash 2008.

In conclusion, it has to be pointed that there is a tie between finance and growth and, sometimes, capital market performance is a reflection of global economy situation, and "Panic 2008" is an example. Stock market crush pulled into recession United States and European Union, following by banking system collapse, currency devaluation and bankruptcy of different institutions. As the deputy governor of the Bank of England, Charles Bean said, "This is a once in a lifetime crisis, and possibly the largest financial crisis of its kind in human history".

Empirical Approach

The link between stock market and economic growth is analyzed using panel for 19 countries and 25 years. This number of countries has been used as they are top representatives of their level of development (high-income, low-income) and years have been chosen by the availability of data. The market cap, share traded ratio and turnover ratio are used as proxies for stock market size and liquidity to evaluate cross country differences in stock market development; their determination and appropriateness for this study is discussed just below. This section describes stock market indicators and other control variables used, and provides data sources for each of them. The data of any single variable is available on World Bank Indicators.

Market Capitalization Ratio (MCR): This proxy of market size equals the share price times the number of shares of listed companies divided by GDP (The World Bank Indicators, 2015). Market cap by itself measures the size of the

[1] **DJIA** – Dow Jones Industrial Average, one of the biggest stock market indexes that shows the trading performance of 30 largest companies based in United States.

[2] **S&P 500** – Standard and Poor 500, the American stock market index that represents the performance of 502 companies during trading in the market.

company, then market cap ratio as a percentage of GDP indicates the value of stock market as a whole (market depth), basically, it used to determine whether an overall market is undervalued or overvalued. For instance, in 1999, according to statistics at the World Bank, the market cap to GDP ratio for the United Kingdom was 188%, denoting an overvalued market, which means that market is potentially dangerous for investors.

Total Value of Shares Traded Ratio (STR): This measure equals total value of shares traded on the stock exchange divided by GDP (The World Bank Indicators, 2015). As claimed by Levine and Zervos (1998), the total value of shares traded ratio measures the trading equity of firm as a share of GDP and, therefore, should positively reflect liquidity on an economy-wide basis. For instance, in 2008 the STR of USA was more than 400% of GDP, taking into account that US stock market is one of the biggest in the world; stock market crash in 2008 could affect this result. For comparison, the same ratio for Bulgaria was just 3% of GDP in the same year.

Turnover Ratio (TR): This ratio equals the value of total shares traded divided by market capitalization (The World Bank Indicators, 2015). A large but inactive market will have a large market capitalization ratio but a small turnover ratio (Demirguch-Kunt, Levine, 1996; Ovat, 2012). In this paper, TR and STR are used as proxies of market liquidity. They indicate the level of trading activity, the high level of it means that security can be easily bought or sold; hence, this asset is considered liquid. The only difference between these two variables is that total value traded ratio focuses on trading towards the size of the economy, while TR measures trading towards the stock market size (Demirguch-Kunt, Levine,1996).

Foreign Direct Investment (FDI): This measure shows net investment inflows in the reporting economy from foreign investors divided by GDP (The World Bank Indicators, 2015). Basically, it is investment made by a company situated in one country into a company situated in another country. Foreign direct investment is used as a control variable since it is assumed that FDI is a key to boost global economy and maintain prosperity worldwide. Theoretically, FDI accelerates economic growth by increasing the amount of investment and its efficiency, and by bringing technologies from the advanced economies to the host country (Borensztein, Gregorio and Lee, 1998). Open economies with cheap workforces and good growth prospects tend to attract larger amounts of foreign direct investment than closed, highly regulated economies. Practically, countries like Nigeria, Malaysia and China are most of all exposed to the FDI flows.

Gross capital formation (gross domestic investment): This variable measures the changes of fixed assets of the economy plus net changes in the level of

inventories (The World Bank Indicators, 2015). Capital formation plays a crucial role in the generation of production and distribution, which take fundamental part of economic growth. The assumption behind is that capital accumulation with a positive correlation can promote a faster rate of growth. Traditionally, growth rate depends on agriculture, industrial development and service sector but stock market is also one of the major parts for capital formation and has straight impact on the global economy (Kumar, 2014). For instance, the level of gross domestic investment in People's Republic of China is 48% of GDP, which is the highest among chosen countries for analysis. It demonstrates how the use of capital in combination with labor increases the Chinese nation capacity for production. Finally, the proper money accumulation in China is one of the reasons of their leadership in fast development of the five sectors: agriculture, industry, construction, transportation and commerce (Chow, 1993).

Bank credit: In order to measure the financial depth of the economy, the bank credit proxy is used. This indicator, according to the World Bank, equals financial resources provided to the private sector by other depository institutions except central banks through different accounts receivable (The World Bank Indicators, 2015). Economists often apply the level of credit provided to the private sector in general to measure financial depth; however, as noted by King and Levine (1993), this variable does not indicate whether the liabilities are given by banks or national bank or other financial institutions.Bank credit enhances traditional financial depth measures by isolating credit issued by banks, which is exactly what we need (Levine, Zervos, 1998). Basically, the higher value of this variable is, the more money goes to the private sector, so it accelerates the growth and development of the private sector. As a result, the developed private sector plays an essential role for a domestic country by maintaining health and prosperity of the economy (World Bank Indicators, 2015). For instance, China had the ratio of domestic credit to private sector by banks / GDP at a rate of 133.6% in 2012. This explains how China succeeded in high economic growth. Basically, it provides more opportunities for private sector to get financing and as a result it leads to the emergence of mixed economy in China as a tool of fast growing and prospering. Another example in 2012, Japan and UK had indications of 110% and 166%, respectively, which means that these countries have well developed and advanced economies because private companies have great financing. In contrast, countries like Nigeria and India with bank credit ratio of 11% and 34%, respectively, demonstrate the reason of their status as lower middle income markets.

Volatility index: It is the 360-day standard deviation of the return on the national stock market index. This measure is included because of recent

consideration of volatility as a new factor of economic growth and extreme interest devoted to this concept. The assumption behind is volatility as an indicator of market price fluctuations can drive investors behavior; thus, it brings outstanding problems in the stock market, by discouraging them from spending. As a result, it could bring a slowdown of financial market activity.

A panel data in this research consists of 10 developed markets and 9 developing ones over 24 years (1988–2012). The combination of time series and cross-section observations "gives more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency" (Gujarati, 2003; Baltagi, 2001). Panel as a type of longitudinal data, provides more information over time and individuals, so more extracted data – the richer picture of results. The data is unbalanced and collected with low frequency because the information of variables like turnover ratio, shares-traded ratio, volatility index and market capitalization was not available in the years between 1988–1993 in Romania, Bulgaria and Russian Federation due to their communist and socialist regime.

This section describes two econometric methods that are used to assess the relationship between stock market and the rate of growth. First, the simple ordinary least squares **(OLS)** regression is used over the 1988–2012 period. Its findings are then compared to results from models that are better suited for the financial analysis, which is autoregressive conditional heteroskedasticity (**ARCH**) in my case. This method of estimation is vastly used, because in the presence of heteroskedasticity, the regression coefficients for an ordinary least squares regression are no longer BLUE (Best Linear Unbiased Estimators) due to their inefficiency, so that is why ARCH model can be applied (Engle, 2001).A distinguishing feature of this model is that the error variance may be correlated over time because of the phenomena of volatility clustering, which is defined as periods in which it exhibits wide swings for an extended time period followed by a period of relative calm (Gujarati, 2003).

The regression takes the form:

$$Growth_{it} = \alpha_1 + \beta_1(TR_{it}) + \beta_2(STR_{it}) + \beta_3(market\ cap_{it}) + \beta_4(Bank\ credit_{it}) + \\ + \beta_5(FDI_{it}) + \beta_6(Volatility\ index_{it}) + \beta_7(Gross\ Domestic\ Investment_{it}) + \varepsilon_{it}$$

Note: i – the country index; t – the year index

Historical yearly data on MCR, STR, TR, FDI, GDP growth, gross domestic investment and bank credit data for nine developing and ten advanced markets are obtained from the World Bank Database. The volatility index data is taken from Federal Reserve Bank of St. Louis Economic Data, (FRED). Data are available at the web sites http://data.worldbank.org/ and http://research.stlouisfed.org/fred2/.

Table 2. presents an explanation and measurement of all variables used in this paper.

Variables	Definition	Measurement
GDP growth	Equals the rate of real GDP growth	%, local currency
TR	Equals value of total shares traded / market cap	%
STR	Equals value of total shares traded / GDP	% of GDP
Market cap	Equals price of shares times number of shares of listed companies / GDP	% of GDP
Bank credit	Equals financial resources provided to private sector by banks / GDP	% of GDP
FDI	Equals investment inflows from foreign countries to domestic one	% of GDP
Volatility index	Equals the 360-day standard deviation of the return on the national stock market index	%
Dross domestic investment	Equals the net increase in fixed assets in reporting economy over period of time / GDP	% of GDP

Source:http://data.worldbank.org/ and http://research.stlouisfed.org/fred2/.

Regression results

This section evaluates whether measures of stock market liquidity, size and volatility are robustly correlated with economic growth. To evaluate the strength of the autonomous relationship between the capital market and the growth indicator, three control variables are included. Specifically, they are the level of FDI inflows, gross capital formation and banking development indicator. Particularly these control variables were chosen by their significance as for macro environment as for financial market of country. In order to study the ties between the growth indicator and measures of stock market development two model estimations are used and both are presented in this section. First, the simple OLS estimation is used as general and starting point of statistical analysis. Second, ARCH as a more complex estimator is applied to analyze financial data and to obtain precise results in the presence of heterskadesticity.

Table 3 presents summary statistics on the stock market development and growth indicator. The data is for 19 countries over the 1988–2012 period. Particularly, Table 3 includes the information about max, min, mean, median and standard deviation in the data.

Table 3. Descriptive statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.	Obs.
BANK_CREDIT	89.157	88.872	217.38	12.304	50.095	346
FDI	2.977	2.097	31.798	-3.679	3.705	346
GDP_GROWTH	3.567	2.972	33.735	-7.820	3.958	346
INVESTMENT	23.612	22.397	48.265	7.011	6.857	346
MARKET_CAP	82.730	66.768	328.876	4.329	61.956	346
STR	70.512	47.187	434.92	0.403	69.034	346
TR	89.484	78.278	404.067	4.116	59.417	346
VOLATILITY_INDEX	268 452.9	233 773.5	740 378	36 902	191 671.6	346

Table 4. Correlations matrix.

	BANK_CREDIT	FDI	GDP_GROWTH	INVESTMENT	MARKET_CAP	STR	TR	VOLATILITY_INDEX
BANK_CREDIT	1	0.048	-0 .256	0 .217	0 .367	0 .316	0 .071	0 .0558
FDI	0.048	1	0 .175	0 .197	0 .155	0 .170	-0 .01	-0 .052
GDP_GROWTH	-0.256	0 .175	1	0 .405	-0 .006	-0 .089	0 .019	0 .021
INVESTMENT	0.217	0 .197	0 .405	1	0 .070	0 .063	0 .168	0 .049
MARKET_CAP	0.367	0 .155	-0 .006	0 .0709	1	0 .634	-0 .036	-0 .060
STR	0.316	0 .170	-0 .089	0 .063	0 .634	1	0 .585	-0 .032
TR	0.071	-0.015	0 .019	0 .168	-0 .036	0 .585	1	0 .096
VOLATILITY_ INDEX	0.055	-0.052	0 .021	0 .049	-0 .060	-0 .032	0 .096	1

Table 4 reports correlations, it demonstrates how change in value of some variables affects the value of other indicators.Gross domestic investment is most of all correlated with growth indicator (40%). These results can be explained by the fact that capital stock increases country's capacity for production, which promote economic growth. Then, FDI is correlated to GDP growth at 17%. Turnover

ratio and volatility index are in the range of 2% correlation. Eventually, variables like bank credit, market capitalization and shares-traded ratio are negatively correlated to the growth indicator. Ultimately, the strong correlation among model predictors – that potentially can cause multicollinearity problem – is observed between market cap and STR (63%) and between STR and TR (58%). Therefore, to treat the multicollinearity problem, different models are estimated by excluding highly correlated variables one by one. Table 5 demonstrates such estimations using OLS method and Table 6 – ARCH method in Appendix.

OLS framework

Independ. vars	Total sample	Developed	Developing
STR	-.0169323 (-3.34)	-.0136552 (-3.04)	-.0135831 (-0.99)
TR	.0121379 (2.07)	.0135722 (2.74)	.0087368 (1.17)
FDI	.1182386 (2.79)	.1232344 (4.73)	-.0439202 (-0.71)
Market cap	.0158683 (3.34)	.0175447 (3.97)	.00337 (0.37)
Investment	.2657648 (7.01)	.132083 (2.75)	.2618659 (3.79)
Volatility index	-.0426303 (-1.82)	-.1308551 (-5.78)	-.0877378 (-2.54)
Bank credit	-.0321333 (-9.38)	-.0121177 (-4.96)	-.0273307 (-2.05)
C	-.3879723 (-0.27)	.8891816 (0.71)	3.489258 (1.55)
R-squared	0.3352	0.3891	0.2273
Number of obs	346	211	135

Before reporting the results, some preliminary notes are necessary. Before running regression, the presence of repeated patterns between residuals, autocorrelation, was checked for. This is an essential tool we are using because in case of autocorrelation standard errors are not reliable; thus cannot be used in the analysis. The results of LM test for detecting the residual autocorrelation

is reported in Table 7 in Appendix section. Generally, we have a null hypothesis, which states that there is no autocorrelation. We accept null hypothesis if p >5%. In this case, the test for autocorrelation is passed and the null hypothesis is accepted.

In addition, the omitted-variable bias is still present in this paper even after including some control variables. The point is that many factors could influence economic growth, this analysis cannot hold all of them and, moreover, this paper is concentrated on the only one sector, capital market. Besides, the test of stationarity of data is reported in Table 8 in the Appendix.Finally, "robust" option in Stata is applied in order to fixheteroskedasticity, which can result in inefficiency of estimators. The result of this test is presented in Table 9 in the Appendix.

The sample was split into "developed" and "developing" countries. Particularly nine developing and ten developed markets were used in analysis in order to capture the individual effect of capital market on economic growth in those countries, and identify which measures are more significant in both regressions.

Let me interpret the results. The slope coefficient of STR is -0.01, it suggests that if shares-traded ratio goes up by one percent, the GDP growth decreases on average by 0.01%. This coefficient is significant at 1% level for developed country sample. In 2008 the STR of USA was more than 400% of GDP, taking into account that US stock market is one of the biggest in the world; stock market crash 2008 could drive this result. For comparison, the same ratio for Romania was just 1.7% of GDP in the same year. Then, the coefficient of TR is 0.012, which demonstrates a positive change of GDP growth in response to a change in TR and this variable is significant at 5% level, the *p* value is 0.039. In fact, STR and turnover ratio are indicators of stock market liquidity. For example, the TR level in UK in 2008 was 227% and 153% in Japan; nevertheless, Bulgarian TR was 10% of GDP and Nigerian – 29%. We can note that developed countries had a sharp rise of the TR level during the global financial crisis in contrast of low-income markets. Moving forward, we can observe a positive relationship of market cap (which represents the stock market size) and GDP growth, and it is significant at 1% level with *p* value of 0.001. Then, different model estimations for high and low-income countries let to evaluate capital market effects for economic growth in those countries. It is clearly seen from the estimation that smaller coefficients and t-stat of market size and liquidity indicators refer to developing economies. The sign of coefficient remains the same in both markets. Eventually, variables like STR, TR and market cap are statistically significant for economic growth at 1% level in developed countries; however, the same situation cannot be observed in case of developing markets.

Findings from the analysis of variables like STR, TR and market cap, which are indicators of market size and liquidity, can definitely prove that stock market performance (i.e. liquidity and size) affects mostly advanced economies as they have the biggest stock markets (Demirguc-Kunt, Feyen, and Levine, 2001). The preceding statement demonstrates the acceptance of the first hypothesis in this paper.

Moving to the next two variables, FDI and gross domestic investment, we can note the same positive relationship in respect to GDP growth; in fact, all of these variables are significant at 1% significance level, with *p* value of 0.006 and 0.00, respectively, in both samples. Another variable is volatility index with the coefficient of -0.04 which indicates a negative relationship to GDP growth; this coefficient is significant at 10% level with the *p* value of 0.069. Finally, bank credit variable with the negative coefficient shows a high significance at 1% level; *p* value is practically zero. Summarizing the model results it is found that stock market size (market capitalization) and liquidity (shares traded ratio) entered the regression significantly; by this we can definitely accept the second hypothesis in this paper.

It is interesting to note that the only significant variables for developing countries sample are investment, volatility and bank credit. Let's consider possible reasons: capital formation is significant for economic growth of developing countries as it determines the production capacity of a country, therefore, low-income markets like China, India or Russia are still in development process and they are still heavily investing in fixed assets (machinery, infrastructure). Second, the influence of volatility index on economic growth of developing economies can be explained by the following: the market of poor countries is highly volatile as there are a possibility of occurrence of additional risks related to frequent aggregate shocks and economic instability in those countries. Finally, financial depth (bank credit) indicator is important for the rate of growth of low-income economies because efficient financial system with healthy financial institutions and access to financial services provides effective investments, which on its own takes a substantial part of economic growth.

At the end, the coefficient of determination (R-squared) is 33%, which means that overall measure of the success of the regression in predicting GDP growth from independent variable is 33%.

ARCH framework

Sample:1989–2011, but with gaps.
Number of gaps in the sample:20 (gap count includes panel changes).

Independ. Vars	Total sample	Developed	Developing
STR	-.0169323 (-2.28)	-.0136552 (-2.29)	-.0135831 (-0.54)
TR	.0121379 (2.11)	.0135722 (2.18)	.0087368 (0.78)
FDI	.1182386 (1.98)	.1232344 (2.29)	-.0439202 (-0.23)
Market cap	.0158683 (2.31)	.0175447 (3.07)	.00337 (0.16)
Investment	.2657648 (8.73)	.132083 (3.63)	.2618659 (3.11)
Volatility index	-.0426303 (-3.61)	-.1308551 (-8.05)	-.0877378 (-3.58)
Bank credit	-.0321333 (-5.88)	-.0121177 (-4.23)	-.0273307 (-1.23)
C	-.3879724 (-0.54)	.8891816 (0.83)	3.489258 (2.32)
Number of obs.	346	211	135

FromARCH estimation, we may observe that p-values of all variables are practically the same as in OLS, there are not significant changes. This model once again verifies that stock market size and liquidity are statistically significant, and previous empirical evidence could be applied here as well. The most interesting point is that from ARCH estimation it is clearly seen that volatility index is at 1% significance level, *p* value is around 0 in all of the samples. Contrariwise, in OLS we have this variable at 10% with *p* value of 0.069. Empirically, a price fluctuation (volatility) determines the stock market performance, because exchange market is all about buying and selling.Thus, higher significance of volatility in this model can be explained by the fact that ARCH is a more complex model, which can be easily used to measure financial sector. Particularly, ARCH estimation, as heteroskedstic stochastic process, is able to model volatility clustering. In addition, in OLS model, the problem of heteroskedasticity and autocorrelation make

estimations not reliable and inefficient. On the other hand, ARCH demonstrates better results in this case. Therefore, this is why volatility index is statistically significant for economic growth at 1% in ARCH estimation. However, these findings are opposite to those which have been done earlier. For instance, R. Levine and S. Zervos (1998) found volatility index as not closely linked variable to output growth. Particularly, they were focused on the market size and liquidity concept, so such behavior of volatility index as a control variable was not explained properly.

Finally, ARCH estimation for developed and developing countries once again verifies that measures of capital market size and liquidity are not statistically significant for the rate of growth in low-income economies, while they are significant at 5% in developed markets.

Conclusion

The influence of the financial market on economic growth is one of the most popular and intensive-studied directions of studies devoted to the role of the financial market. This is always relevant to measure the role of different variables in the growth of economy and, therefore, to find new and influencing measures. During last decades, the attention of economists was devoted toward capital market as significant sector of well-being of the economy. One of the reasons is, first, worldwide financial markets are experiencing a fundamental change. Financial market depth and structure is always in motion; particularly, it concerns the global market leaders like United Kingdom, United States and Japan. Second, the most global economic and political events like the financial crisis in 2008 emphasized the link between capital market and rate of growth, where market crash led to banking collapse, devaluation of most currencies, bankruptcy and, finally, recession for US and EU.

This paper studied the empirical relationship between different variables of stock market development and economic growth through a panel of 10 developed markets and 9 developing ones over 25 years (1988–2012). The stock market development variables that are used in this paper are as follows: market capitalization, turnover ratio, shares-traded ratio. Besides, the level of FDI inflows, gross capital formation and bank credit were included in analysis as control variables. In order to study the ties between the growth indicator and measures of stock market development, OLS and ARCH model estimations are used.

The main objectives in this paper were, first, to find out if advanced economies are more exposed to changes of stock market liquidity and size as they

have bigger markets. Second, to measure if indicators of stock market size and liquidity are statistically significant for economic growth.

The regression results found STR and TR as measures of stock market liquidity, statistically significant at 1% and 5% level, respectively. Besides, evaluating the data of these variables the following was pointed: developed countries had a sharp rise of the TR and STR level during the global financial crisis unlike low-income markets. Moving forward, the analysis found market cap (which represents the stock market size) significant at 1% level in both estimations.It demonstrates similarity of this paper with recent studies (R. Levine, S. Zervos, 1998) and, in fact, by this we accepted the second hypothesis in this paper.

The ARCH estimation demonstrated the same results; however, volatility index is found significant at 1% level, which is much higher than it has in OLS. It can be explained by the ability of ARCH to capture volatility clustering and, besides, it better fixes hetereskadesticity and autocorrelation. Moreover, both estimations demonstrated that the smaller number of coefficients and t-stat of capital market development indicators refers to low-income economies, besides, STR, TR and market cap are not statistically significant for economic growth in analysis of developing countries. However, market size and liquidity variables entered the regression significantly in both estimation in case of advanced markets. It definitely proves that stock market performance (i.e. liquidity and size) influences mostly advanced economies as they have bigger markets. By this, the first hypothesis in this paper is accepted.

Finally, the novelty of this study is, first, a focus on two types of markets: low-income and high-income and, second, model estimation was conducted through two different methods: OLS and ARCH. The findings of this analysis could be useful for policy-makers to evaluate the situation of market in each type of economy in order to make appropriate steps to maintain its well-being and, as a result, control market effects for economic growth. Besides, market participants can benefit from this paper as well. For instance, analysis of ties between finance and growth, the information about price volatility and role of the biggest market players, which are presented in this study, take a substantial part in evaluating market environment before making investment.

Bibliography

Abiy H., Chi G. (2014). *Stock market development and economic growth: Empirical evidence for emerging market economies*. "International Journal of Economics, Finance and Management Sciences", Vol. 2, No. 2, 171–181. DOI: 10.11648/j.ijefm.20140202.19.

Agarwal S. (2001). *Stock Market Development and Economic Growth: Preliminary Evidence from African Countries*. "Journal of Sustainable Development in Africa", Vol. 3, No. 1, 48–56.

Demirguc-Kunt A., Feyen E., Levine R. (2011). *The Evolving Importance of Banks and Securities Markets*. "*Policy Research Working Paper 580,* the World Bank",http://siteresources.worldbank.org/EXTFINANCIALSECTOR/Resources/Banks_and_SecuritiesWP5805.pdf.

Barro, R.J. (1991). *Economic Growth in a Cross Section of Countries*."Quarterly Journal of Economics"*,* Vol. CVI, 407–443.

Barro, R. J., Sala-i-Martin, X. (1995)*Economic growth*. New York: McGraw-Hill.

Beck, T., Demirguc-Kunt, A., Levine, R. (2000). *A new database on financial development and structure*. "World Bank Economic Review", Vol. 14, 597–605.

Beck, T., Levine, R., Loayza, N. (2000). *Finance and the sources of growth*. "Journal of Financial Economics", Vol. 58, 261–300.

Bencivenga, V.R., B. Smith., R.M. Starr. (1996). *Equity Markets, Transaction Costs, and Capital Accumulation: An Illustration.*"The World Bank Economic Review"*,* Vol. 10, 241–65.

Bharati V. Bathak, (2011). *The Indian financial system*. India: Darling Kindersley.

Boyd, J.H., Prescott, E.C. (1986). *Financial intermediary-coalitions*. "Journal of Economics Theory", Vol. 3, 211–232.

Calderón, C. and L. Liu (2003). *The direction of causality between financial development and economic growth*. "Journal of Development Economics", Vol. 72, 321–334.

Campbell, J.Y., Lettau, M., Malkiel, B.G., Y., Xu (2001). *Have Individual Stocks Become MoreVolatile? An Empirical Exploration of Idiosyncratic Risk*, "Journal of Finance"*,* Vol. 56(1), 1–43.

Damodar N. Gujarati (2003). *Basics in Econometrics*. New York: McGraw-Hill.

Kaufmann D., Kraay A., Mastruzzi M. (2005). *Governance Matters IV:Governance Indicators for 1996–2004*. *The World Bank*. http://info.worldbank.org/etools/docs/library/206973/GovMatters_IV_main.pdf.

Demirguch-Kunt, A., Levine R. (1996). *Stock Market Development and Financial Intermediaries: Stylized Facts*. "The World Bank Economic Review"*,* Vol. 10, 291–321.

Demirgüç-Kunt, A., Maksimovic V. (2002). *Funding growth in bank based and market based financial systems: Evidence from firm level data*, "*Journal of Financial Economics",* Vol. 65, 337–363.

Demirgüç-Kunt, A., Levine R. (2001). *Financial Structures and Economic Growth*, MIT Press, Cambridge.

Demirgüç-Kunt, A., Levine R. (2008*). Finance, Financial sector policies, and Long-run Growth,* "Policy research working paper 4469"*,* The World Bank.

Demirgüç-Kunt. A., Feyen. E., Levine. R. (2013). *The evolving importance of banks and Securities markets*, "World Bank Economic Review", Vol. 27, 476–490.

Borensztein, E., De Gregorio, J., Lee, J.-W. (1998). *How Does Foreign Direct Investment Affect Economic Growth?*, "Journal of International Economics", NBER Working Paper No. 5057, Vol. 45, 115–135.

Engle R. F., Ghysels, E., Sohn, B. (2006). *On the Economic Sources of Stock Market Volatility*, http://www.unc.edu/~eghysels/.

Engle R.F., Ghysels, E., Sohn, B. (2009). *Stock Market Volatility and Macroeconomic Fundamentals*. "The Review of Economics and Statistics", Vol. 95, No. 3.

Engle, R. F., Mezrich J. (1996). *GARCH for Groups, RISK*, 9(8), 36–40.

Engle, R. F., Ng, V. (1993). *Measuring and Testing the Impact of News on Volatility*, Journal of Finance, 48, 1749–1778.

Wheeler, G. (2008). *Financial Market Cycles, Globalization, and the Current Banking Crisis*. *Sovereign Debt Management Forum Policy Challenges for the Financial Sector*, The World Bank, Washington, D.C.

Greenwood, J., Smith B. (1996). *Financial Markets in Development and the Development of Financial Markets,* "Journal of Economic Dynamics and Control", Vol. 21,145–81.

Chow G. C. (1993). *Capital Formation and Economic Growth in China*. "The Quarterly Journal of Economics", Vol. 108, No. 3, 809–842. DOI: 10.2307/2118409.https://ideas.repec.org/a/tpr/qjecon/v108y1993i3p809-42.html.

Kanasro, H.A., Jalbani, A.A., Junejo, M.A. (2009). Stock Market Liquidity: A Case Study of Karachi Stock Exchange. "Pakistan Journal of Commerce and Social Sciences", Vol. 3, http://jespk.net/publications/22.pdf.

Kim, H. E., Morse, A., Zingales, L. (2006). *What Has Mattered to Economics since 1970*. "NBER Working Paper".

International Monetary Fund. *International financial statistics*. Washington, DC: International Monetary Fund, various issues, www.imf.org. (access: 02.2015).

Islam, N. (1995). *Growth Empirics: A Panel Data Approach*."Quarterly Journal of Economics", Vol. 110, 1127–1170.

Juzhong, Zhuang, Herath, Gunatilake, Yoko, Niimi, Muhammad, Ehsan, Khan, Yi, Jiang, Rana, Hasan, Niny, Khor, Anneli S., Lagman-Martin, Pamela, Bracey, Biao, Huang (2009). *Financial Sector Development, Economic Growth, and Poverty Reduction: A Literature Review*. "ADB Economics Working Paper Series", No. 173.

Khan, A. (2000). *The Finance and Growth Nexus*,"Business Review", Federal Reserve Bank of Philadelphia.

King, Robert G., Levine, R. (1993a) *Finance and Growth: Schumpeter Might Be Right*. "Quarterly Journal of Economics", Vol. 108, No. 3, 717–38.

Levine R. (2000). *Market-based or bank-based financial systems: which is better?* "NBER Working paper 9138. "http://www.nber.org/papers/w9138.

Levine, R. (2003). *Finance and Growth: Theory, Evidence, and Mechanisms*. "*NBER working paper.*"

Levine, R. (2004). *Finance and Growth: Theory and Evidence*, "*NBER working paper*" http://citeseerx.ist.psu.edu/viewdoc/download?rep=rep1&type=pdf&doi=10.1.1.207.2610

Levine, R., Zervos, S. (1998). *Capital control liberalization and stock market development*. *World Development*, Vol. 26, No. 7,1169–1183. http://faculty.haas.berkeley.edu/ross_levine/Papers/1998_WD_Cap%20Mkt%20Liberalization.pdf.

Levine, R. (1991). *Stock Markets, Growth, and Tax Policy*. "Journal of Finance", Vol. XLVI: 1445–1465.

Levine, R., Beck, T. (2004). *Stock markets, banks, and growth: Panel evidence*, "Journal of Banking and Finance", Vol. 28, 423–442.

Levine, R. (2002). *Bank-based or market-based financial systems: Which is better?*"Journal of Financial Intermediation", Vol. 11, 398–428.

Levine, R. (1998). *The legal environment, banks, and long-run economic growth*. "Journal of Money, Credit, and Banking", Vol. 30, 596–613.

Levine, R., Zervos, S. (1998). *Stock Markets, Banks, and Economic Growth* "American Economic Review", Vol. 88, 537–58. http://www.researchgate.net/publication/4901422_Stock_Markets_Banks_and_Economic_Growth.

Maureen Burton, Reynold Nesiba, Bruce Brown (2010). "An introduction to financial markets and institutions." New York, M.E.Sharpe, https://books.google.pl/books?id=jvvqBgAAQBAJ&pg=PR2&lpg=PR2&dq=Maureen+Burton,+Reynold+Nesiba,+ Bruce+Brown.+An+introduction+to+financial+markets+and+institutions.+New+York.

Mohtadi, Hamid, Sumit Agarwal (2007). *Stock Market Development and Economic Growth: Evidence from Developing Countries. Working paper*. http://www.uwm.edu/~mohtadi/PA1-4-01.pdf.

Naresh Kumar (2014). Estimation of Market Capitalization and Economic Growth in India

Okey O. Ovat (2012). *Stock Market Development and Economic Growth in Nigeria: Market Size Versus Liquidity*. "Canadian Social Science", Vol. 8(5).

Okey O. Ovat (2014). Assessing the Extent of Development of the Nigerian Capital Market: A Comparative Analysis. "International Journal of Financial Economics", Vol. 2, No. 2, p. 73–81. http://www.academia.edu/7255973/Assessing_the_Extent_of_Development_of_the_Nigerian_Capital_Market_A_Comparative_Analysis.

Omar M. Al Nasser, Xavier Garza Gomez (2009). *Do Well-Functioning Financial Systems Affect the FDI Flows to Latin America?* "International Research Journal of Finance and Economics" ISSN 1450-2887 Issue 29. http://www.eurojournals.com/finance.htm.

Onakoya Adegbemi Babatunde (2013). *Stock Market Volatility and Economic Growth in Nigeria (1980–2010)*. "International Review of Management and Business Research", Vol. 2(1). http://www.academia.edu.

P. Geoffrey Allen, Robert Fildes (2001). Econometric Forecasting. "Principles of Forecasting: A Handbook for Researchers and Practitioners." http://www.forecastingprinciples.com/paperpdf/Allen-econometric.pdf.

Patrick Cusatis (2011). *Volatility in the Stock Market*, "Quarterly Investment Newsletter of Hershey Trust Company".

Peter L. Rousseau, Paul Wachtel (2000). *Inflation, Financial Development and Growth*. "Economic Theory, Dynamics and Markets: Essays in Honor of Ryuzo Sato."

Peter L. Rousseau, Paul Wachtel (2001). *Inflation Thresholds and the Finance-Growth Nexus*. Presentation at the X Tor Vergata Financial Conference, Rome.

Engle R, (2001). *GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics*. "Journal of Economic Perspectives", Vol. 15, Number 4, p. 157–168. http://www.researchgate.net/publication/4902177_GARCH_101_The_Use_of_ARCHGARCH_Models_in_Applied_Econometrics.

Rousseau, Peter L. and Paul Wachtel, (1998) *Financial Intermediation and Economic Performance: Historical Evidence From Five Industrialized Countries*,"*Journal of Money, Credit and Banking*."

Rousseau, P. L., Wachtel, P. (2000). *Equity Markets and Growth: Cross-Country Evidence on Timing and Outcomes: 1980–1995*,"*Journal of Banking and Finance"*, Vol. 14.

Selma Kurtishi-Kastrati (2013). *Impact of FDI on economic growth: an overview of the main theories of FDI and empirical research. "*European Scientific Journal", Vol. 9, No. 7.

Shaw, E.S. (1973). *Financial Deepening in Economic Development*. Oxford University Press, New York.

Shu-Chen Chang (2015). *Effects of financial developments and income on energy consumption*. "*International Review of Economics & Finance"*, Vol. 35, 28–44.

Solow, R. M. (1956). *A Contribution to the Theory of Economic Growth*."Quarterly Journalof Economics", Vol. 30, No. 1, 65–94.

Stolbov, M.I. (2008). *The impact of the financial market on economic growth and business cycles. "*Economy of the XXI century", No. 8, 55–69.

Sumit Agarwal, Hamid Mohtadi (2004). *Financial Markets and the Financing Choice of Firms: Evidence from Developing Countries*. "Forthcoming: Global Finance Journal"

Thompson, James (2008). *Icelandic stock market crashes on reopening*. The Independent (London). (access on 25.02.2015).

Tumanova E.A., Chagas N.L. (2004). *Macroeconomics. Elements of advanced approaches*. "INFRA-M: Moscow", p. 184.

Wachtel, P. Rousseau, P. (1995). *Financial Intermediation and Economic Growth: A Historical Comparison of the U.S., U.K. and Canada, "Anglo-American Finance"*.

Winkler A. (1998). *The Dual Role of Financial Markets in Economic Development: Engine of Growth and Source of Instability*. IPC Working Paper No. 18.

World Bank. *World development indicators.* Washington, DC: World Bank. www.worldbank.org.

Yi Wen (2011). *Explaining China's Trade Imbalance Puzzle*. "Working Paper 2011-018A." http://research.stlouisfed.org/wp/2011/2011-018.pdf.

Appendix

Table 5. OLS estimation.

Independent vars	Model 1 (coeff. and t-stat.)	Model 2 (coeff. and t-stat.)	Model 3 (coeff. and t-stat.)	Model 4 (coeff. and t-stat.)
STR	-.0169323 (-3.34)	-	-	-
TR	.0121379 (2.07)	-.0004674 (-0.14)	-	-
FDI	.1182386 (2.79)	.0868694 (2.21)	.083787 (2.16)	.0935046 (2.35)
Market cap	.0158683 (3.34)	.0043587 (1.73)	.0044703 (1.80)	-
Investment	.2657648 (7.01)	.2837722 (7.23)	.2826812 (7.08)	.282684 (7.12)
Volatility index	-.0426303 (-1.82)	-.0349659 (-1.49)	-.0327127 (-1.45)	-.0370364 (-1.69)
Bank credit	-.0321333 (-9.38)	-.0331595 (-9.86)	-.0326382 (-9.75)	-.0309128 (-8.54)
C	-.3879723 (-0.27)	.0759592 (0.06)	-.0077063 (-0.01)	.2804142 (0.23)
R^2	0.3352	0.3178	0.3102	0.3063
Observations	346	346	355	355

Table 6. ARCH estimation.

Independent vars.	Model 1 (coeff. and t-stat.)	Model 2 (coeff. and t-stat.)	Model 3 (coeff. and t-stat.)	Model 4 (coeff. and t-stat.)
STR	-.0169323 (-2.28)	-	-	-
TR	.0121379 (2.11)	-.0004674 (-0.15)	-	-
FDI	.1182386 (1.98)	.0868694 (1.34)	.083787 (1.31)	.0935046 (1.54)
Market cap	.0158683 (2.31)	.0043587 (0.91)	.0044703 (0.94)	-
Investment	.2657648 (8.73)	.2837722 (9.35)	.2826812 (9.70)	.282684 (9.74)
Volatility index	-.0426303 (-3.61)	-.0349659 (-3.06)	-.0327127 (-2.91)	-.0370364 (-3.32)
Bank credit	-.0321333 (-5.88)	-.0331595 (-5.99)	-.0326382 (-5.93)	-.0309128 (-6.58)
C	-.3879724 (-0.54)	.075959 (0.11)	-.0077066 (-0.01)	.280414 (0.41)
Observations	346	346	355	355

Table 7. Autocorrelation LM test.

Sample: 1988 2012					
Included observations: 304					
Lags	**LM-Stat**	**Prob**	**Lags**	**LM-Stat**	**Prob**
1	96.64918	0.0052	7	61.23166	0.575
2	68.45363	0.3287	8	59.95332	0.6203
3	63.89692	0.4801	9	53.24769	0.8289
4	77.71101	0.1165	10	41.75245	0.9859
5	63.55904	0.492	11	54.83379	0.786
6	66.31381	0.3971	12	75.2913	0.158

Notes: H_0: there is not autocorrelation. H_1: there is residual autocorrelation. We accept H_0 when $p > 5\%$.

Table 8. Stationarity test.

Variables	P value
GDP growth	0.00
STR	0.02
TR	0.02
FDI	0.0008
investment	0.0025
Market cap	0.01
Volatility index	0.00
Bank credit	0.99

Notes: H_0: data is stationary.
H_1: data is not stationary.
We accept H_1, when $p > 5\%$.

Table 9. Hetereskadesticity test.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

chi2(1)	**35.09**
Prob > chi2	0.0000

Notes: H_0: there is homoscedasticity.
H_1: there is hetereskadesticity.
We accept H_0 when $p > 5\%$.

Chapter II.

Empirical Analysis of the Impact of Oil Price Shocks on Stock Markets

Jacek Bastin, bitFlyer / Lazarski University
0000-0002-6626-3183

A crucial part of portfolio construction is to assess the risk that a stock bears. The main risks are, among others, interest rate risks, FX risks and, political risks. But, many other variables may influence stocks such as news affecting a particular company, country, or region, innovation, the change in commodity price, etc. Investors and financial advisors that know and understand the effects that different variables might have on their portfolio are able to diversify them in order to minimize risks. Therefore, being aware of the reaction that stock markets may have towards a particular event is crucial for constructing and managing a portfolio. Also, knowing how stocks and financial markets behave when news are released or when events hit enables one to anticipate with the help of its feelings, forecasts and information the reaction of the stock. This paper analyzes the effects that one particular variable, crude oil price (thereafter oil price) shocks, has on the variability of different stock market indices.

Oil as one of the major input of the economy influences companies' business cycles by affecting their direct and indirect costs. Two of the main direct costs are production and transportation costs. They are affected due to the fact that for instance, an increase in oil price increases production and shipping costs of raw materials. Indirect costs are, for instance, the slowing demand from emerging market; thus, they directly impact other companies elsewhere. Very few alternatives to oil exist and the ones proposed are neither stable nor able to meet, yet, the demand due to a lack in technology or in means such as ethanol, hydraulic and wind energy. This scarcity explains the nearly perfectly inelastic oil price-demand relationship for both household and companies. It means that an increase in oil prices will not diminish the demand for oil but will decrease households' and companies' disposable income. As changes in oil prices are impacting companies' business cycle, it should also have an impact on stock returns. The rationale behind that statement is that as oil prices impact total

costs of most companies, oil price changes also impact the profits which lead to a change in the dividend payouts whichin turn impact the value of the share. Moreover, knowing how oil price shocks behaved historically may help financial analysts to forecast what would happen if, for example, the embargo imposed on Iran is abolished or reduced due to the US-Iran talks, a further trade restrictions on Russia, thus a possible reduction in the supply of oil or, what might happen if the ISIS extend in the Middle East and take other oilfields thus, also reducing the supply of oil.

In this paper, the author aims at testing three hypotheses. The first and main one tests the fact that the different oil price shocks impact stock markets in substantially different manners. This hypothesis is based on the fact that Killian and Park (2009) found that all except supply shocks influence the American stock market. For China, Ling, Fang and Cheng (2010) found that only oil specific demand shocks are positively significant, while Fang (2010), found that none of the shocks are significant. As one can see, the impact of oil has not yet been as accepted as the ones on macroeconomic fundamentals. Therefore, the research focuses on six different stock markets extends the literature and enables a comparison between the results found in this paper with the research previously made. The second hypothesis the author aims at testing is to see if stock market variability in developed markets is impacted to a lesser extent than the ones in emerging markets. The rationale behind this hypothesis is that as the US, the UK and Germany are more service-oriented economies than China, India and Russia, an increase in oil prices should impact companies' business cycle to a lesser extent. The third hypothesis explores the decline that oil price shocks have overtime on stock market returns. The rationale behind this hypothesis is that as Blanchard and Galli (2010) and Hooker (1994) said the demand landscape from crude oil has changed due the rise of demand coming from emerging markets such as China. Answering those three hypotheses enables one to understand the impact that oil price shocks have on investor's returns. Besides, this paper may help financial analysts to be reactive when news are released and even pro-active if they feel or knowthat something will happen within the oil market. Also, this paper enables financial analysts to invest in the country which offers the greatest returns based on their feelings and risk attitude.

After the two oil crisis of 1973 and 1979, Hamilton (1983) researched the effect that oil price shocks had on the economy. He found that nine out of ten US recessions were preceded by a large hike in oil prices and that there was a significant correlation between oil price increase and GNP decrease. (Molsen and Mysen (1994), Mork (1989), Gisser and Goodwin (1986), among others). Another property of oil price shocks is its asymmetry – that means that an increase in oil

price will have negative impact on GNP while a decrease in oil price will not have significant impact on that variable. (Mork, Molsen and Mysen (1994), Mork (1989). It is only in 1966 that research on oil price shock impact on stock markets started with the paper written by Jones and Kaul (1996). They found that in the US, UK, Canada and Japan during 1947–1991, oil price shocks had a negative impact on real stock returns. Other studies found the same negative correlation between oil price shocks and stock market returns in oil-importing countries. (Park and Ratti (2007), Papatrou (2001), Ciner (2001), Sadorsky (1999)). All of the research mentioned above examined oil price shocks as an exogenous variable, but Kilian (2009) suggested that oil price shocks should be treated endogenously as change in oil prices can come from three different sources. Some shocks may come from the supply side, some others from the aggregate demand and finally, some from the oil-specific demand. Therefore, in order to capture the three kinds of shocks, scholars have to use structural VAR (SVAR) rather than restricted and unrestricted VAR frameworks as used in the previous research. Using Kilian (2009) approach, Lin, Fang and Cheng (2010) found that only oil supply shocks have a significant impact on China, while Fang (2010) found that only oil specific demand shock are significant. For Russia, oil-specific and aggregate demand shocks are impacting positively the stock market returns (Fang, 2010).

This paper contributes to the literature by first of all, expanding the literature by using Killian's (2009) methodology rather than Hamilton's (1983) one. In other words, this paper uses a structural vector auto-regression (SVAR) rather than a simple vector auto-regression as commonly used. The advantage of using a SVAR is that it allows the model to distinguish the different kinds of shocks. Secondly, this paper explores three emerging countries/region and three developed ones namely – Russia, China, India, the UK, the US and Germany. The rationale behind the choice of these countries is that it enables one to see the difference between 3 of the largest developed economies and 3 of the largest emerging economies. Besides, all the countries which are studied differ in their oil dependence. According to the EIA in 2013, China, the US, India and Germany were net importers, Russia was a net exporter, while the UK just switched in 2013 from being a net exporting country to being a net importing one for the first time since 1984. Thirdly, the previous research had all different results for China and for the US while Germany has not been studied yet. Also, very few papers focus on India and the UK. Last but not least, the study aims to expand the research previously made by inputting newer period data from January 1999 to October 2014.

The proxy for investor's return is a variable which has been widely used and accepted: stock market indices. The stock market indices used in this paper for the developed countries are the S&P500, the FTSE100 and the DAX which

represent the US, the UK and Germany, respectively. For emerging markets, China is represented by the SSE composite index (SSEC), Russia by the Russia Trading System (RTS) and India by the BSE30. All the indices taken into account are some of the most analyzed stock market indices for the given countries and are some of the most representative indices of their respective economy. Other variables in the SVAR model are supply, aggregate demand and oil-specific demand shocks. The three of them are going to use a proxy; the supply shock will be represented by the world oil production, the oil-specific demand shocks by the real price of Brent oil within the given country and finally the aggregate demand shock is represented by an index computed by Killian (2009), the global real economic activity.

As stated previously, in order to verify the four hypotheses, this paper follows a Structural Vector Auto-Regression analysis (SVAR) as proposed by Killian (2009) and developed by Sims (1980). Most of the empirical literature uses restricted and unrestricted VAR and takes oil price shock as exogenous. The problem is that as described by Killian (2009), there exist three kinds of oil price shocks and they should be treated as endogenous due to their interdependence. The SVAR methodology permits not only this distinction to be made but also to capture their effects on each other as all the variables do not affect the others in the same way. In order to perform a SVAR, this paper checks, first, the stationarity of the variables using an Augmenter Dickey-Fuller test. Finally, we will add to the residuals of the VAR models the structural shocks. Once the model has been constructed, variance decompositions are performed in order to verify the four hypotheses.

The first hypothesis is verified. The Russian stock market is the stock market which is the most impacted by oil price shocks. The total variability driven by oil price shocks accounts for 39.95% with 19.76% coming from oil-specific demand shocks and 19.92% from aggregate demand shocks. In contrast, the Chinese and Indian stock markets variability is driven merely by aggregate demand shocks at 21.03% for China and 16.44% for India. For developed countries, namely, the US, the UK and Germany, the variability of the stock market accounts for both aggregate demand shocks and oil-specific demand shocks to more or less the same extent for both shocks. It is also worth specifying that supply shocks in all stock markets are negligent which is in line with Kilian and Park (2009). The second hypothesis refuted the fact that oil price shocks' impact on emerging stock markets were bigger than the impacts on developed ones. The results showed, Russia put aside, the total impact of oil price shocks on the variability of the stock exchange markets were more or less the same. Russia was put aside-because its stock market is too much driven by the oil market and therefore it is affected by more or less 20% by both demand shocks. Nevertheless, depending

on the source of the oil price shock, emerging and developed countries' stock markets are impacted differently. On the one hand, developed countries stock markets are impacted by both, aggregate and oil-specific demand shocks. On the other hand, emerging ones are almost uniquely driven by aggregate demand shock. The importance of aggregate demand shocks on emerging markets can be explained by the fact that emerging markets are export oriented thus, they rely a lot on the state of the global economy while developed markets are not that driven by exportations. For oil-specific demand shocks, the explanation is that emerging markets do not list many companies directly related to the oil sector while developed ones do. The third hypothesis, which looks at the diminishing impact that oil price shocks have over time on the stock market, is also refuted. The results show that for all stock markets, the impact of the stock market variability was increasing. This increase is mainly coming from oil-specific demand shocks which is explained by the fact that after the 2008 financial crisis, the uncertainty about the supply of oil drove an un-preceding fluctuation within the demand not driven by the aggregate demand.

The remainder of this paper is arranged as follows. Chapter 1 provides an extended literature review and outlines the contribution of this paper within the literature. Chapter 2 describes the data and the methodology used in order to conduct the study. Chapter 3 reports the empirical results. Finally, chapter 4 concludes the paper.

Literature Review

Before considering the methodology used within this paper, an insight of what has been researched on oil price shocks impact is considered. This chapter not only enables one to understand the research framework, but it also sheds light on where this paper stands within the literature. This chapter explores, in a chronological way, four strands of the literature. The first one, which is also the most predominant within the literature, is the impact that oil price shocks have on macroeconomic fundamentals. Secondly, the impact of oil price shocks on financial markets is considered. An important breakthrough made by Killian (2009) exploring the different kinds of oil price shocks composes the third strand. Lastly, an investigation on the effect that oil price shocks have on country-specific financial markets is made.

Research on the effects of oil price shocks on macroeconomic aggregates dominates largely the literature. Hamilton (1983) investigates why 90% of US recessions post World War 2 were preceded by a drastic increase in oil prices.

Using a vector auto-regression (VAR) process from 1948 to 1972, he states that in the US, there is a negative correlation between oil price increases and GNP. Scholars such as Molsen and Mysen (1994), Mork (1989) and Gisser and Goodwin (1986) find the same negative relationship using different timeframes and methodologies, thus accepting Hamilton's (1983) statement. Using a time series starting in 1970 and ending in 2009, Al-mulali (2013) discovers the same relationship for China. Naturally, since an increase in oil prices lead to a recession, a decrease should lead to an economic boom. However, Mork (1989) does not find any significant effects of oil prices decline on the American GNP. Neither do Mork, Molsen and Mysen (1994) extending the analysis to the US and to 6 OECD countries, namely, Canada, Japan, West Germany, France, the UK and Norway. The results of both studies suggest that an asymmetry in effect exists as oil price increase impacts on GNP are almost always significant while an oil price declines are almost always insignificant. Later, Hooker (1994), found that the impact of oil price increases on GDP were diminishing overtime. Exploring that phenomenon, Blanchard and Gali (2010) find that despite having comparable shocks in the 1970s and in the 2000s, their impacts on macroeconomic fundamentals were different. Analyzing 6 industrialized countries, they conclude that the impact of the decreasing oil price shocks on stock market indices were due to three factors: the increasing labor market flexibility, the increase in central banks inflation targeting credibility and, the change in the economic landscape. This last factor is explained by the changes in demand for oil, mainly caused by the emergence of developing countries such as China and India. According to Katayama (2013), other factors explain the decreasing impact of oil price shocks overtime such as the deregulation within the transportation industry and the improved energy efficiency. Millard and Shakir (2013) find the same overtime decrease results than Katayama (2013) and Blanchard and Gali (2010) but for the UK.

A decade after Hamilton's (1983) paper, scholars started to analyze the relation between oil price shocks and financial markets. The ground-breaking paper of Jones and Kaul (1996) tests the impact that oil price shocks had on the US, Canadian, Japanese and British stock markets using a standard cash-flow model. Analyzing quarterly data from 1947 to 1991, they find that oil prices shocks have a significant negative effect on real stock returns in all stock markets but the UK. Sadorsky (1999), Cinner (2001), Park and Ratti (2007) conclude like Jones and Kaul (1996) that oil price increase shocks had a significant negative impact on US stock returns as on the GNP. Park and Ratti (2007) also find that the relationship was negatively significant in Germany, Belgium, Spain, Greece, Sweden, Finland, France, the Netherlands, Austria, Italy and Denmark. The rationale explanation follows a discounted dividend model. An increase in oil price impacts companies'

business cycle by increasing, among other variables, production costs and transportation costs. As a result, it leads to decreasing earnings, thus decreasing dividends payouts that lead to a decrease of stock prices. On the contrary,

Huang et al (1996) do not find any significant impact of change in oil price futures on the S&P500. However, Cinner (2001), extends the dataset of Huang et al (1996) to 1990 and he realizes that a non-linear relation existed between oil price shocks and stock market return explaining Huang et al. (1996) refutation. Later, Sadorsky (1999) finds that on average, the impact of a negative shock was 20% bigger than the one of a positive shock. Both those studies (Cinner, 2001 and Sadorsky, 1999) show that as for macroeconomic fundamentals, oil price shocks' impacts on stock market returns are asymmetric.

Most of the research on the impacts of oil price shocks on the economy and the financial market are based on Hamilton's (1983) work, taking oil price shock as exogenous – it means that oil price shocks influence the model but are not influenced by it. The dominant methodology used within the literature is the VAR modeling one. Papapetrou (2001) tests the relationship between oil prices and real stock using monthly data for Greece from January 1989 to June 1999. She finds that oil price shocks have a negative impact on Greek real stock returns. The same result was found by Park and Ratti (2007) which focused on the US and 10 European stock market from 1986 to 2005. For China, covering a study period going from January 1999 to September 2009, Ono (2011), as Cong, Wei, Jiao and Pan (2008) did previously, finds that oil price shocks impacts on the two main Chinese stock exchanges, the Shenzhen and Shanghai one, were not significant. Ono (2011) also analyzes other BRIC countries and he finds that oil price shocks had positively significant impacts on the Indian and Russian returns. However, for Brazil, the relationship is not significant. In contrasts, for Norway, an oil exporting country, the relationship is positively significant and a 10% increase in oil prices led to an immediate 2–3% increase in stock market returns (Bjørnland, (2009)). Paytakhi (2012), does not find for Iran, an oil-exporting country, any correlation between oil price shocks and stock market returns. In a few words, scholars find a negative relationship in Greece, the US and 10 European Economies, while positive relationships are found in Norway and Russia, both oil exporting countries.

Those findings are not surprising as, on the one hand, oil exporting countries such as Russia and Norway depend heavily on the sales of oil. On the other hand, companies situated in oil-importing countries see their business cycle influenced negatively by increase in oil prices; therefore, reduce the dividends payouts, thus reducing the cost of the share. For China and Brazil, the no significance may be explained by the fact that despite oil price shocks influencing companies' business

cycle, the prospects of growth are numerous; therefore, investors believe that the price of the share is well valued regardless of the dividend payouts.

As said previously, most researches are based on Hamilton's (1973) work. They assume that oil price shocks are exogenous and are caused by supply shocks. In contrast, Killian (2009) states that different oil price shocks exist and that their impacts on macroeconomics fundamentals and on financial markets are different. According to him, three types of oil price shocks exist. The first one is the supply shock which is related to the availability of oil or, in other words, to its production. The second type of shock is the aggregate demand one. To clarify this shock, Killian (2009) explains that this shock is led by the global companies' business cycles. When the demand for oil increases globally due to an increase in production and shipment, this increase in demand will lead to an increase in price. Finally, the third type of shock is the oil-specific demand shock which arises from the difference between the expected supply and the expected demand, thus a disequilibrium. Further explanation about these three kinds of oil price shocks may be found in Killian (2009). Kilian and Park (2009) argue that oil price shocks have a negative impact on the US economy only by shocks driven by oil-specific market demand shock and not for all kind of shocks.

Few research papers focus on the impact that the different kinds of shocks have on investor's returns, using a structural VAR framework as suggested by Kilian (2009). Lin, Fang and Cheng (2010) find that global oil supply shocks have a significant positive impact on China's return while aggregate demand and oil-specific demand shocks have no significant impact. But for China another study (Fang, 2010) found that from January 2001 to September 2008, only oil-specific demand shocks were positively significant. Not only those findings are contradictory to the ones made before Killian's (2008) suggestion but they also differ when the SVAR framework is used. Fang (2010) has also studied Russia and India using the same frequency and study period as for China. He finds that none of the shocks has a significant effect for India. In contrast, for Russia, a net oil exporter country, they find that oil-specific and global demand shocks are positively impacting Russian returns. Abhyankar, Xu and Wang (2013), find that aggregate demand shocks are positively correlated with Japanese returns from January 1988 to December 2009, while oil price increases related to oil market specific demand shocks are negatively correlate with Japanese returns. For Nigeria, according to Effiong (2014), supply shocks are not significant while both demand shocks are positively significant.

To summarize, when Killian (2009) suggestion is taken into account, stock markets are responding differently to the different oil price shocks depending on the time frame and the analyzed stock market. The problem is that most of

the literature uses Hamilton's (1985) methodology, thus presents oil price shocks as exogenous and not as endogenous as suggested by Killian (2009). This paper explores the impact of oil price demand and supply shocks on 6 different countries' stock markets, namely; the US, the UK, Germany, Russia, China, and India. It contributes to the literature by comparing six different countries using recent data from January 1999 to October 2014. The six chosen countries are different in terms of oil trade balance, of business cycle and of the state of the economy as there are three developed and three developing countries. Moreover, this paper aims at answering three hypotheses with the first and second ones looking at the general impact of oil price shocks on the different economies. And with the third looking at the different impact that oil price shocks have over time. Last but not least, the study, focuses uniquely on stock market behavior rather than on macroeconomic fundamentals.

Data

The frequency of the data used in this paper is monthly, covering 15 years from January 1999 to October 2014. The rationale behind the chosen study period is that it enables one to have an insight on the impact of oil price shocks from the beginning of the millennium. 15 years have also been chosen in order to permit two SVAR of more or less the same length to be performed in order to verify the hypothesis which states that oil price shocks are declining overtime. As we take the monthly change for all the variables, the first date of the sample is January 1999. The reason of taking monthly data is that the global oil production data is only available on a monthly, quarterly and yearly frequency and the highest frequency available for the global real economic activity is also monthly. Lower frequencies such as yearly and quarterly may bias our model due to the longer time period between the observations, thus the possibility of omitting small important oil price shock impacts on investor's returns. Also, the data for global oil production is not available for the period after October 2014. The chosen countries in this paper are the US, the UK, Germany, Russia, China, and India. On the one hand, representing the developed markets, the US, the UK and Germany are among the most integrated and capitalized financial markets. On the other hand, Russia, China and India represent three of the main emerging markets in terms of market capitalization and in economic development. The global oil production data are taken from the U.S. Energy Information Administration. The real prices of oil are computed using equation 1 below; the Brent oil prices are taken from the U.S. Energy Information Administration and, the monthly Consumer Price

Index (CPI) for each individual country from the OECD database. The index of global real economic activity in industrial commodity markets (GRA) composed by Dr. Killian (2009) is a proxy for the aggregate demand shock. The GRA index as explained by Killian (2009, 1056), "measures the growthrate in percent of a panel of single voyage bulk dry cargo shipping freight rates in dollars per metric ton". In other words, as the supply for cargo is inelastic in the short-run due to, both, its expensive fixed costs and the time span it takes to build a cargo. If the global demand for commodities increases, the price of a metric ton in a cargo will increase as well due to the law of demand and supply. Monthly data for stock market indices, which represent investors' returns, is taken from Yahoo finance database. The stock market indices used within this paper are the S&P500, FTSE100, DAX, RTS, BSE30 and, SSEC representing the US, the UK, Germany, Russia, India and China, respectively. These stock markets were chosen over others due to the fact that they are widely used by financial analysts and that they are a good representation of the financial markets of their country. All the data and their sources used within this paper are presented in Appendix A.

$$Real\ Brent\ Oil\ Price_t = Brent\ oil\ price_t * \left(\frac{CPI_{Jan1999}}{CPI_t} \right) \quad (1)$$

GOP stands for the monthly change in Global Oil Production, GRA for the monthly change in global real activity. RBUS, RBUK, RBPDE, RBPRU and RBPIN are the monthly change of the real price of Brent oil for the US, the UK, Germany, Russia, China and India, respectively. USR, UKR, DER, RUR, CNR and INR are the monthly change the stock market indices for the US, the UK, Germany, Russia, China and India. The dataset used in this research consists of 189 observations starting from February 1999 to October 2014.

The descriptive statistics table (table 2) shows that emerging countries stock market indices have on average a greater monthly return than developed country stock market indices. The standard deviation is also bigger for emerging markets – highlighting the most known financial law: the higher the risk, the higher the returns. One can also see that the real price of oil has increased in the same way for the US, the UK, Germany and China while for India and Russia it increased to a lower extent. This difference is explained by the fact that the Russian and Indian CPI increased drastically from December 2008 to October 2014: from 87.6 to 133.8 basis points for Russia and from 83.3 to 143.8 basis points for India. In contrast, the US CPI increased from 96.4 to 108.9 basis points only thus, showing a hyperinflation in Russia and India in the post 2008 crisis years. Furthermore,

Table 1. Descriptive statistics, %.

	GOP	GRA	RBPUS	RBPUK	RBPDE	RBPRU	RBPCN	RBPIN	USR	UKR	DER	RUR	CNR	INR
Mean	0.12	6.55	1.27	1.3	1.35	0.52	1.31	0.95	0.34	0.18	0.61	2.24	0.88	1.31
Maximum	2.62	60.7	21.88	21.77	22.02	19.43	22.82	22.05	10.77	19.65	21.84	55.98	32.07	38.71
Minimum	-2.5	-48.4	-25.64	-26.65	-26.35	-27.31	-26.15	-27.34	-16.9	-22	-25.2	-36.2	-24.9	-28.9
Std. Dev.	0.8	28.1	8.53	8.68	8.66	8.55	8.74	8.77	4.39	5.19	6.94	11.57	8.05	9.1
Skewness	-0.1	0.05	-0.48	-0.5	-0.51	-0.6	-0.4	-0.47	-0.56	-0.18	-0.4	0.41	0.17	0.25
Kurtosis	4.06	1.95	3.8	3.84	3.88	3.85	3.88	3.78	3.89	5.58	4.19	5.47	4.83	4.28
Jarque-Bera	9.52	8.74	12.22	13.42	14.2	16.81	11.12	11.88	16	53.65	16.28	53.33	27.31	14.95
Probability	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Observations	189	189	189	189	189	189	189	189	189	189	189	189	189	189

for Russia the inflation rate hiked more recently due to the financial sanctions imposed by the US and the European Union during the Ukrainian conflict. The Global oil production (GOP) has slowly increased over the years and in a steady path as the standard deviation of the GOP is very small. The small increase in GOP occurs despite the fact that the proven reserves of oil have, according to the U.S. Energy Administration, increased by 60% from 1999 to 2014. It means that oil producers, for market disruption, did not produce as much oil as they could. The global real activity index, as shown by its high standard deviation, is very volatile. This may be caused by the fact that the study period covers many crisis such as the 2000s energy crises, the 2008 global financial and economic crisis, the EU sovereign debt crisis and expansionary periods; thus, leading to significant changes in global real activity during the study period.

Methodology

As stated in Chapter 1, the shortcoming of previous studies with most of them using VAR models (Rault and Arouri (2009), Paytakhi (2012) is that oil price shocks are taken as exogenous. It means that the shocks do not influence each other. In contrast, this paper, following Killian (2009), uses a SVAR model where oil price shocks are taken as endogenous. A VAR model, as explained by Stock and Watson (2001), is a set of simultaneous equations that allows each variables from this set of equations to be impacted by their own lags as well as by the lags of other variables implemented within the model. For instance, in this paper it allows the monthly change stock in stock market index returns to be impacted by its lagged values as well as by the lagged values of the monthly change of the three kinds of oil price shocks. The two main advantages that VAR process are that it allows for Impulse Response Analysis and Variance decomposition. An impulse response refers to the reaction of one variable in response to the change in another variable which in this research is the response of the stock market indices to the different kinds of oil price shocks. The variance decomposition shows, for instance, in this paper to what extent shocks are responsible for the variability of the stock market indices. A SVAR model is a VAR that keeps the same advantages with the unique difference that we add a structure, explained by economic theory, to the error terms.

In this paper, the endogenous variables are the stock market indices and the three kinds of oil price shocks: oil supply shock, aggregate demand shock and the oil-specific demand shock. As explained by Killian (2009), it is generally accepted that the state of macroeconomic fundamentals which are reverberated within

stock prices influences oil prices and that oil prices also impact macroeconomic fundamentals (Hamilton's 1983). Thus, the shocks and the stock market should be treated as endogenous due to the fact that the shocks are dependent on each other and on the stock market. As a reminder from the previous chapter, oil supply shocks are changes in oil production, for instance, driven by policy decisions made by the cartels such as the OPEC and due to conflicts occurring in the Middle East. Aggregate-demand shocks are related to the state of the economy. For instance, if there is a recession in the US, stocks returns would drop but the demand for oil would also be reduced. Oil-specific demand shocks are caused by future expectations on the price of oil – it means that if one expects the price of oil to increase in the future, he will buy more oil today. The difference between the three kinds of oil price shocks in extensively explained in Barsky and Kilian (2004) and in Killian (2009).

In order to identify if the variables are suitable for a SVAR model, one needs to check, first, if the variables are stationary. Non-stationary time-series often encounter a spurious regression problem. This problem means that the estimates of non-stationary variables show a significant relationship between two variables when this relationship does not exist. In order to test for stationarity, an unit root test, the Augmented Dickey-Fuller (ADF) test is performed as presented by Said and Dickey (1984). The formula of the ADF test is presented below in equation 2. The null hypothesis of the test is as follows: if γ equals zero, the variable has a unit root and the time series is non-stationary. The rejection of the null hypothesis H_0: $\gamma = 0$ would mean that the variable does not have a unit root and is stationary.

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{n} (\beta_j \Delta y_{t-i}) + \varepsilon_t \tag{2}$$

Where y_t represents the dependent variable at time t, Δy_{t-1} is the first difference of the lagged variable y_t, ε_t are the residuals and, γ is the coefficient which will be used to test the null hypothesis.

Once the variables are stationary, the VAR estimation can be performed. VAR models capture the linear interdependence between time series; where the evolution of the variables is explained using their own lags and the lags of the other variables. The reduced VAR equation used by Killian (2009) is presented below in equation (3), where Y_t consists of the (n*1) vector of endogenous variables which is this paper are the three kind of oil price shocks and the stock market indices' returns. Y_{t-i} is a (n*1) vector of the lagged endogenous variables, A_0 is a (n*n) vector of constant. A_i is a (n*n) vector of the unknown coefficient of

the lagged endogenousvariables. The error terms or residuals of the VAR model are denoted by e_t and represent the uncorrelated structural error terms.

$$Y_t = A_0 + \sum_{i=1}^{n} A_i Y_{t-i} + e_t \tag{3}$$

The number of lags is crucial for our VAR process; if not enough lags are used, the model loses information. For instance, a variable may impact significantly the model after 5 lags, thus if there are 4 lags or less, this variable will be insignificant. Using too many lags, on the other hand, would increase the number of parameters to estimate, hence reducing the degree of freedom of the model. For that, an Aikike Information Criterion is performed.

After choosing the optimal lags of the VAR, we must take the residuals from the VAR to which we give a structure based on the different kinds of shocks. The structure enables the model to identify the effects that each shock has on the stock market index. The structure of the SVAR model noted in equation 5 is the same as the one adopted by Killian (2009), where e_t represents the residual from the VAR equation, e_{nt} represents a white noise process and a_{11}, ..., a_{44} are the estimated parameters. The matrix below (5) shows that oil supply shock isonly affected by its own lags but it can affect all the other variables. Aggregate demand shock is affected by its own lags and by the oil supply shocks, oil-specific demand shocks. Oil specific demand shock is affected by its own lags and by oil supply shocks and aggregate demand shocks, while other shocks to stock returns are affected but all the other variables plus its own lags. The rationale behind this set of restriction is that firstly, according to Killian (2009), oil supply shock does not respond immediately to changes in demand shocks as the cost of adjusting production is high. Secondly, changes in the real price of oil do not immediately impact the aggregate demand, but changes in supply are due to the fact that changes in oil supply may impact business cycles thus, aggregate demand. Thirdly. The oil-specific shocks are impacted by both the supply and the aggregate demand due to the supply and demandeconomic law. Fourthly, other shocks to stock markets may be impacted by the three kinds of oil price shocks. An extensive explanation on the set of restriction is discussed in Killian (2009).

$$e_t = \begin{pmatrix} e_{1t}^{\Delta \textit{global oil production}} \\ e_{2t}^{\Delta \textit{global real activity}} \\ e_{3t}^{\Delta \textit{real price of oil}} \\ e_{4t}^{\Delta \textit{Stock returns}} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{23} & a_{33} & 0 \\ a_{41} & a_{24} & a_{34} & a_{44} \end{bmatrix} \begin{pmatrix} \varepsilon_{1t}^{\textit{oil supply shock}} \\ \varepsilon_{2t}^{\textit{aggregate demand shock}} \\ \varepsilon_{3t}^{\textit{oil-specific demand shock}} \\ \varepsilon_{4t}^{\textit{other shocks to stock returns}} \end{pmatrix} \tag{5}$$

From the above matrix, we can perform a variance decomposition which enables the verification of the first and second hypothesis. These hypotheses state that the different oil price shocks impact stock markets differently and that the impact on emerging markets is greater than on the developed ones. To verify the third hypothesis, we first create two sub-periods. The first one covering the period from January 1999 to July 2008 and the second, from January 2009 to October 2014. The 2008 financial crisis was purposely omitted as the stocks decreased drastically during that time period and the real price of Brent oil increased exponentially. Therefore, this period would bias the model. After two variance decompositions per country are performed and compared.

Results

Table 2 presents the outcomes of the ADF test performed for each variable used within thispaper. Stock returns in all countries have no unit root properties in levels – it means that thetime series is stationary, thus all the variables have no persistent impacts. Global Oil Production(GOP) and Real Brent oil price in the given countries (RBUS, RBUK, RBDE, RBRU, RBCNand, RBIN) are also stationary at levels.Global Real economic Activity (GRA) fails to rejectthe hypothesis at a 1% confidence interval without trend and at a 10% confidence interval withtrend at levels but they reject the null hypothesis in the first difference. Therefore, this variablewill be transformed by its fist difference.

Table 3 presents the summary of the variance decomposition (see appendix B) of each analyzed stock market index estimated through the structural vector auto-regression presented in equation 6. This table shows the impact that oil price shocks and other shocks to stock markets have, in percentage terms, on the variability of the analyzed stock markets. As a reminder, the stock market are the S&P500, FTSE100, DAX, RTS, SSEC, and BSE30 for the US, the UK, Germany, Russia, China, and India, respectively. Impulse response analysis could also have been performed. Unfortunately, a problem arises due to the computing limitations of the software used. The significance levels for the structural decompositions are not available within the program; therefore, shock significance cannot be known. Despite the fact that they could have been added using coding, the author could not write the codes due to its complexity which would have require attending a full course on eviews7 programming. Therefore, IRFs are omitted and left for further research.Table 3 enables one to answer the first and the second hypothesis. With the first hypothesis which states that oil price shocks impact stock markets differently and the second stating that emerging markets are more

Table 2. ADF unit root test.

	Level		First difference	
Variables	**Without trend**	**With trend**	**Without trend**	**With trend**
GOP	-12.19 ***	-12.16 ***	-11.73 ***	-11.69 ***
GRA	-2.93 **	-2.96	-10.10 ***	-10.14 ***
RBUS	-11.63 ***	-11.80 ***	-11.03 ***	-11.00 ***
RBUK	-11.51 ***	-11.70 ***	-11.00 ***	-10.96 ***
RBDE	-11.51 ***	-11.69 ***	-10.93 ***	-10.90 ***
RBRU	-11.61 ***	-11.68 ***	-10.95 ***	-10.91 ***
RBCN	-11.47 ***	-11.67 ***	-10.69 ***	-10.65 ***
RBIN	-11.41 ***	-11.64 ***	-11.04 ***	-11.01 ***
USR	-12.39 ***	-12.46 ***	-14.02 ***	-13.99 ***
UKR	-13.38 ***	-13.38 ***	-11.31 ***	-11.27 ***
DER	-12.18***	-12.16 ***	-11.05 ***	-11.03 ***
RUR	-11.33 ***	-11.61 ***	-10.90 ***	-10.88 ***
CNR	-07.86 ***	-07.85 ***	-14.22 ***	-14.19 ***
INR	-13.96 ***	-13.92 ***	-14.34 ***	-14.30 ***

Note 1: At levels, the critical value without trend is, with 1% significance level, -3.46 and the critical value with trend is -4.00.
Note 2: *** means significant at 1% significance level while ** means significant at 5% significance level.

impacted by oil price shocks than developed ones. For the US, the impact of supply shocks are negligible in the short-run and, they account in the long-run for 4.37% of the total variability of the stock market. This estimation is in line with Kilian and Park (2009) which stated that supply shocks are not important for the US stock market. Also, both demand shocks impact the stock market to more or less the same extent in the long run; at 10.4% for the aggregate demand shocks and at 9.93 for the oil-specific ones. The predominance of demand shocks is in line with Kilian and Park (2009). Also, we can see that the impact of the three oil price shocks is bigger in the long term as they account for 24.34%. While in the short run, they account for 18.39%. This may be due to the fact that companies and investors do not react instantly to change in oil prices due to the switching costs. From those findings, two recommendations for people investing in the American stock market can be made. The first one is to look at the global economy, thus at

Table 3. Variance decompositions summary with values in %

	Supply shocks					
	US	**UK**	**DE**	**RU**	**CN**	**IN**
Short-run	0.04	0.16	0.46	0.02	1.35	4.07
Long-run	4.37	3.19	2.93	0.27	1.75	5.27
	Aggregate demand shocks					
	US	**UK**	**DE**	**RU**	**CN**	**IN**
Short-run	8.08	8.86	11.55	17.23	19.82	13.26
Long-run	10.04	11.52	13.2	19.92	21.3	15.44
	Oil-specific demand shocks					
	US	**UK**	**DE**	**RU**	**CN**	**IN**
Short-run	10.27	10.14	8.77	18.74	1.78	5.3
Long-run	9.93	10.13	8.86	19.76	2.56	5.3
	Sum all oil price shocks					
	US	**UK**	**DE**	**RU**	**CN**	**IN**
Short-run	18.39	19.16	20.78	35.99	22.95	22.63
Long-run	24.34	24.84	24.99	39.95	25.61	26.01

the aggregate demand. If there is a contractionary global economy, the investor should sell assets. On the other hand, if the economy is expansionary, the investor should buy assets. The second recommendation is that the investor should look at the feelings that people have regarding the future demand and supply of oil. As oil supply has been quite stable during the study period which covers 15 years, investors have only to look at people's expectations regarding demand. If people think that oil supply will increase, investors should buy assets due to the fact that oil prices will go down. On the other hand, if people believe that the supply of oil will decrease, one should sell its assets.

The long-run impact of oil price shocks on the British stock market returns accounts for 24.85% of the total variation of the stock market, while they account only for 20.16% in the short-run. For the UK, supply shocks account for 3.19% of the total variation which is negligible just like for the US. Together, demand shocks impact the stock market by 21.65% withaggregate demand shocks representing 11.52% of the total variation of the stock market and oil-specific demand

shocks 10.13%. The conclusion for the British stock market is the same as for the American one; investors have to focus on the feeling that people have regarding the future demand of oil as well as on the state of the global economy.

Supply shocks results for Germany are the same as for the US and the UK. In the long run, they are smaller than for the two markets described above, thus they are still negligible. While for the US and the UK, the difference in impact between oil-specific shocks and aggregate demand shocks is not higher than 1.39%. For Germany, the aggregate-demand shocks impact the stock market by 4.34% more than oil-specific demand shocks. This may be due to the fact that as Germany is an export oriented country, the global economy is important for the companies within the DAX. As weaker global demand leads to fewer exports. It may also be due to the importance of the automobile industry within the stock market. Companies such as Volkswagen, BMW, and Daimler (which owns Mercedes) are listed in the DAX, thus when there is a global recession, with a high unemployment rate, people do not buy cars which impacts the earnings of those automobile companies. To explain the lesser importance of oil-specific shock, one may look at the composition of the stocks. The DAX lists less oil-related companies than the FTSE100 and the S&P500 do. The recommendation for stockholders investing in this stock market is to mainly focus on the state of the global economy before investing in the German stock market.

Not surprisingly, the Russian stock market is the market which is the most impacted by oil price shocks compared with any country analyzed in this paper. Russia is impacted at 35.99% in the short and at 39.95% in the long-run by oil price shocks. This is due to the fact that the Russian economy is completely dependent on its oil sale. It is also caused by the fact that a big share of the Russian stock market is composed of companies competing in the oil market such as Gazprom, Lukoil and Rosneft. Therefore, when oil prices change, the dominantcompanies within the Russian stock market have changes in earnings, thus in dividend payouts. As for other stock market, supply shocks are negligible. On the contrary, both demand shocks are significant; together, they account for 35.99% in the short run and 39.95% in the long run of the total variation of the stock market. Those results are in line with Fang (2010) that found that for Russia, supply shocks are not significant but both demands shocks are. For investors, this finding is important as it means that oil prices are very important for the Russian stock market. On the one hand, when oil prices increase due to global economy expansion, returns may be done within the Russian stock market as in any other emerging country. On the other hand, when the global economy is in recession, oil price drops, thus leading to a decrease in oil sales which leads to a decrease in earnings for major Russian companies. Therefore, investors should invest in

Russia only when they think that there is a global economy expansion as well as when they feel that despite a constant supply, people think that the supply will decrease, thus increasing demand for oil for precaution.

The Chinese stock market is only impacted by aggregate demand shocks; they account for 21.30% of the variation of the stock. This can be explained by the fact that the Shanghai Composite Index does not list oil directly-oriented companies, thus oil-specific demand shocks are smaller than for the US, the UK and Germany. Due to the fact that China is export-oriented, aggregate demand drives its economy. The explanation about the importance of the aggregate demand in the Chinese stock market is simple. When price of oil goes up due to an increasing demand, Chinese companies increase their costs, but as they sell more due to the expansionary state of the global economy, their earnings also increase. Here, investors have to focus on the state of the global economy. When the global demand is increasing, it means that Chinese companies sell more of their product, thus increase the cost of the shares.

Last but not least, just like for China, the Indian stock market is also impacted mainly by aggregate demand shocks. The explanation about the small impact of oil-specific demandshocks is the same like for China. The difference in the importance of aggregate demand shocks on the Indian stock market compared to the Chinese one is that the Indian economy is less export oriented than the Chinese one. Here, just like for China, investors have to look at the state of the global economy.

To summarize the findings about the impact of oil price shocks on stock markets are driven by demands shocks as suggested by Killian and Park (2009). In none of the analyzed stock markets, supply shocks impact the stock markets by more than 5.27%. In contrast, aggregate demand shocks can vary from 10.04% to 21.3% and oil-specific demand shocks from 5.3% to 19.76%. This research illustrates the fact that emerging markets are mainly impacted through aggregate demand shocks, while developed markets are impacted by both demand shocks with both holding the same weight.

Table 3 also enables one to answer the second hypothesis which states that emerging markets are more impacted by oil price shocks than developed ones. In the table 3 we can see that the sums of the impact of oil price shocks are more or less equal for all countries with the exception of Russia for the reasons mentioned above. Therefore, we can say that oil price shocks impact both kinds of stock markets in the same manner. But as stated in the previous paragraph, emerging markets, with the exception of Russia, are mainly impacted by aggregate demand shocks while developed ones are impacted to more or less the same extent by both demand shocks. The difference in the impact of aggregate demand may be

explained by the fact that emerging market companies are more export-oriented than the ones in developed markets. Therefore, global recession or expansion will impact more companies' business cycles in emerging markets. In contrast, if there is a recession in Europe, American companies will have their earnings diminished but to a lesser extend as there is still a strong demand at home. The difference in impact for oil-specific demand shocks may be explained by the fact that the European and American stock markets list some of the major oil-related companies such as BPand Chevron. While emerging markets list fewer oil-related companies; therefore, Chinese and Indian companies are not impacted by oil-specific shocks.

In order to verify the third hypothesis that states that the impact of oil price shocks diminished over time, we created two SVAR covering two different sub-periods. The first one starting from January 1999 to July 2008 and the second one covering the period starting in January 2009 and finishing in October 2014. As stated in chapter 3, the financial crisis period was omitted in order for the aggregate demand shocks not to be too much dominant. The findings can be found in table 4 which summarizes the tables from appendix C.

From table 4, one can see that for all stock markets, the impact of oil price shocks have increased in the long run, by 6.55% in the US, 10.39% in the UK, 10.03% in Germany, 43.83% in Russia, 15.8% in China and, 6.97% in India. Those results are surprising when compared with the literature. One of the reasons of the differences may be that Blanchard and Gali (2010) used a VAR rather than a SVAR methodology and therefore, no distinction between the shockswas made. Another reason may be due to the fact that the crisis experienced in 2008 which was the biggest global recession since the oil crisis of the 1970s had repercussions on the oil-specific demand. One of the reasons to believe that these results are alright is the increasing importance of oil-specific demand shocks between the two sub-samples. Oil-specific demand shocks may have increased due to the fact that people were unsure about the price of oil after the exponential increase and decrease in oil price shocks after the 2008 financial crisis. The increasing impact of oil price shocks on the Russian stock market may be due to the importance of oil companies of its stock market. Therefore, an increase or a decrease within the oil-specific demand shock impacts directly those companies' earnings, while before the crisis, oil-specific demand shocks were quite stable.

Table 4. Variance decompositions summery of the sub-samples with values in %

Supply shocks												
	US1	**US2**	**UK2**	**UK2**	**DE1**	**DE2**	**RU1**	**RU2**	**CN1**	**CN2**	**IN1**	**IN2**
Short-run	5.69	2.13	7.24	0.88	0.46	0.29	5.36	0.43	3.52	10.31	0.63	6.56
Long-run	7.55	4.35	8.99	6.45	2.93	2.48	6.38	2.53	4.53	9.94	2.7	8.88
Aggregate demand shocks												
	US1	**US2**	**UK2**	**UK2**	**DE1**	**DE2**	**RU1**	**RU2**	**CN1**	**CN2**	**IN1**	**IN2**
Short-run	10.69	5.62	3.19	7.49	11.54	1.38	8.82	0.17	13.87	10.8	7.48	0.88
Long-run	12.61	6.72	5.89	7.25	13.3	4.66	9.66	3.35	15.93	12.31	14.57	1.41
Oil-specific demand shocks												
	US1	**US2**	**UK2**	**UK2**	**DE1**	**DE2**	**RU1**	**RU2**	**CN1**	**CN2**	**IN1**	**IN2**
Short-run	0.11	14.99	0	12.9	8.76	22.03	0.7	56.52	0.37	11.79	0	15.25
Long-run	2.01	17.65	2.79	14.36	8.87	27.99	1.78	55.77	1.29	15.3	1.05	15
Sum all oil price shocks												
	US1	**US2**	**UK2**	**UK2**	**DE1**	**DE2**	**RU1**	**RU2**	**CN1**	**CN2**	**IN1**	**IN2**
Short-run	16.49	22.74	10.43	21.27	20.76	23.7	14.88	57.12	17.76	32.9	8.11	22.69
Long-run	22.17	28.72	17.67	28.06	25.1	35.13	17.82	61.65	21.75	37.55	18.32	25.29
Difference between subsample 1 and 2												
	US	**UK**			**DE**		**RU**		**CN**		**IN**	
Short-run	6.25	10.84			2.94		42.24		15.14		14.58	
Long run	6.55	10.39			10.03		43.83		15.8		6.97	

Note: the number on the left of the country name represents the sub-period, with 1 being the sub period covering January 1999 to July 2008 and 2, January 2009 to October 2014.

Conclusions

All hypotheses were verified using a Structural Vector Auto regression framework. The first hypothesis that states that the kind of oil price shocks impacting stock markets were different for all countries is verified. We saw that all stock markets respond to the different oil price shocks in different manners depending on the state of their economy and of the companies listed within their stock market. The US and the UK are quite similar and are impacted by both aggregate demand and oil-specific demand shocks. Germany is impacted mainly by aggregate demand shock as does China and India. This is due to the fact that the three countries are export-oriented and therefore a decreasing global demand impacts negatively companies' earnings and vice-versa for an increasing global demand. Also, oil-specific demand shocks on the German stock exchange have a smaller impact than on the UK and the US due to the fact that the DAX has fewer companies directly dealing in the oil market. Not surprisingly, Russia is impacted by aggregate demand and oil-specific demand shocks. This is due to the fact that as Russia is an oil-exporting country, when there is a change in the global demand for oil, its companies' earnings are directly impacted. The fact that oil price shocks impact more emerging markets than developed ones is refuted. Russia is not taken into account due to the dependence of its stock market in the oil market, all stock markets are impacted to more or less the same extent. What changes is the source of the oil price shocks. Emerging markets are impacted almost completely by aggregate demand shocks while the developed ones by both aggregate demand and oil-specific demand shocks. The reasons for this difference is explained in the above country-specific explanation. The third hypothesis is also refuted as the results show that the impact of oil price shocks increased over time. That increase mainly comes from oil-specific demand shocks. As an explanation for that phenomenon, we argued that this increase may come from the uncertainty regarding the demand for oil, thus increasing abnormally the demand foroil, creating a gap between the supply and the demand. Policy makers can also use the results from this paper in order to reduce the impact that oil price shocks have on their stock markets. For example, China is too much receptive to the global economy and therefore contagion problems from the global economy may arise. Chinese authorities may decide to invest in the local demand or in companies which are not impacted by recessions such as the luxury market in order to diminish oil price shock impacts.

From all the results discussed above, risk taking investors must understand that if they expect a change in the price of oil coming from the aggregate, they should invest in Russia, China and India. Risk averse investors expecting a change

in the oil of price caused by oil-specific shocks should also invest in those markets, except Russia, as they do not respond to those shocks. Investors thinking that oil-price shocks are driven by both aggregate demand and oil-specific demand shocks should invest in Russia as it is the stock market which is the most affected by oil price shocks. Developed markets namely, the US, the UK and Germany, should attract investors which do not know from where oil-price shocks come.

Due to the complexity of the SVAR methodology, confronting the results of this research with another one would be useful. That study could use the same data and methodology to enable a proper comparison. One may also decide to check if an asymmetry in effects exists as such a hypothesis using the SVAR methodology was not tested yet. Further research could use, just, as Fang (2010) did a SVAR parameter estimation in order to check the significance level and the direction of the oil price shocks impacts.

Bibliography

Abhyankar, Xu and Wang, 2013, *Oil price shocks and the stock market: Evidence from Japan.* "Energy journal", Vol. 34:2, 199–222.

Al-Mulali, U., *The impact of oil shocks onChina'sGDP: a time series analysis.*"OPEC Energy Review", Vol. 37:1, 20–29.

Blanchard and Gali, 2010, *The Macroeconomic Effects of Oil Price Shocks: Why are the 200sso different from the 1970s?,"*International Dimension of Monetary Policy", Universityof Chicago Press, 373–421.

Bjørnland, 2009, *Oil price shocks and stock market booms in an oil exporting country*. "Scottish Journal of Political Economy", Vol. 56:2, 232–254.

Cinner, C,. 2001, *Energy shocks and financial markets: nonlinear linkages*. "Studies in Non-linear Dynamics and Econometrics", Vol. 5:3, 203–2012.

Cong, Wei, Jiao and Pan, 2008, *Relationships between oil price shocks and stock market: Anempirical analysis from China*, "Energy Policy", Vol. 36:9, 3544–3553.

Effiong, Ekpeno L., 2014, *Oil price shocks and Nigeria'sstock market: what have we learnedfrom crude oil market shocks?* OPEC Energy Review, Vol. 38:1, 36–58.

Fang, C., 2010, *The impact of oil price shocks on the large emerging countries'stock prices:Evidence from China, India and Russia. "*International Review of Economics andFinance". Vol. 29, 330–338.

Gisser, M., and Goodwin, T.H. 1986. *CrudeOil and the Macroeconomy: Tests of Some-Popular Notions*, "Journal of Money, Credit and Banking", Vol. 18:1, 95–103.

Hamilton J. D., 1983. *Oil and the Macroeconomy since World War II*."Journal of Political Economy", Vol. 91, 228–48.

Hamilton J.D., 1985. *Historical causes of Postwar Oil shocks and Recessions*, "Energy Journal, Vol. 6, 97–116.

Huang, R., R. Masulis, and H. Stoll. 1996. *Energy shocks and financial markets*. "Journal of Futures Markets", Vol. 16, 1–27.

Jones, C., and Kaul, G., 1996. *Oil and stock markets.*"Journal of Finance", Vol. 51, 463–91.

Millard and Shakir, 2013, *Oil shocks and the UK economy: the changing nature of shocks andimpact overtime.* "Bank of England Quarterly Bulletin", Vol. 53:3, 282–282.

Katayama, 2013, *Declining effects of oil price shocks,*"Journal of Money, Credit & Banking", Vol. 45:6, 977–1016.

Kilian, L. 2008. *Exogenous Oil supply shocks: how big are they and how much do they matterfor the U.S. Economy*, "Review of Economics and Statistics", Vol. 90, 216–240.

Kilian, L. 2009. *Not oil price shocks are Alike: disentangling Demand and Supply shocks in thecrude oil market*. "American Economic Review", Vol. 99:3, 1053–1069.

Kilian, L., and Park, C., 2009. *The impact of oil price shocks on the US stock market.*"International Economic Review", Vol. 50, 1267–87

Lin, Fang and Cheng, 2010, *Relationships between oil price shocks and stock market: an empirical analysis from Greater china*. "China Economic Journal", Vol. 3:3, 241–254.

Mork, K.A., 1989, *Oiland the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton's Results*, "Journal of Political Economy", Vol. 97:3, 740–744.

Mork,Olsenand,Mysen.1994.*Macroeconomic responses to oil price increases and decreases in seven OECD countries*. "EnergyJournal", Vol. 15:4, 19–35.

Ono, S., 2011. *Oil Price Shocks and Stock Markets in BRICs.*"The European Journal of Comparative Economics", Vol. 8:1 29–45.

Paytakhi, O., 2012, *Oil price shocks and stock market in oil exporting country: evidence fromIran stock market.*"OPEC Energy Reviews", Vol. 36:4, 396–417.

Papapetrou, E., 2001, *Oil Price Shocks, Stock Market, Economic Activity and Employment inGreece*, "Energy Economics", Vol. 23, 511–532.

Park, J., Ratti, R.A., 2008, *Oil price shock markets in the US and 13 European countries*."Energy Economics", Vol. 30, 2587–2608.

Rault, Arouri, 2009, *Oil prices and stock markets in GCC countries: Empirical evidencefrom Panel analysis,* "International Journal of Finance & Economics", Vol. 17:3, 242–253.

Sadorsky, P., 1999, *Oil price shocks and stock market activity.*"Energy Economics", Vol. 21, 449–469.

Said, Dickey, 1984. *Testing for unit roots in autoregressive-moving average models ofunknown order*, "Bioketrika", Vol. 71:3, 599–607.

Shahriar, Mahbobi, 2013, *The increasing influence of oil prices of the Canadian stockmarket, "*The International Journal of Business and Finance Research", Vol. 7:3, 27–37.

Stock J. and Watson. M., 2001, *Vector Autoregressions*, "Journal of Economic Perspectives", Vol. 15:5, 101–115.

Lutz Kilian homepage, 2014. [Online] Available from: <http://www-personal.umich.edu/~lkilian/reaupdate.txt>. [Accessed: 20th December 2014]

OECD database, 2014. [Online} Available from: <http://stats.oecd.org/Index.aspx?querytype=view&queryname=221>. [Accessed: 8th December 2014]

U.S. Energy Information Administration, 2014. Weekly retail gasoline and diesel prices. Available from: EIA Database. [Accessed: 8th December 2014]

Yahoo Finance, 2014. Stock market index quotation 01/01/1999 to 31/10/2014. *S&P500,FTSE100, DAX, RTS, SSEC, BSE*. Available from: Yahoo finance database [Accessed: 8th December 2014].

Appendices:

Appendix A: Data descriptions and sources.

Appendix A.1: Data descriptions and sources			
Variable name	**Variable representation**	**Data frequency**	**Data source**
Global oil production	Supply shock	Monthly	U.S. Energy Administration
Global economic Activity	Aggregate demand shock	Monthly	Killian personnal webpage
Consumer price index	Consumer Price index	Monthly	OECD database
Nominal price of brent oil price	Nominal Price of oil	Monthly	U.S. Energy Administration
Real price of brent oil price	Oil-specific demand shock	Monthly	Transformed by the author
BSE30	Indian Stock Returns	Monthly	Yahoo Finance
FTSE100	British Stock Returns	Monthly	Yahoo Finance
S&P500	American Stock Returns	Monthly	Yahoo Finance
SSE100	Chinese Stock Returns	Monthly	Yahoo Finance
DAX	German Stock Returns	Monthly	Yahoo Finance
RTS	Russian stock returns	Monthly	Yahoo Finance

Appendix B: Variance decomposition of each stocks.

Appendix B.1: USR Variance decomposition in %							Appendix B.2: UKR Variance decomposition in %						Appendix B.3: DER Variance decomposition in %					
Period	S.E.		GOP	DGRA	RBPUS	Other shocks	Period	S.E.	GOP	DGRA	RBPUK	Other shocks	Period	S.E.	GOP	DGRA	RBPDE	Other shocks
	1	0.77	0.04	8.08	10.27	81.61	1	0.76	0.16	8.86	10.14	80.84	1	0.76	0.46	11.55	8.77	79.22
	2	0.78	1.58	8.64	10.14	79.64	2	0.78	1.97	8.98	9.90	79.15	2	0.78	1.01	12.03	8.95	78.02
	3	0.80	4.39	9.52	9.66	76.42	3	0.80	3.18	11.07	9.88	75.87	3	0.80	2.94	12.89	8.69	75.48
	4	0.81	4.36	10.03	9.74	75.87	4	0.81	3.17	11.47	9.99	75.37	4	0.81	2.93	13.31	8.70	75.05
	5	0.81	4.35	10.03	9.93	75.69	5	0.81	3.18	11.52	10.12	75.18	5	0.81	2.93	13.30	8.85	74.92
	6	0.81	4.37	10.03	9.93	75.67	6	0.81	3.19	11.51	10.13	75.17	6	0.81	2.93	13.30	8.86	74.91
	7	0.81	4.37	10.03	9.93	75.67	7	0.81	3.19	11.52	10.13	75.16	7	0.81	2.93	13.30	8.86	74.91
	8	0.81	4.37	10.04	9.93	75.66	8	0.81	3.19	11.52	10.13	75.16	8	0.81	2.93	13.30	8.86	74.90
	9	0.81	4.37	10.04	9.93	75.66	9	0.81	3.19	11.52	10.13	75.16	9	0.81	2.93	13.30	8.86	74.90
	10	0.81	4.37	10.04	9.93	75.66	10	0.81	3.19	11.52	10.13	75.15	10	0.81	2.93	13.30	8.86	74.90
	11	0.81	4.37	10.04	9.93	75.66	11	0.81	3.19	11.52	10.13	75.15	11	0.81	2.93	13.30	8.86	74.90
	12	0.81	4.37	10.04	9.93	75.66	12	0.81	3.19	11.52	10.13	75.15	12	0.81	2.93	13.30	8.86	74.90
	13	0.81	4.37	10.04	9.93	75.66	13	0.81	3.19	11.52	10.13	75.15	13	0.81	2.93	13.30	8.86	74.90
	14	0.81	4.37	10.04	9.93	75.66	14	0.81	3.19	11.52	10.13	75.15	14	0.81	2.93	13.30	8.86	74.90
	15	0.81	4.37	10.04	9.93	75.66	15	0.81	3.19	11.52	10.13	75.15	15	0.81	2.93	13.30	8.86	74.90

Appendix B.4: RUR Variance decomposition in %							Appendix B.5:. CNR Variance decomposition in %						Appendix B.6: INR Variance decomposition in %					
Period	S.E.		GOP	DGRA	RBPRU	Other shocks	Period	S.E.	GOP	DGRA	RBPCN	Other shocks	Period	S.E.	GOP	DGRA	RBPINR	Other shocks
	1	0.78	0.07 *	0.28	14.20	85.44	1	0.76	1.35	19.82	1.78	77.06	1	0.75	4.07	13.26	5.32	77.35
	2	0.81	1.02 *	0.82	15.96	82.20	2	0.78	1.32	20.67	2.55	75.45	2	0.76	4.24	13.24	5.32	77.21
	3	0.85	3.37	1.34	16.40	78.90	3	0.80	1.75	21.31	2.55	74.39	3	0.81	5.24	15.30	5.21	74.24
	4	0.86	4.43	6.83	14.76	73.98	4	0.81	1.75	21.32	2.56	74.38	4	0.81	5.25	15.45	5.20	74.10
	5	0.88	4.66	6.86	14.92	73.56	5	0.81	1.75	21.30	2.56	74.40	5	0.81	5.27	15.43	5.29	74.00
	6	0.88	5.25	9.78	18.48	66.48	6	0.81	1.75	21.30	2.56	74.39	6	0.81	5.27	15.43	5.30	74.00
	7	0.90	4.90	14.97	18.23	61.90	7	0.81	1.75	21.30	2.56	74.39	7	0.81	5.27	15.44	5.30	73.99
	8	0.90	5.30	14.82	19.42	60.46	8	0.81	1.75	21.30	2.56	74.39	8	0.81	5.27	15.44	5.30	73.99
	9	0.90	5.37	14.81	19.45	60.37	9	0.81	1.75	21.30	2.56	74.39	9	0.81	5.27	15.44	5.30	73.99
	10	0.92	6.34	14.01	22.25	57.40	10	0.81	1.75	21.30	2.56	74.39	10	0.81	5.27	15.44	5.30	73.99
	11	0.92	6.29	14.67	22.32	56.73	11	0.81	1.75	21.30	2.56	74.39	11	0.81	5.27	15.44	5.30	73.99
	12	0.93	6.26	14.59	22.37	56.79	12	0.81	1.75	21.30	2.56	74.39	12	0.81	5.27	15.44	5.30	73.99
	13	0.94	6.57	14.63	22.25	56.55	13	0.81	1.75	21.30	2.56	74.39	13	0.81	5.27	15.44	5.30	73.99
	14	0.94	6.51	14.73	22.57	56.19	14	0.81	1.75	21.30	2.56	74.39	14	0.81	5.27	15.44	5.30	73.99
	15	0.94	6.66	16.84	21.73	54.77	15	0.81	1.75	21.30	2.56	74.39	15	0.81	5.27	15.44	5.30	73.99

Appendix C: Sub-periods variance decompositions for each stocks

Appendix C.1: US variance decomposition sub-period 1						Appendix C.3: UK variance decomposition sub-period 1						Appendix C.5: DE variance decomposition sub-period 1					
Period	Error term GOP		DGRA	RBPUS	Other shocks	Period	Error term GOP		DGRA	RBPUS	Other shocks	Period	Error term GOP		DGRA	RBPUS	Other shocks
1	0.80	5.69	10.68	0.11	83.52	1	0.78	7.24	3.19	0.00	89.56	1	0.76	0.46	11.55	8.77	79.22
2	0.82	5.91	12.29	1.72	80.08	2	0.80	8.38	5.45	2.46	83.70	2	0.78	1.01	12.03	8.95	78.02
3	0.88	7.25	12.65	1.72	78.38	3	0.89	8.60	5.85	2.68	82.87	3	0.80	2.94	12.89	8.69	75.48
4	0.89	7.55	12.57	1.97	77.91	4	0.89	9.00	5.85	2.79	82.35	4	0.81	2.93	13.31	8.70	75.05
5	0.90	7.55	12.57	2.02	77.87	5	0.89	9.00	5.86	2.80	82.34	5	0.81	2.93	13.30	8.85	74.92
6	0.90	7.55	12.60	2.01	77.83	6	0.89	9.00	5.89	2.80	82.32	6	0.81	2.93	13.30	8.86	74.91
7	0.90	7.55	12.61	2.01	77.82	7	0.89	9.00	5.89	2.80	82.32	7	0.81	2.93	13.30	8.86	74.91
8	0.90	7.55	12.61	2.01	77.82	8	0.89	9.00	5.89	2.80	82.32	8	0.81	2.93	13.30	8.86	74.90
9	0.90	7.55	12.61	2.01	77.82	9	0.89	9.00	5.89	2.80	82.32	9	0.81	2.93	13.30	8.86	74.90
10	0.90	7.55	12.61	2.01	77.82	10	0.89	9.00	5.89	2.80	82.32	10	0.81	2.93	13.30	8.86	74.90
11	0.90	7.55	12.61	2.01	77.82	11	0.89	9.00	5.89	2.80	82.32	11	0.81	2.93	13.30	8.86	74.90
12	0.90	7.55	12.61	2.01	77.82	12	0.89	9.00	5.89	2.80	82.32	12	0.81	2.93	13.30	8.86	74.90
13	0.90	7.55	12.61	2.01	77.82	13	0.89	9.00	5.89	2.80	82.32	13	0.81	2.93	13.30	8.86	74.90
14	0.90	7.55	12.61	2.01	77.82	14	0.89	9.00	5.89	2.80	82.32	14	0.81	2.93	13.30	8.86	74.90
15	0.90	7.55	12.61	2.01	77.82	15	0.89	9.00	5.89	2.80	82.32	15	0.81	2.93	13.30	8.86	74.90

Appendix C.2: US variance decomposition sub-period 2						Appendix C.4: UK variance decomposition sub-period 2						Appendix C.6: DE variance decomposition sub-period 2					
Period	Error term GOP		DGRA	RBPUS	Other shocks	Period	Error term GOP		DGRA	RBPUS	Other shocks	Period	Error term GOP		DGRA	RBPUS	Other shocks
1	0.57	2.13	5.63	14.99	77.24	1	0.57	0.88	7.49	12.82	78.82	1	0.57	0.29	1.38	22.04	76.29
2	0.59	2.15	5.30	18.40	74.15	2	0.58	2.20	7.15	14.67	75.98	2	0.58	1.85	1.37	30.73	66.05
3	0.60	3.97	6.50	17.81	71.72	3	0.59	6.28	7.18	14.38	72.16	3	0.59	2.07	3.56	28.63	65.74
4	0.60	4.05	6.49	17.77	71.69	4	0.60	6.42	7.21	14.41	71.96	4	0.59	2.07	3.60	28.70	65.63
5	0.60	4.32	6.70	17.67	71.32	5	0.60	6.41	7.24	14.38	71.98	5	0.60	2.38	4.49	28.12	65.01
6	0.60	4.32	6.71	17.66	71.31	6	0.60	6.43	7.25	14.37	71.95	6	0.60	2.38	4.51	28.13	64.98
7	0.60	4.34	6.72	17.65	71.28	7	0.60	6.45	7.25	14.37	71.93	7	0.60	2.46	4.63	28.02	64.89
8	0.60	4.34	6.72	17.65	71.28	8	0.60	6.45	7.25	14.37	71.93	8	0.60	2.47	4.64	28.02	64.87
9	0.60	4.35	6.73	17.65	71.28	9	0.60	6.45	7.25	14.37	71.93	9	0.60	2.48	4.65	28.00	64.86
10	0.60	4.35	6.73	17.65	71.27	10	0.60	6.45	7.25	14.37	71.93	10	0.60	2.48	4.66	28.00	64.86
11	0.60	4.35	6.73	17.65	71.27	11	0.60	6.45	7.25	14.37	71.93	11	0.60	2.48	4.66	28.00	64.86
12	0.60	4.35	6.73	17.65	71.27	12	0.60	6.45	7.25	14.37	71.93	12	0.60	2.49	4.66	28.00	64.86
13	0.60	4.35	6.73	17.65	71.27	13	0.60	6.45	7.25	14.37	71.93	13	0.60	2.49	4.66	28.00	64.86
14	0.60	4.35	6.73	17.65	71.27	14	0.60	6.45	7.25	14.37	71.93	14	0.60	2.49	4.66	28.00	64.86
15	0.60	4.35	6.73	17.65	71.27	15	0.60	6.45	7.25	14.37	71.93	15	0.60	2.49	4.66	28.00	64.86

Chapter III.

The Impact of Fukushima Daiichi Nuclear Disaster on Stock Returns of Oil Corporations

Mariia Savchenko, CBRE Corporate Outsourcing / Lazarski University
0000-0003-0758-0506

From the very beginning of the development of human thought, people have been trying to understand and analyze various aspects of life that surrounds them. The history of energy, of natural resources from which it could be generated was born many centuries ago. In addition, with economic development, financial markets have also developed. However, the trading of oil corporations on the financial market, the processes there and reactions to events were also the subjects of research for many economists, investors and interested in the topic people.

Financial markets as aggregate of all possible buyers and sellers of financial securities are an integral part of many economies all around the world. As one of the most liquid markets in the economy, it has always been crucial to analyze all the factors and events that have a potential effect on the market's conditions. Liquidity describes the velocity degree to which the stock could be bought or sold; with this fact, the reaction of the financial market on the event is very rapid. With today's development of technological capabilities, the reaction of financial market on the smallest news or event is incredibly fast. Many investors and shareholders, capital owners and corporations can buy and sell financial instruments in less than a minute. That could be one of possible reasons why financial markets and indicators there can be a reflection of the current state of many corporations that are traded publicly.

With the development of stock market, many theories about the processes which had occurred there were discovered. For instance, the main idea of efficient-market hypothesis is that all available information about the stock is reflected in its price. From this theory, the direct implication states that it is impossible to "beat the market", i.e. to gain extra profit knowing some extraordinary information. In addition, the prices will react to any new information appearing. Information is assumed to be a key determinant of prices of stocks.

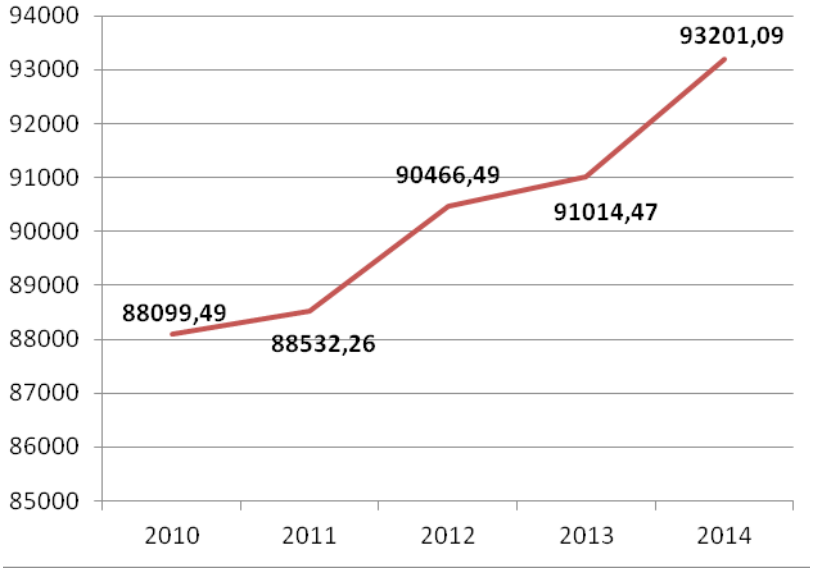
Hence, the stock returns which could be calculated from stock prices are also influenced by the theory.

The possibility to analyze and measure the impact of not all the information about the stock, but the specific identified event was developed as well. The event study is a very universal methodology which allows to measure the effects of any type of event on the direction and magnitude of stock price changes. It is possible to study stock market responses to both external (events outside the corporation) and internal (inside the corporation) factors. Assuming that the market is efficient and all the information existing is available for all the players on the market, the reaction of the stock prices and returns should be immediate. Another assumption of the paper which is taken from the efficient-market hypothesis is that investors are rational agents that take into account all information available on the market to make decisions whether to buy or sell stocks. The main objective of the paper is to find out whether investors of oil-related companies perceived Fukushima Daiichi event as a positive one, negative, or whether they were indifferent to it. The main research question is whether oil corporations' returns were affected by the event that happened in nuclear power industry.

The motivation behind this paper is great popularity of petroleum corporations and their trading on financial markets during many years. As an integral part of stock markets, oil corporations could be influenced by many external and internal events. Knowing the reaction to the events and their magnitude, it is possible to analyze its impact on corporations. Such an analysis could help in decision-making processes of the corporations' management. It could also be important for policy makers; it will be possible to see the reaction of publicly-traded oil corporations to some government announcements.

In the case of Fukushima catastrophe as an example of an event, its harmful influence on nuclear energy sector was widely discussed. Inside the energy sector, petroleum has many alternatives and possible substitutions. Nuclear power, which has developed during the last few decades, could be a substitute for oil in the nearest future. According to Nuclear Energy Institute, in 2012, 10.9% of the world's electricity production was generated by nuclear power plants (NEI, 2016). In 2014, this share was equal to 9.9% (NEI, 2016). As oil is non-renewable source of energy, during the last few years it is a very often question what will happen to the energy industry when oil deposits run out. What will the authorities of the countries which have oil deposits (USA, Norway, Russia, UAE etc.) do at the moment and what will happen to all oil corporations? According to US Energy Information Administration statistics, the supply of oil products increases from year to year. According to Graph 1 presented below, the increase of total oil supply in the world could be observed.

Graph 1. Total Oil Supply (Thousand Barrels Per Day).



Source. US Energy Information Administration (2016).

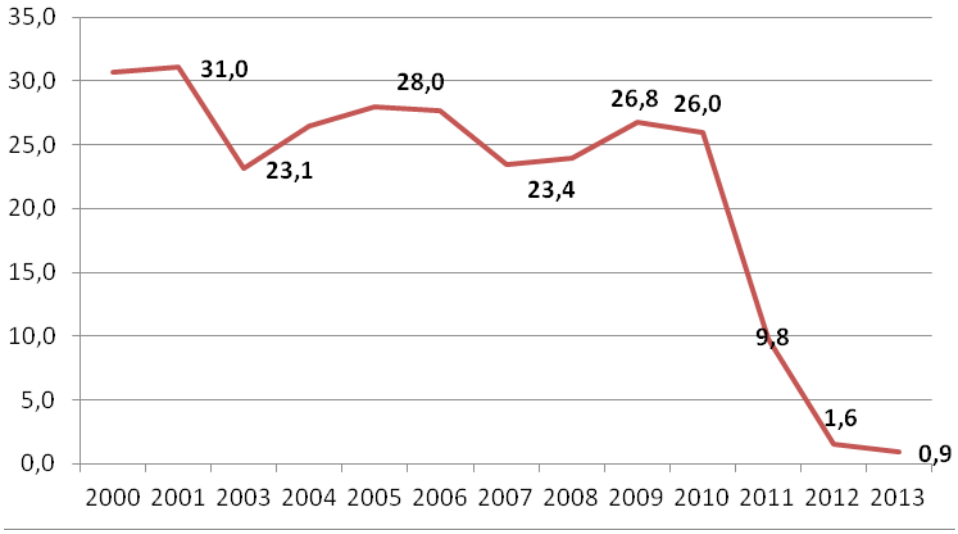
It is estimated that there are 1.3 trillion barrels of proven oil reserves left in the world's fields. With the present rates of consumption, it should last 40 years (The Institute of Mechanical Engineers, 2016). Hence, the alternative ways of energy generation should be developed. Nowadays, oil is still a very universal fuel for many types of technologies, machines and mechanisms all around the world.

While oil is an incredibly valuable part of many industries, it is important to understand whether Fukushima Daiichi disaster could influence the profitability of the corporations and whether this impact is big or small. Humanity is still dependent on oil, despite the development of possible substitutes, for instance, nuclear power. Hence, Fukushima accident that happened in the nuclear sector, which is considered to be more dangerous, unpredictable and less explored, could change the preferences of investors in energy sector and redirect their interest towards oil, as something long familiar and less risky. Whether such a substitution effect exists and whether the preferences of investors could be changed by some event is one of the main ideas of the paper.

The event in the nuclear sector, which may have such a powerful effect, happened in March 2011 in Japan. Fukushima Daiichi nuclear disaster was not only a devastating event for the environment and the lives of many people, but no less devastating for the nuclear sector as a whole. Such a great accident with

the highest level on The International Nuclear and Radiological Event Scale has shown the world authorities how unpredictable and still uncontrolled source of energy has been discovered by humanity. Without doubt, this event had a strong influence on the nuclear sector and its financial market. Graph 2 below illustrates the effect of Fukushima disaster on electricity production in Japan.

Graph 2. Electricity Production from Nuclear Sources in Japan (% of total).



Source: the World Bank (2016).

As it could be seen from Graph 2, in 2010, electricity production from nuclear sources was 26% of total amount produced in Japan; in 2011, it was 9.8% and 1.6% in 2012 (The World Bank, 2016.) However, to analyze whether it has affected oil stock exchange market as well is the main goal of the paper, because the effect of Fukushima disaster on the oil industry and its financial market was not studied so far.

The aim of the paper is to detect and analyze the character of the reaction of stock returns of petroleum corporations to the Fukushima Daiichi nuclear disaster using event study methodology. By selecting geographically distanced corporations, it is possible to measure and compare the reaction in different parts of the world. Using petroleum and nuclear statistics, it is possible to analyze whether the dependence and substitution effect between oil and nuclear power exists.

Fukushima disaster is the second tragedy in the nuclear sector after Chernobyl disaster in 1986 that has so great influence on many sectors of the world economy. Hence, the investment in oil corporations as a possible substitute for

nuclear ones could also be influenced by such a significant event. It is natural for investors of oil companies to react to some news and events and change their preferences.

The rates of return of the following oil corporations will be analyzed: CGG (France), CNOOC (China), InterOil Corporation (Papua New Guinea), Statoil ASA (Norway) and ExxonMobil (USA). All the corporations are publicly traded on NYSE. The choice of exactly these corporations could be explained by the fact that these companies are one of the biggest in the countries of their origin; all of them are publicly traded and have a big share on the oil market. For example, ExxonMobil is the world's 5th largest company by revenue in 2015 (Fortune, 2016). In addition, it is also possible to indicate the reaction to the event in different parts of the world, and that is one of the reasons of such a geographical variety. The effect could be different in other countries due to different shares of nuclear power usage in each of them and different relation of investors to this type of energy. For example, in 2014 in France, 74.7% of total amount of electricity produced was generated from nuclear sources; for the USA this share was equal to 19.2%; Chinese share was equal to 2.1%; the share was not available for Papua New Guinea and for Norway the share was 0% (The World Bank, 2016).

The main hypothesis of the paper is that the stock returns of oil corporations were affected positively by Fukushima disaster and the substitution of investors' preferences between oil and nuclear powers exist. Reacting to the negative event in the nuclear sector, it is possible that the investors will switch to another type of energy investment, which could be oil. It is assumed that the reaction effect will be positive, since investors of the energy sector will be looking for something safer and less risky than nuclear power inside the energy sphere. However, it is also possible that the impact will be negative, because investors will prefer not to invest into the energy sector at all taking into account its general instability during and after the catastrophe. Having learned about what happened in the nuclear sector in Japan, traders all over the world may change their preferences radically.

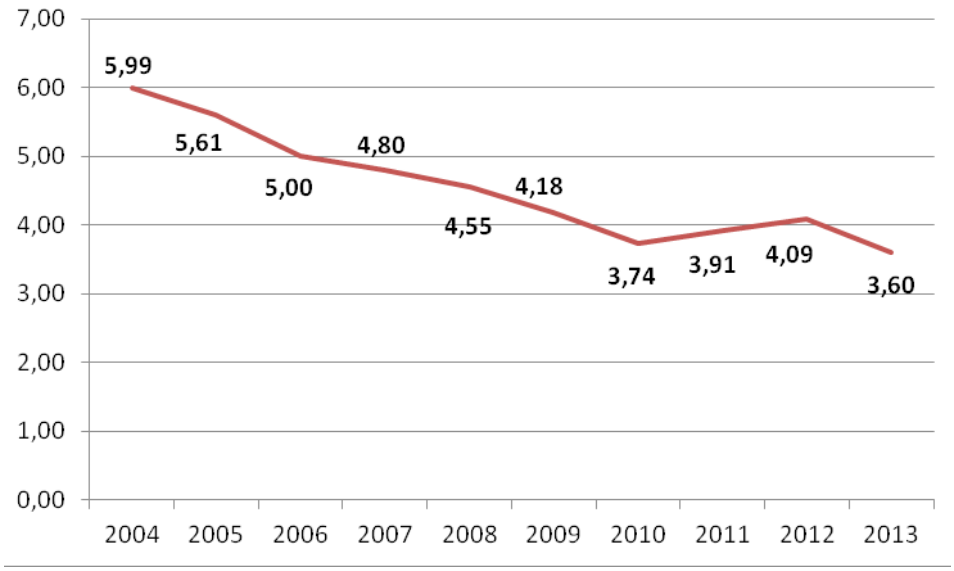
The outline of the paper is the following. Chapter 1 provides the theoretical background of the theories related to the topic of the research, i.e. current trends in oil and nuclear power industries and corporations, efficient market hypothesis and event study theory. Chapter 2 describes the event study methodology and its application on the particular example of Fukushima Daiichi. Chapter 3 describes estimation results.

Literature review and Theoretical Framework

The paper is related to the following areas of economic literature: stock exchange markets of petroleum and nuclear sectors and how could they be affected by Fukushima disaster, the efficient-market hypothesis and event study methodology.

In order to measure the reaction of oil stock market to a specific event, it is crucial to understand and discuss general facts and knowledge which economic world has accumulated during the long existence of the petroleum industry. The value of oil products has changed vastly during the last few centuries. Currently, it is one of the most important industries in the world economy and many countries such as the USA, Russia, Saudi Arabia, Venezuela and OAE take an active role in oil production, refining and trade. Currently, oil is used in order to generate electricity as well. The trend in the electricity production from oil resources could be seen in Graph 3.

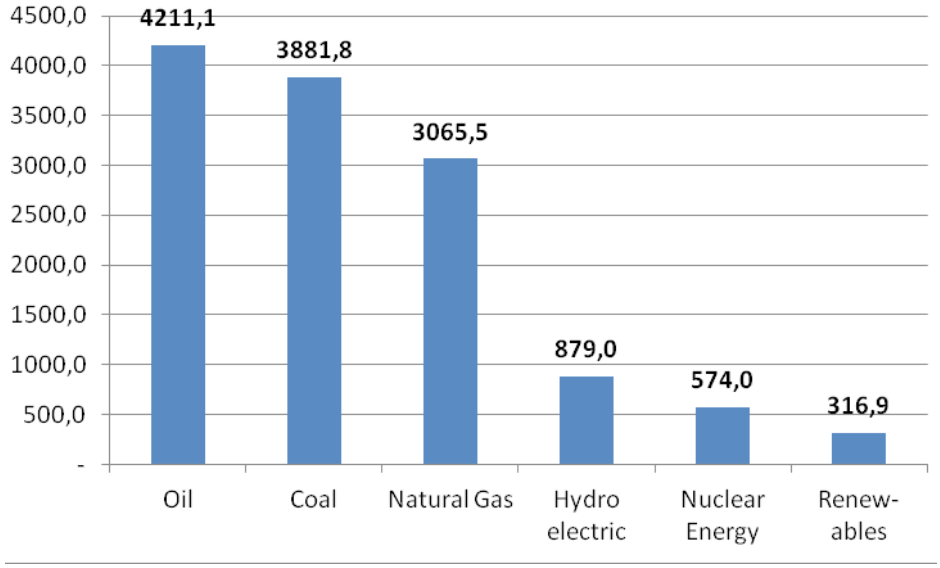
Graph 3. Electricity production from oil sources in the world (% of total).



Source: the World Bank (2016).

As it could be seen from Graph 3, in 2011, 3.9% of total electricity generated in the world was produced from oil resources; in 2012, there was already 4.1% (The World Bank, 2016). Moreover, analyzing more closely the energy sector, it could be seen that oil has the greatest share of total energy consumed in the world. The share of oil in the total amount of energy consumed in the world could be seen in the Figure 1.

Figure 1. Total consumption of energy by fuels in the world (Million tones oil equivalent).



Source: BP Statistical Review (2015).

The humanity knows about petroleum existence since the very ancient times. However, only in the beginning of 20th century, oil and gas production reached an industrial worldwide scale. Currently, oil and natural gas compose the basis of the energy balance of the world.

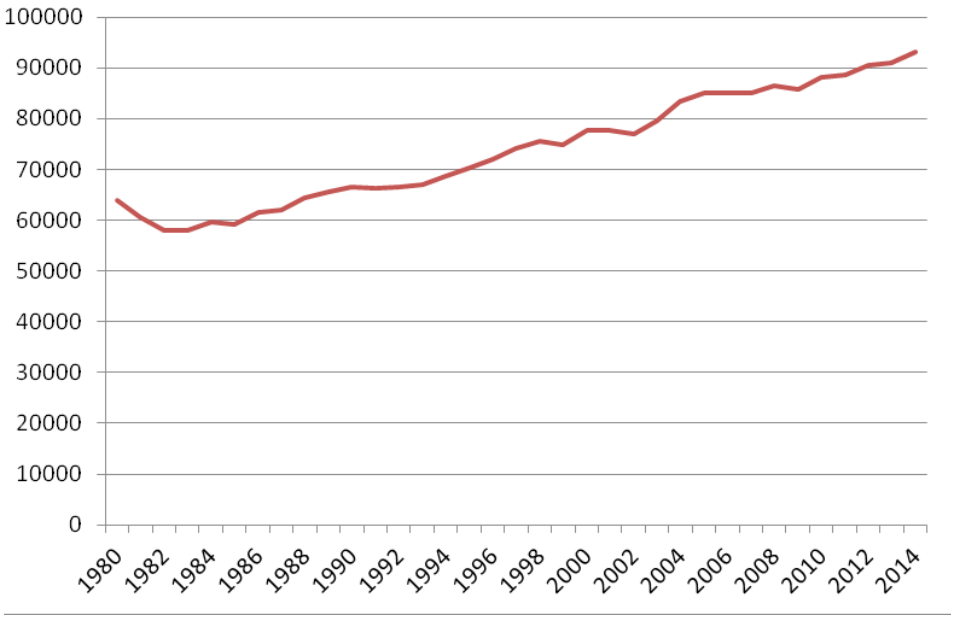
As it could be seen from Graph 3, the total amount of oil production has positive tendency during the last few decades. Currently, according to the US Energy Information Administration, Saudi Arabia, Russia and the USA are the top producers of oil in the world (EIA, 2012). However, Venezuela has the biggest amount of oil resources and total value of crude material – about 296.5 billion barrels (estimation) (BP Statistical Review of World Energy, 2011).

The reason of such popularity of petroleum could be explained by the fact that it is the most universal source of energy which is very crucial in today's world. There are many machines and technical equipment that operate on petroleum energy. Despite the fact that humanity is trying to find alternative sources of energy, oil remains most important and suitable for all kinds of machinery.

With the increase of oil production and development of the world economy, oil corporations have entered the stock exchange markets.

During the last few years, it has been a very often question what would happen to the energy industry when the oil deposits will run out. What will the world authorities of the countries which have oil deposits (USA, Russia, Norway, UAE

Graph 4. Total World Oil Production (Thousand Barrels Per Day).



Source: US Energy Information Administration (2016).

etc) do at the moment and what will happen to all the oil corporations. According to Statista (2016), energy sector contributes 19.1% to Norwegian GDP; for the USA, this proportion is equal to 5.9%.

According to Gordon J. MacDonald (1978), in the US, the reserves of crude oil are estimated by a number of organizations. The conclusion of the author was that the estimation process was more difficult than finding new resources. While drilling recently found source, it is possible to estimate the quantity of oil there more precisely.

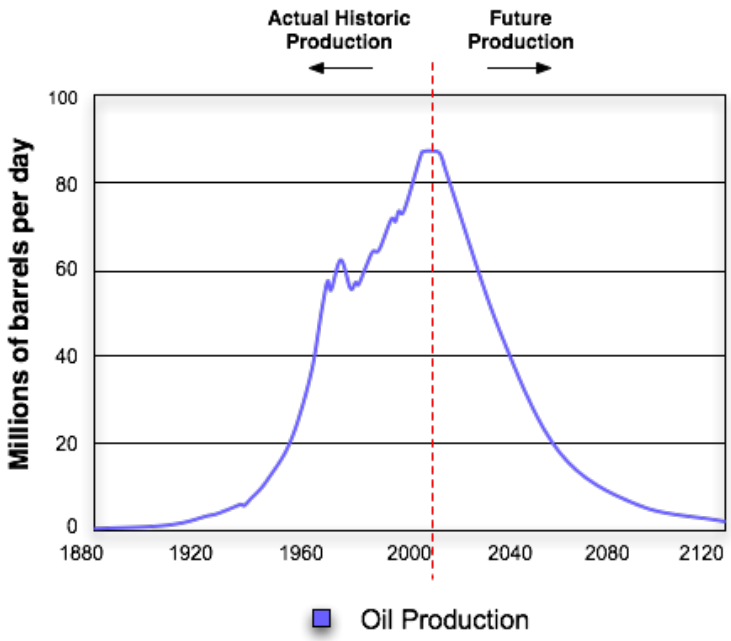
Hence, the estimation process is quite uncertain and vague. Another problem that could appear is recoverability of petroleum. In 1978, about 30% of oil in the US is recovered; i.e. with the help of specific technologies, it is possible to use the same source of oil a few times and the substance is recovered there. Currently, according to D.W. Green and G.P. Willhite (2003), a recovery factor after primary and secondary oil recovery operations is between 30 and 50%. Hence, the last few decades' technologies allowed to increase the factor.

In addition, Gordon J. MacDonald concludes that despite the fact of presence of own resources, the US is facing great dependence on imported oil, which is the case of today's economy of the United States. In 2014, the USA imported 3,372 thousand barrels of oil from other countries and 3,431 in 2015 (EIA, 2006). The

main countries from which the oil is imported to USA are Canada, Saudi Arabia, Venezuela, Mexico and Colombia. According to the EIA (2016), in 2015, about 24% of the petroleum consumed by the USA was imported from other countries. Despite the fact that the USA is extracting its own oil, the country's demand is so high that it has to import petroleum as well.

Another quite important theory of Hubbert Peak Oil was developed by M. King Hubbert in 1956. The main idea of the theory is that the production rate of oil tends to follow a bell-shaped curve. In addition, this applies to both small industrial objects and the planet as a whole. Hence, the capacities of oil production will start to decrease in the world after reaching the peak (Hubbert, 1956). Currently, this theory is also applied to many types of natural resources, such as coal, gas and uranium. In Graph 5 presented below, the illustration of the theory is presented.

Graph 2. Historical oil production rates and future predicted oil production rates.



Source: Dynamic Cities, based on OPEC projections and Hubbert Peak Oil Theory (1956).

With the help of Hubbert Peak Oil Theory, the predictions of present time are estimated by many scientists. In addition, the uncertainty of actual resources remained is still significant. For instance, Miller and Sorrell estimate that after the peak of oil production there will be "potentially serious impacts on the global

economy"; however, the peak will occur in 2035 (Miller, R. G., Sorrell, S. R., 2014). On the other hand, according to the US Energy Information Administration, the peak of oil will not occur at least till 2040; this year appears a few times in the report. It is assumed that OPEC market share of petroleum production will decrease from 39% in 2014 to 37% in 2020 followed by an increase to 41% by 2040 (U.S. Energy Information Administration, 2015).

Hence, the world authorities have some time until the predicted decline of oil amount in the world. In the meantime, it is important to develop and analyze other sources of energy. If it is possible, it is worth to displace petroleum from its leading usage as the most universal fuel all around the world. The decrease of oil amount will lead to the increase of price and it will directly affect the stock exchange market and its indices. It is important to measure whether the substitution effect between oil and some other sources of energy appears and how strong it is.

According to Dhaoui and Khraief (2014), there is significant influence of oil prices and stock market returns. In this paper, the authors examine the impact of oil prices' volatility on the stock returns in the USA, Switzerland, France, Canada, the UK, Australia, Singapore and Japan. Despite the fact that the prices are taken as the key indicators, the general tendency of the oil industry could be examined as well. With EGARCH-M model as a tool, the authors have identified the following macroeconomic indicators as independent variables of the equations: oil process, oil production, industrial production and short-term interest rates. One of the assumptions was that "negative shocks assume to increase volatility more than positive shocks do"; it is also mentioned that higher oil price increase the production costs and reduce the value of equity; hence, a higher oil price induces an increase in the risk of holding stocks (Dhaoui, Khraief, 2014). The authors have chosen 8 countries and it appeared that strong negative connections between oil prices and stock market returns were present in 7 of them (Singapore was the exception). The authors have also emphasized that oil constitutes a substantial input for many industries; hence, the increase in oil price leads to economic crises by creating cost-push inflation and increasing unemployment. As a consequence, a rise in oil prices increases risk of uncertainty and this affects stock price as well (Dhaoui, Khraief, 2014).

Another interesting result which proves the dependence between oil prices and stock returns was presented by Boyer and Filion (2004). In their paper, many factors of Canadian energy industry are examined. The main aim was to determine what explained the total return of oil and gas stocks in Canada. The authors took the data of 105 Canadian oil and gas companies. Using generalized least squares method and return of the stock as dependent variable, the unexpected

result was achieved – the firms that increase the production of crude oil experience a lower stock return in the market. The authors have explained this result with the help of the theory of real options, the assumption of which is that the firm holds a portfolio of options – whether to expand production or to reduce it. For research of Boyer and Filion (2004), it was quite possible that the increase in production means that the corporation has experienced its options so that risk is reduced. Hence, the return should be reduced as well.

As a universal fuel, petroleum has a big role and share in the energy sector of every economy in the world. However, the energy industry consists of many components: coal, natural gas, alternative sources of energy, electricity and nuclear power. The latter sector is considered one of most innovative and with great potential. Despite all the arguments against and for nuclear power, it could be estimated as a substitute for oil in the nearest future. And if these sources of energy could be substitute for each other, it is possible that on the financial markets this effect exists as well. Assuming that some unexpected event appears in one of the sectors inside a big energy industry, the substitution of stocks on petroleum and nuclear financial markets could appear as well.

The history of nuclear power and its active usage was developed much later than petroleum. Oil, which sometimes was on the surface of the planet was spotted and developed by people, while the power generation from nuclear reactions has required much more technological capacities.

When in the beginning of 20th century, it was discovered by Frederick Soddy and Ernest Rutherford that radioactivity could be used as a source of inexhaustible energy, the Atomic Era has begun. The idea that nuclear chain reaction could be used in order to generate electricity and energy was very popular. Hence, the hypothesis that in the future fossil fuels would be unused appeared.

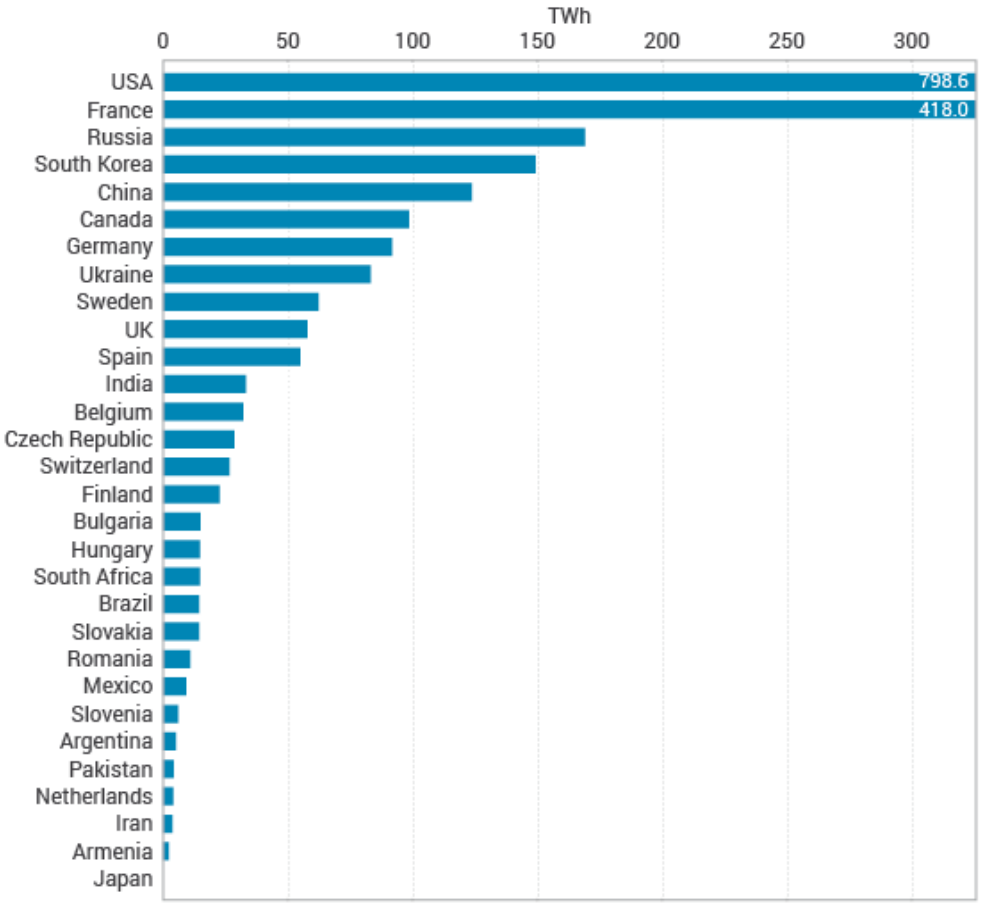
Very optimistic thoughts emerged in the 1950s; during those years it was believed that all power generators, machines and vehicles in the future would be atomic in nature. These ideas affected Ford, who presented the concept of the first atomic car in 1958. Hence, the relevance of fuel for the energy sector will decrease. It was also predicted that the usual ways of electricity generation, such as coal or water, would be also left behind, since nuclear power was cheaper.

However, nuclear power is more dangerous in its nature. Petroleum extraction and processing could cause serious damage for the environment; however, the reactions of nuclear power could cause serious technogenic catastrophes. The well-known Chernobyl disaster has clearly illustrated all potential consequences of atomic power usage. According to IAEA, 5–7% of the Ukrainian budget is still devoted to Chernobyl-related benefits; in Belarus, this figure was equal to 6.1% in 2002 (International Atomic Energy Agency, 2003). Maybe understanding how

dangerous radiation could be for humans has led to the fact that nuclear power is not as popular as oil one; it has not reached our cars, houses and everyday life, as it was assumed in the middle of 20th century. Nevertheless, it remains a widespread source of energy generation in many economies of the world.

Nowadays, the generation of energy from nuclear power is actively used by many countries. Figure2 presented below shows the list of the countries with the biggest amount of nuclear-generated energy.

Figure2. Nuclear generation by country in 2014.

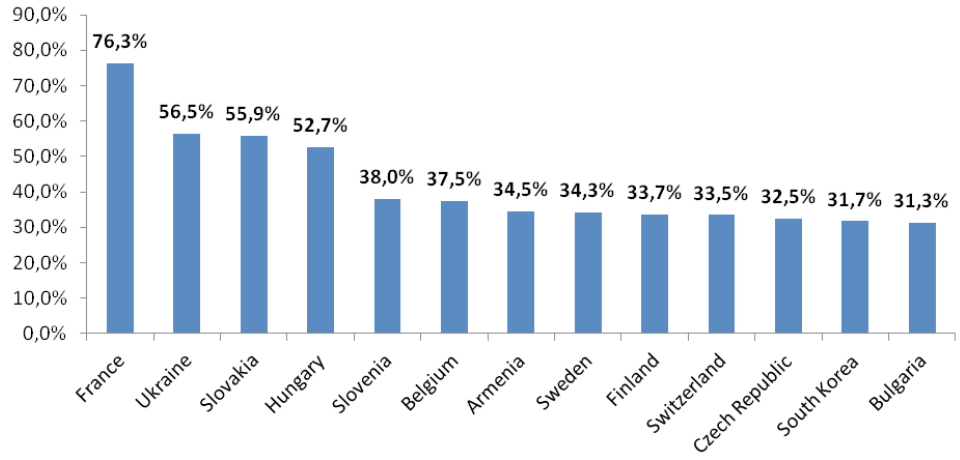


Source: World Nuclear Association 2016.

As it could be seen from the Figure2, the USA, France and Russia were the world leaders of nuclear energy generation in 2014. However, Japan, which has also used nuclear sources previously, is in the lowest position of the list.

In order to identify the share of atomic power in the total amount of energy produced from all the sources in these countries, Figure3 is presented.

Figure 3. The share of nuclear power energy in the total amount of energy produced in 2015.



Source: Power Reactor Information Systems Database 2016.

As it could be seen from Figure 3, France remains the leader in the share. However, Ukraine and Slovakia are on the 2nd and the 3rdplaces respectively and are even not presented in Figure 2; hence, they generate a smaller amount of energy from nuclear power plants in comparison with other countries.

During the recent years, nuclear power has been improved in safety and reliability of reactors' work. However, when the energy-oriented investor makes a decision whether to invest in fuel or nuclear power, there are many factors that could influence the person could be discussed. For instance, individual preferences of investor are the core elements in the decision. In addition, the comparison of what is assumed to be more profitable or less risky from the investor's point of view is also important. And whether general economic environment in the sector is stable or is influenced by some external factors or events.

For sure, the advantages and disadvantages of both energy sectors exist. According to OECD (2016), in the long-term perspective, the investment to nuclear power technologies will be more profitable. First of all, it is connected with the costs of input (the source of energy generation). In addition, fuel costs for nuclear power are much smaller in comparison to costs for fossil-fired power plants and total nuclear generation costs are less sensitive to fluctuation of fuel price. From the same quantity of uranium and oil, the generation of energy from uranium will be much powerful. According to European Nuclear Society (2016),

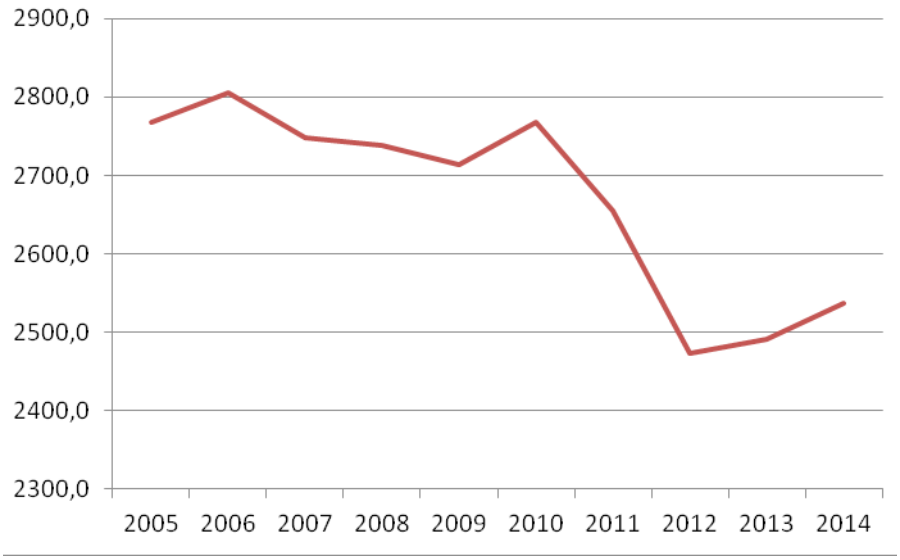
from 1 kg of oil approximately 12 kWh of power could be generated, while from 1 kg of uranium around 24,000,000 kWh could be generated. As nuclear power plants are less sensitive to petroleum price volatility, the stability of fuel cost in the short and medium term could be guaranteed. Hence, the advantages of nuclear power due to low fuel costs become more attractive (OECD, 2011).

However, the risk of investment into nuclear power is much higher. Apart from the fact that the starter costs of the nuclear plant are much higher than the oil one, the risk of unexpected disaster and its consequences are higher as well.

Nevertheless, nuclear power is more attractive for investors all around the world. The demand for nuclear power increases and this could be reflected in the prices of uranium. Prior the Global Financial Crisis, in 2000, the price of pound of uranium was around $20; in 2007, it was already around $140 (IMF, 2016). Currently, many corporations connected with the nuclear industry (uranium mining, the generation of energy) are trading on stock markets all around the world.

As nuclear power remains quite profitable and popular in many countries, such as the USA, France, Ukraine, Russia, South Korea and others, the real amount of energy produced could be analyzed. As it could be seen from Graph 6, the total amount of energy produced from nuclear power in the world has changed during the last few years.

Graph 6. Total amount of energy produced from nuclear power in the world (Terawatt-hours).



Source: BP Statistical Review 2015.

According to the graph, the decline in the amount of energy produced in 2011 could be observed. It is possible that this decrease could be connected with Fukushima Daiichi nuclear disaster, showing that many countries all around the world have refused such an active use of nuclear power stations. According to Sokolov and McDonald (2007), the USA, France and Japan are the world leaders in the quantity of nuclear power reactors; in 2006, they had 103, 59 and 55 operating reactors respectively. However, after the disaster in Japan, according to the World Bank, electricity production from nuclear sources was decreasing much in 2011 (from 26% in 2010 to 9.8% in 2011). It is possible that such a decrease in the amount of energy produced has happened due to Japanese reaction to the disaster. However, during the last few years, in 2013–2014, the positive tendency of energy generation from nuclear sources could be observed in Graph 6, meaning that the nuclear energy generation becomes a more profitable and cheaper method of energy production in comparison with other sources (such as oil). According to Schneider and Froggatt (2015), in 2014 and 2015, 9 reactors started up in China, Russia and Argentina. Despite the challenge, nuclear power remains attractable for investment. Moreover, the increasing of energy produced which is a kind of indicator that the sector is recovering could attract the potential investors as well.

Hence, in the scale of the energy sector of the economy, oil and nuclear power could be treated as substitutes for investors, because both the industries remain attractive for investors. Both types of energies are popular all around the world and it is possible to assume that whenever some event is happening in one sector, the preferences of investors could change and affect another one.The events could change not only the preferences of investors, but the financial markets as well. Knowing that stock exchange market is very sensitive to any news or events, it is possible to analyze whether such a substitution effect exists.

The very first theories about the information available for society and its importance for the economy were developed by Hayek in 1945. In his article "The Use of Knowledge in Society", he claimed that the investors are motivated to play on the market using the private information which is available for them. Hence, by accumulating this information from every single agent, the traders and investors are contributing to more and more efficient prices. That leads to the assumption that market prices are reacting only to the change of information (events and news) which is appearing. In addition, if the knowledge and information is available to everybody, it is very important and allows the market to be efficient. It was also mentioned by Hayek (1945) that the interaction of people is crucial in order to spread the information and knowledge, because, usually, each person possesses only partial knowledge. Hence, the assumption that all the

knowledge is given to a single mind in the same manner to all society members is very important.

Later, the theory was developed further and in 1970 it was presented as we know it today – as efficient market hypothesis by Nobel winner Eugene Fama. In his "Efficient Capital Markets: A Review of Theory and Empirical Work", he clearly explains how important the information is and the prices are determined by accumulation of this knowledge. The theoretical background behind the theory requires that agents have rational expectations; the average actions done by population are correct and whenever any new information is appearing, people adjust their expectations accordingly. However, EMH does not require all people to be rational, it is also considered that some agents will react to changes and some will not. Hence, the actions of people should be random.

The most valuable assumption behind EMH is that the market is efficient when all the information is available for everybody. In addition, there are three efficient markets stated by Fama (1970) – weak-form efficiency, semi-strong-form efficiency and strong-form efficiency. This assumption was added in order to explain that markets could work differently. The scientist describes it as weak form tests, where the information could be extracted from the historical prices of the shares. Semi-strong form tests are ones in which the prices efficiently adjust to the publicly available information (e.g., announcements of annual earnings, stock splits, etc.). And strong form tests are the cases when some investors have monopolistic access to insider information which could influence the price.

In weak-form efficiency, the only information available for people is historical data from the past of particular stocks. However, Fama (1970) has proved that the prices of stocks cannot be predicted by analyzing historical data. That has led to the conclusion that prices are determined by another principle, namely random walk hypothesis, which was proven by the scientist in his paper. Fama (1970) has taken serial correlations between successive changes of natural log of price for each of 30 stocks from the Dow Jones Industrial Average; they were shown for different intervals of one, four, nine and sixteen days. It appears that there is no evidence of substantial linear dependence between a lagged price change and returns (Fama, 1970). Hence, his conclusions led to the result that there is no indicated "pattern" to apply in order to forecast the prices, they cannot be predicted and the random walk hypothesis could be proved.

In semi-efficient form of market, it is stated that the market reacts very quickly to any changes in publicly available news, which is reflected in share prices. As the empirical proof, Fama has analyzed 940 stock splits (corporate actions when company divides its shares) on NYSE from 1927–1959 and has analyzed the reaction of traders to these publicly available announcements (which were

unknown previously). With the help of cumulative average residuals, the scientist has shown that prior to the splits, there was a rise of the residuals. However, after the split, there is almost no further movement. From the other hand, there was greater percentage dividend increase in almost 71.5% of all splits. This has been explained by Fama as "the large price increases in the months immediately processing a split may be due to an alteration in expectations concerning the future earning potential of the firm, rather than to any intrinsic effects of the split itself". Hence, there was a kind of unbiased forecast on the market of the implications of a split for future dividends and this is reflected in the prices of stocks. That has led to the conclusion that market is efficient at least with respect to its ability to adjust information.

The strong-efficient market assumes that share prices reflect all the information taken from every agent – public information, private information, insider information. However, even under these circumstances, no one can earn excess returns. To prove that, Fama has made his findings on the basis of Jensen's (1969) works. There was assumed that the heads of 115 mutual funds seem to have an access to special information, which is not available for anyone else. Jensen has calculated expected return on an asset using the model of equilibrium expected returns. It appeared that in 89 out of 115 cases, the risk-return combination of funds is below the market line of ten year returns from the market time (Fama, 1970). Hence, even with availability to internal information, it is impossible to beat the market.

More recent thoughts on efficient market hypothesis were actively developed during the global financial crisis of 2007–2008. For instance, Grantham (2009) has blamed the theory because it has caused financial leaders to have "chronic underestimation of the dangers of asset bubbles breaking (Nocera, 2009)". Namely, the increasing bubble has been perceived by the traders as ordinary expansion of the market and boom on the stock exchange. However, the people who predicted the bubble and approximate time of its breaking have considered it as general information available for everybody and further investment increased the bubble.More criticism was received from other people; it was argued that the theory has nothing common in it and how the market works in the real life. However, Fama has claimed that "poorly informed investors could theoretically lead the market astray" and the recession is a reason of the crisis, but not the improper interpretation of the theory by investors (Fama, 2009).

Nevertheless, efficient-market hypothesis remains a very popular theory despite criticism that has appeared during the recent financial crisis. For this paper, the hypothesis is crucial, since it is assumed that efficient stock exchange market reacts to new information appearing. The general ideas of the hypothesis

could be transferred and tested on the example of specific event, which will be treated as new information. Fukushima Daiichi nuclear disaster was a very sudden and unexpected accident; hence, investors could not adjust their expectations prior of the event or change preferences. However, this information was available for everybody in many parts of the world and with the help of event study methodology it is possible to analyze the reaction of investors of oil corporations to this event.

Event study could be described as statistical methodology which allows to analyze the impact of the event and its magnitude on the rates of returns of chosen corporations. Moreover, the idea is very universal and could be applied to many different kinds of events – announcements of dividends paid, of a merger of the firm, political events, economic events, natural disasters etc. It also is common for many research areas, such as economics, political studies, physics, law and many others spheres.

One of the pioneers in today's event study method was MacKinlay (1997), who was trying to find an answer what effects of economic event on the firm are. The scientist stated that using financial market data, an event study measures the impact of a specific event on the value of a firm. The main assumption behind this theory is that the unexpected event that is known to investors could influence the rates of returns of the corporations. Hence, the effects of an event will be reflected immediately in the share prices. In this way, a measure of the event's economic impact can be constructed using security prices observed over a relatively short time period (MacKinlay, 1997).

MacKinlay (1997) has taken the quarterly earnings announcements for the 30 firms in the Dow Jones Industrial Index. In total, there were 600 event observations (30 firms and 20 announcements per each of them). After the collection of the data, it appeared that these corporations' announcements had affected the valuation of the firms.

According to MacKinlay (1997), with the help of market model, the abnormal returns during the announcement day (day 0) for the good news was equal 0.965 percent. The received results have shown that the null hypothesis that the event had no impact was strongly rejected.

In 1985, Brown and Warner have also used an event study methodology. In their paper "Using Daily Stock Returns. The Case of Event Studies", the authors have described many issues which can appear while applying the methodology on daily-frequency data, such as non-normality, when the distributions of daily returns are fat-tailed in comparison with normal distribution. In addition, they discuss bias in OLS estimates of market model parameters, estimation of the variance to be used in hypothesis tests concerning the mean excess returns

(autocorrelation in daily excess returns) and other issues. The main idea of the paper is to show advantages and disadvantages of using daily data in the event study. Brown and Warner have randomly selected 250 samples of 50 daily securities available in the Center for Research in Security Prices. Each time a security was selected, the event day was generated. Then, the scientists have performed all event study methodology steps, such as defining event and estimation windows, market adjustment returns calculations, OLS market model regression, abnormal returns, CAR (Cumulated Abnormal Returns) and testing of its significance. The main idea of the paper has been reached and proved. The results from simulations with daily data has reinforced the conclusions of the previous work of the authors with monthly data and the methodologies based on the OLS market model and using standard parametric tests has been well-specified under a variety of conditions. Brown and Warner (1985) have also proved that the use of daily data is simple.

Hence, the authors have clearly analyzed all advantages and disadvantages, issues that could appear while applying daily-frequency data in the event study, such as non-normality, bias in OLS and autocorrelation in daily excess returns.

From more recent researches on the topic, it is worth admitting "Econometrics of Event Studies", presented by Kothari and Warner in 2006. In this paper, the authors admit that short-horizon methods which are the analysis of short period of time (few days, a month) in the event study are quite reliable; however, long-horizon methods, which are used in order to analyze long periods of time, i.e. several months or years still contain some limitations. It was also discussed that the usage of daily returns data ensures more precise measurement of abnormal returns than monthly, it also provides more informative studies of announcements effects or the moment when the agents become aware of the event. Kothari and Warner (2006), have gone shortly through main methodologies of event study and have examined the difficulties with long-horizon methods, when the study is focusing on large-size samples. The first problem that could appear is risk adjustment and expected returns. The error in risk adjustment can make an economically non-trivial difference in measured abnormal performance over one-year or longer periods. This could happen when the event result is unusual; in other words, the reaction which was expected is different than one which was received (stock split follows good performance). Another reason could be when the event sample contains the data of firm with extreme economic characteristics, such as bad reputation, high volatility of share prices or unsuccessful financial performance. "Under these circumstances, accurate risk estimation is difficult, with historical estimates being notoriously biased because prior economic performance negatively impacts the risk of a security. Therefore,

in long-horizon event studies, it is crucial that abnormal-performance measurement be on the basis of post-event, not historical risk estimates (Kothari and Warner, 2006)". Then, the authors present different approaches of abnormal performance measurement of long-horizon data, for instance BHAR (buy-and-hold abnormal returns) approach, which could be defined as the difference between the realized buy-and-hold return and the normal buy-and-hold return. This method allows to make investors' actual investment experience more alike to buy-on-hold returns. It is easier to calculate BHAR when a firm or portfolio is identified. The alternative method discussed is the Jensen-alpha approach, which allows to study the event even if it is spread over several years. In addition, Kothari and Warner discuss the tests that can verify the relevance of the methods.

The paper "I Just Did 400 Million Event Studies" – A Study of Market Model Robustness and Deterioration in Times of Crisis" presented in 2014 by Chen is describing still an actual problem of recent financial crisis and the behavior of stock during that time. It has been observed by the author that selected stock returns became more correlated during the crisis and R-square also increased. Nevertheless, the volatility of financial market those days also increased the standard errors of the models. The main aim of the author was to eliminate the effect of financial crisis on stock returns and to show more credible results. To investigate the impact of financial crisis on market model, Chen has selected 450 stocks on the S&P 500 during 3 separate periods of 2006–2007, 2007–2008 and 2008–2009. It appeared that R-square during the financial crisis was higher due to the fact that it was easier to predict stock returns from available information. In addition, market models appeared relatively robust in comparison with stable markets prior of 2007. To make the observations more credible, it was decided to use a market model ending closer to the date of event. The solution was calculating Robust and Deterioration Specific (RADS) critical values. That led to the result that from 20.37% of significant returns of FTSE 100 in 2008–2009, RADS method has shown 5%. Hence, the idea of research was reached, since Chen claimed that "standard errors from traditional event studies do not accurately indicate whether or not the price movement of a stock is significant" during the time of crisis.

This paper has shown that the event study methodology could always be improved, especially when the market disturbance during the crisis exists and the data the probability of which was never in doubt before reflect inaccuracies.

In Ye, Karali and Ramirez (2014) research "Event Study of Energy Price Volatility: An Application of Distributional Event Response Model", the researchers have studied daily crude oil futures returns and volatility in order to analyze the pattern of market responses to selected events. The following events were

considered: the Asian financial crisis, OPEC's production cut, the US invasion of Iraq and the bankruptcy of Lehman Brothers. In order to analyze the impact, Distributional Event Response Model was implemented, which allows to estimate the location and width of the event window. In addition, DERM allows to measure the impacts of events in a flexible way and to obtain estimates of the time path of the market response. Crude oil contracts were taken from the New York Mercantile Exchange during 1995–2013 years. In total, there were 4224 observations in the sample. As a result, all the events which were selected had statistically significant effects on crude oil futures price volatility. Most of all, the volatility of prices was influenced by OPEC's production cut, the market was reacting during about 1076 working days.

All the thoughts and theory described above show the great opportunities and universality of event study methodology. It could be developed further where the additional knowledge is needed or can be improved when some external information causes the volatility of indicators. Previously, the event study methodology was often used to define the answer how the event affects the firm value. However, in this particular paper, the event study could be used to verify how the disaster which happened in the different (nuclear) sector could influence the returns of oil corporations.

The dependence between the oil market and nuclear power was discussed by many economists and scientists. For example, in Naser (2014) research "Oil Market, Nuclear Energy Consumption and Economic Growth: Evidence from Emerging Economies", the author has examined the relationship in four emerging economies such as Russia, China, South Korea and India. The author has taken real output, oil and nuclear energy consumption and real oil prices of the selected countries during 1965–2010. In his paper, Naser (2014) has implied the long-run causality test which was developed by Toda and Yamamoto (1995). This is the modified Wald test with restrictions on parameters of the variable vector autoregression (VAR) model. However, usually, VAR process contains unit roots existence and the procedure of Toda and Yamamoto (1995) eliminates this problem. As a result, it appeared that emerging economies do not support the hypothesis of neutrality for neither oil consumption-growth nor nuclear energy consumption-growth relationship. The only exception is Russia, where the relationship did not affect the output growth.In addition, nuclear energy consumption stimulates economic growth in India and South Korea; additional nuclear energy is required in order to stimulate economic growth in China. Hence, both oil and nuclear power industries are important for economic growth in emerging countries.

In Kiany's (2014) research, the relationship between Iran's nuclear power and oil was discussed. As far as nuclear power in Iran remains one of the disputes

between Iran and Europe, the negations on the topic still continue. The main idea of Kiany (2014) is that nuclear power is very important for the Iranian economy, as it could be used in many sectors, such as electricity, medicine or even veterinary. However, currently, Iran is treated as "oil-based economy" which means that the extraction of petroleum remains the main strategy and is a core industry of the country. As this is a well-known fact that petroleum resources are limited, it is crucial for Iran to develop and support alternative sources of energy and nuclear power is one of the most preferable options due to its universality.

The impact of events on oil industry is also a topic of interest for many researchers. Demirer and Kutan (2010) in their research "The Behavior of Crude Oil Spot and Futures Prices around OPEC and SPR Announcements: An Event Study Perspective", have analyzed the impact of OPEC Conference and Strategic Petroleum Reserve (SPR) announcements on daily spot and future prices of oil during 1983–2008. In total, there were taken 63 OPEC announcements regarding quotas and 15 SPR announcements. The authors have used the market model, the ARCH model, and the three-factor Fama-French model. As a result, it appeared that no significant reaction was observed to OPEC production increase announcements. However, the production cut announcements have caused significant positive returns during the post event period indicating incomplete reaction of investors. However, in the case of SPR announcements, the CAR tests have shown an insignificant impact of the announcements on the oil market.

Hall and Kenjegaliev (2009) have also analyzed the impact of oil related event on the petroleum market. In their research "Effect of oil price changes on the price of Russian and Chinese oil shares", the authors have selected four oil markets: Chinese, European, Russian and US one. The crude oil prices during 2000–2008 were taken for the research; there were two types of events – positive and negative. As a result, the tests have shown considerable abnormal returns for oil corporations. However, the discrepancies among the companies have appeared. For instance, European and American markets have reacted as expected (positively to good news and negatively to bad ones). In Chinese and Russian markets, atypical behavior was observed (Hall and Kenjegaliev, 2009). In the paper, potential causes of such results have been described. It is possible that the markets were influenced by insider information, corruption and political influence.

As it could be observed, oil related events influence petroleum markets. However, whether the events outside the sector could influence oil and petroleum energy markets is also considered an actual question. Natural or technological disaster could be an example. As any unexpected event, the disasters could influence the stock market and have severe economic consequences.

Muller and Kraussl (2007) have discussed the impact of Katrina Hurricane on stock prices of the corporations which were very proactive donors during the disaster. Philanthropic behavior of the corporations has been selected due to the fact that it can generate direct and indirect benefits to the firm as investors interpret donations differently. Hence, abnormal returns of the model were associated with donation "event". The authors have selected big American corporations listed in Fortune Global 500 that announced their donation efforts. The S&P 500 Composite has been used as a benchmark to calculate daily volatility of stock returns. This dataset covered the period from September 1, 2004, until February 28, 2006 (Muller, Kraussl, 2007). Of the 190 US companies listed in the Fortune Global 500, 134 announced donations in response to Hurricane Katrina and the authors have selected these corporations. The hypothesis of the paper was that donation announcements would be associated with positive abnormal returns. However, the results have shown an absolutely indifferent result. Hence, the investors' decisions were not influenced by the corporations' announcements of donation.

The Fukushima Daiichi nuclear disaster was also considered a valuable event for the stock returns. Ferstl, Utz and Wimmer (2011) have examined the impact of Japanese nuclear disaster on the daily stock prices of German, French, Japanese and US nuclear utility. The market model has been estimated for a period of three years starting on January 4, 2008, and ending on March 10, 2011. The stock oil prices, market value and book value of the shares have been used by the authors. As a result, very high volatility of Japanese nuclear stocks was observed, which was explained by the uncertainty about future policy implications. However, French and German stock prices adjust very rapidly and it has been indicated as the change of expectations of policy toward alternative energies. The results for the USA were not significant.

In general, the discussion about the significance of Fukushima Daiichi disaster and its negative impact to Japanese economy is quite widespread. According to Masumoto (2014), Japan's overall fuel import in 2013 increased and was equal to $880 billion comparing to 2010, when the import was equal to $206.2 billion; this was the result of increased use of fossil. The impact of the accident on nuclear corporations has been also analyzed. However, whether the disaster has influenced not only the nuclear stock returns, but also the stocks of other sectors was not verified and analyzed previously. In this paper, the dependence between Fukushima Daiichi nuclear disaster and petroleum stock returns will be discussed.

On 11 March, 2011, after one of the most powerful earthquakes ever registered in Japan, the atomic disaster in Fukushima I Nuclear Power Plant station happened. The table presented below illustrates the timeline of the events during that period.

Table 1. The timeline of the main events during the Fukushima Disaster (2011).

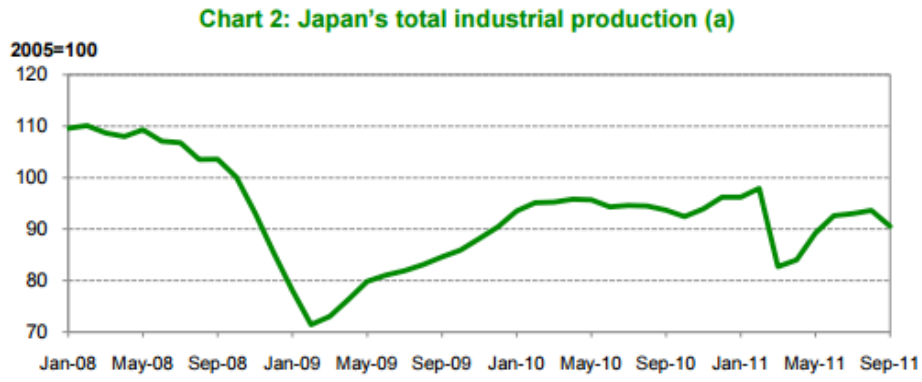
Day	What has happened
11th of March	Tōhoku earthquake andtsunami, the announcement of problems at Fukushima
12th of March	explosion at Fukushima Daiichi, release of radioactive materials
13th of March	deterioration in unit 3, crash of the cooling elements
14th of March	the second explosion at Fukushima Daiichi

As it could be seen from Table 1, the information about the event was constantly updated and more and more details appeared in the world mass media. And the consequences of the accident were announced and discussed.

Fukushima disaster was not only the environmental catastrophe, it affected many spheres of Japan and its economy was not an exception. In 2010, GDP annual growth rate in Japan was 4.7%; in 2011, it was -0.5% (The World Bank, 2016). According to Schneider and Froggatt (2015), TEPCO (the owner of Fukushima plant) reported that the total cost of bringing the accident under control and decommissioning was about 992.7 billion yen (US $9.9 billion) for the 4-year period after the beginning of the accident. The overall cost was not announced by Japanese government; however, the estimated sum is 10 trillion yen (US $100 billion) (Schneider and Froggatt, 2015).

Apart from GDP, many spheres of Japanese economy were affected by the disaster. For example, industrial production of Japan has dropped significantly in few days.

Graph 4. Japan's total industrial production.



Source: Collins, 2012.

As it could be seen from Graph 4, the greatest shocks in Japanese industry were observed only during the recent Global Financial crisis of 2008. And the decline after Fukushima disaster was also dramatic. Even the tourism sphere was affected by the disaster. In July 2010, over 878,000 visitors were registered in Japan; in April 2011, this amount fell to 296,000 (Collins, 2012). Currently, tourism in Japan has recovered after the disaster as nuclear power generation in the country was stopped after the accident.

The real impacts of the Fukushima disaster on the world are explained by Holt, Campbell and Nikitin (2012) in their "Fukushima Nuclear Disaster". The authors have described the chronology of the event and indicator data (for instance, Cesium Depositions around the station) and the current statuses of Fukushima plant reactors. The main goal of the paper is to highlight the aspects of the Fukushima disaster that could bear on U.S. nuclear plant safety and nuclear energy policy in general (Holt, Campbell and Nikitin, 2012). In addition, different responses of Japanese government and results are described. With the help of many countries and the USA, the effects of the catastrophe were diminished. Many types of equipment, transport, pumps, drones, medical and evacuation support has been received from the other countries, such as the USA, China, South Korea. Because of the accident, many countries which actively use nuclear energy restricted their policies and safety regulations. "As a result, Fukushima has prompted a reexamination of nuclear plant safety requirements around the world, including in the United States" (Holt, Campbell and Nikitin, 2012).

Just after the accident, nuclear power, which provides 30% of electricity generation in Japan, was paralyzed (NPR, 2012). As a result of such energy shortage, many corporations were asked to reduce energy consumption. A substitution effect was not long in coming; because Japanese authorities were afraid of nuclear power, the coal, gas and oil power has replaced the nuclear one. According to the World Bank, electricity production from oil sources in 2010 was 6.5% of total amount produced; in 2011, it was already 9.9% and 12.2% in 2012 in Japan (The World Bank, 2016). Even green energy was developed and started to be used more actively. According to Lambrecht (2014), the events following the Great East Japan Earthquake and Fukushima Daiichi nuclear disaster in 2011 shifted Japan's energy policy towards less reliance on nuclear power. In addition, the Japanese renewable energy market is expected to grow significantly in the years ahead (Lambrecht, 2014).

In addition, the substitution effect was discussed by other scientists as well. It was also admitted that the magnitude of substitution is so great that this mass replacement of nuclear power could cause negative effects for the environment. According to Vercelli (2014), currently, the impact on climate change of the

Fukushima disaster will continue to be negative if the missing supply of energy and power in the country will continue to be filled by further use of fossil sources, such as coal, unconventional oil and gas that cause massive emissions of greenhouse gases and other severe negative externalities.

However, it should be verified how the oil corporations' returns in other parts of the world were affected by the disaster. It is possible that the event with such a huge effect on one of the most developed economies in the world has also changed the rates of returns of selected oil corporations.

Methodology

In order to measure the impact of Fukushima Daiichi nuclear disaster on oil corporations' returns, five corporations were chosen: CNOOC, CGG, InterOil, ExxonMobil and Statoil. The countries where the headquarters of corporations are located are geographically distant. This will allow to analyze how the corporations in different parts of the world – the USA, France, China, Norway and Papua New Guinea, were affected by the event in Japan. The reaction of investors in these countries could be different due to economical and cultural differences between them.

The first corporation that was chosen is China National Offshore Oil Corporation (CNOOC). On the Chinese oil market, it is the 3rd largest oil company (CNN Money, 2015). In addition, it is a monopolist of crude oil extraction in offshore China. Only 30% of the shares are traded on NYSE and Hong Kong exchange, the rest of the shares is the property of the Chinese government (CNOOC Official Webpage, 2015). The corporation was founded in 1982 and in 2014 its total annual revenue was 611 mln RMB, which is about 94 mln USD (CNOOC Annual Report, 2014). As the indicator of company's probability, EPS ratio is equal to 6.96 currently which mean that this is a portion of a company's profit allocated to each outstanding share of common stock (Google Finance, 2016). That means that the corporation has rather successful financial performance.

The second corporation chosen is CGG located in France. This corporation is not an oil producer directly; however, it provides geological and geophysical research in order to find new sources of oil. Currently, it is traded on NYSE. It was founded in 1931 and in 2014 its revenue was 3.09 billion USD (CGG Annual Report, 2014). The revenue declined in comparison with 2013; EPS ratio is equal to -8.19 which is connected with the decline of revenue. The financial indicators above show successful performance of the corporation during the latest years.

The third corporation chosen is InterOil Corporation from Papua New Guinea. It was founded in Canada in 1997; however, it focuses on oil and gas extraction in undeveloped region of Elk-Antelope. This corporation is also traded on NYSE. In 2013, its revenue was 1.3 billion USD and EPS ratio is equal to -4.39 (InterOil Annual Report, 2013). In 2015, the heads of corporation announced that a new offshore reservoir near Papua New Guinea was discovered (Petro Global News, 2015). This could increase the corporation's revenue in the future and improve their financial position.

A penultimate company selected for the research is well-known ExxonMobil from USA. In fact, this corporation is multinational, but its headquarter office is located in the United States. It has the longest history since it foundation in 1870. The corporation is the world's 8th largest company by revenue and the 3rd largest corporation by market capitalization value (Forbes, 2015). In 2014, its revenue was 411 billion USD and its EPS ration is equal to 3.85 nowadays, reflecting stable development of the corporation with such a long history (ExxonMobil Annual Report, 2014).

The last corporation is Statiol from Norway. It is the biggest oil corporation in Norway and the 11th largest oil corporation in the world, it was founded in 1972 (Forbes, 2013). 67% of shares belong to the Norwegian government; the rest is traded on NYSE. In 2015, the revenue of Statoil was 482 billion NOK, which is approximately 57 billion USD (Statoil Annual Report, 2015). By comparing the corporations' revenue with each other, Statoil and CNOOC would be rather medium-sized corporations; ExxonMobil has the largest revenue and CGG and InterOil are comparatively small ones.

Hence, the corporations selected are different in market capitalization size, in their location and history of development. Some of them are different from the point of view of oil extraction – whether it is continental or offshore extraction or even geological corporation which only helps to find new sources. Anyway, they all are connected and highly depend on oil prices, share prices and the general situation on petroleum and energy markets. It is possible that the Fukushima Daiichi nuclear disaster influenced the corporations' stock returns. Moreover, according to Sokolov and McDonald (2007), the USA, France and Japan are the world leaders in the amount of nuclear power reactors; hence, when the event in nuclear sector appears, it could influence other sectors in the country as well. China has the 5th place on the list of the countries with the biggest amount of nuclear-generated energy. Norway does not have nuclear power reactors despite the fact that this is legally permitted in the country. However, Norway is considered to be a country with emerging nuclear energy usage, nuclear power stations are planned there. Currently, Norway is importing energy from Denmark and

Sweden and the last country has the 9th place on the list of the countries with the biggest amount of nuclear-generated energy. According to the IndexMundi Statistical Portal (2016), in 2012, Norway imported approximately 4.168 billion kWh of energy.

Data Description

The data for the given paper has been collected on publicly available financial sources, such as Yahoo! Finance. The selected period is the frame between the 1st of July 2010 and the 31st of March 2011. The prices of shares of CNOOC, CGG, InterOil, ExxonMobil and Statoil were taken. The data has been taken on a daily frequency. In addition, the market values of NYSE – NYSE Composite Index Revised and BNO – United States Brent Oil Fund were also collected for the period identified. Then, the rates of returns were calculated by using the following formula:

$$rate\ of\ return = \frac{p_t - p_{t-1}}{p_t}$$

Where p_t is equal to current price of stock and p_{t-1} is equal to its previous value.

The received rates of returns for all the corporations and stocks selected were sorted by date and transformed into a table and imported into Stata software.

Event Study Methodology

First of all, the initial task is to define the market model for the corporations. Assuming that the market is efficient, the rate of return on the share price of firm *i* on day *t* is expressed as following:

$$r_t = \propto + \beta r_t^M + \gamma r_t^{BNO} + e_t$$

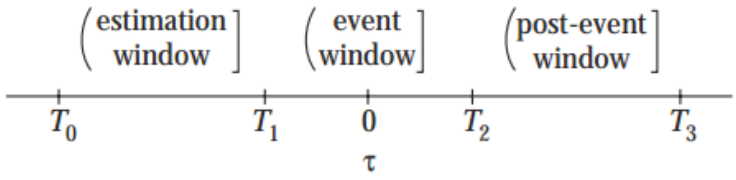
Where
r_t – is the rate of return on the share price of each firm on specific day
r_t^M – is the rate of return on a market portfolio of stocks (NYSE)
r_t^{BNO} – is the rate of return on a Brent Oil Index (BNO)
e_t – is the error term

Efficient-market hypothesis is the main assumption behind the model. Here, the market works normally assuming that all the information that could influence the prices is available.

NYSE index contains a composite of the biggest corporations' stocks from all the industries which are traded there. In order to reveal more oil-specific results, United States Brent Oil Index (BNO) was also added to the model. BNO is an exchange-traded fund (ETF) designed to provide investors with the current trends of Brent oil. Its main aim is to illustrate general information and changes of Brent oil prices.

Then, the estimation and event windows could be identified. By defining the precise event date and the period when the stocks of the selected corporations will be influenced by the event, the event window could be estimated. Once the model is estimated, once can calculate the abnormal returns, which are assumed to reflect the stock market;s reaction to the arrival of new information (McWilliams and Siegel, 1997).

Figure 4. Time line for an event study.



Source: Event Studies in Economics and Finance, MacKinlay, 1997.

As it could be seen, Event window could be described as a specific date ($\tau = 0$), when the event is actually happening and few days prior of and after the date. For this paper, the date of 11th March 2011 is selected. In order to take few days prior and after this date, there are 10 event windows selected: [-2;+2], [-2;+1], [-2;+0], [-1;+2], [-1;+1], [-1;+0], [-0;+2], [-0;+3], [-0;+1] and [-0;+0]. Longer length of the windows could be not optimal since there were other events happening around the date. During those days, the earthquake in Japan was happening and the general social, economic and environmental condition in Japan was very unstable.

Estimation window should be also identified and could be described as the period when the market works normally under general and usual conditions (without any shocks). Usually, the estimation window is equal to 200–800 days. The interval between estimation and event windows should be equal to 6–8 trading days.

Then, the regression analysis inside the estimation window should be done. In order to measure abnormal returns, the normal ones should be specified. With the help of regression analysis, it is possible to derive normal stock returns of the selected corporations. Then, the normal returns could be used for calculations of the abnormal ones in order to receive attributed to the event results.

After the estimation of market model in estimation window for each corporation and identifying $\hat{\alpha}$ and $\hat{\beta}$, the error term e_t should be estimated in the event window:

$$e_t = r_t - \hat{\alpha} - \hat{\beta} r_t^M - \hat{\gamma} r_t^{BNO}$$

Abnormal returns are usually caused by "events" in corporate finance. This could include mergers, dividend announcements, lawsuits or the unexpected events, which is the case of the paper. Abnormal return is the difference between actual return and expected return. Whenever abnormal returns are identified, the aggregation (CAR) should be calculated in order to detect overall reaction on the event of interest in the event window.

$$CAR_t = \sum_{j=t_0}^{t} e_j$$

If derived CAR is positive and statistically significant, that could indicate that the impact of event on abnormal returns of the corporations is positive. Negative and significant CAR indicates a negative impact on abnormal returns. In order to verify the received results, testing the significance should be made. Usually, it could be done by t-test. In order to identify the value of t-statistics, firstly, the standard deviation of abnormal returns should be generated and the days in event window should be counted as well. Then, the following formula was used:

$$t_{CAR} = \frac{1}{\sqrt{N}} \cdot \frac{CAR}{S_{CAR}}$$

Where *N* is a number of days in the event window and *SCAR* is a standard deviation of abnormal returns. In Stata, where the whole estimations will be performed, the test looks as follows: test = (1/sqrt(number of days in event window)) * (cumulative_abnormal_return /ar_standard deviation).

In addition, all the data should be checked for structural problems existing, such as heteroskedasticity; especially, while using high-frequency data which is

the case of financial market example. With the help of the specific command in Stata, the structural problems of the data were eliminated.

For the given paper, the stock returns daily data of 5 oil corporations were taken. The date of Fukushima Disaster is the 11th of March 2011; hence, the 10 event windows around this date were selected. The event windows could be defined as follows:

[-2;+2] – 9th – 15th March
[-2;+1] – 9th – 14th March
[-2;+0] – 9th – 11th March
[-1;+2] – 10th – 15th March
[-1;+1] – 10th – 14th March
[-1;+0] – 10th – 11th March
[-0;+2] – 11th – 15th March
[-0;+3] – 11th – 16th March
[-0;+1] – 11th – 14th March
[-0;+0] – 11th March

The estimation window, where it is assumed that the market works normally, is defined as a period between 1st July 2010 and 1st March of 2011 (190 trading days, which is common for short-horizon methods). The interval between estimation and event windows is equal to 8 trading days. In total, there are 190 + 8 + 6 observations

With the help of Stata software and the code, the event study methodology steps were performed and the results of the research could be described.

Estimation Results

Despite the fact that the selected corporations are publicly traded on the same stock exchange market and they all represent petroleum sector, the results of the estimations differ from each other and are not alike. The tables below illustrate the reaction of investors to Fukushima disaster inside 3 event windows – prior of, during and after the event. The rest of event windows are presented in Appendix. In order to verify the significance of the results, t-tests were performed in Stata and T-statistics is illustrated in parenthesis.

The table presented below illustrates CAR in the event window.

Table 5. The results of CAR estimation in event window [-2;+0] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-996.38***	-997.18***	-919.72***	-1062.95***	-0.42
t-stat	(-6.7)	(-6.72)	(-9.15)	(-53.49)	(-0.57)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 9th March 2011 – 11th March 2011.

As it could be seen from Table 5, a strong negative reaction to news could be detected on the stock returns of petroleum industry. CNOOC, CGG, Exxon-Mobil and Interoil are showing a very similar reaction. As it could be seen from T-statistics values, the corporations' results are significant. First of all, it could be explained by general economic instability in Japan as one of the most developed economies with which many economies all around the world are connected. However, such a reaction of Chinese, US and French corporations could be explained by the fact that the very first news about the earthquake in Japan appeared on 9th March, when the first tremors were fixed in 40 km from the main source (US Geological Survey, 2011).However, the greatest reaction was observed on 11th March 2011, when the Fukushima Disaster happened

The strongest reaction of -1062.95 of InterOil from Papua New Guinea, could be explained by its own earthquake, which happened on 9th and 10th March 2011 on the New Britain island (US Geological Survey, 2011). Statiol from Norway reflects very poor and insignificant results to Fukushima disaster.

The next table presents CAR in the event window of the exact day of Fukushima Disaster.

Table 6. The results of CAR estimation in event window [-1;+0] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-996.38***	-997.18***	-919.72***	-1062.95***	-0.42
t-stat	(-6.7)	(-6.72)	(-9.15)	(-53.49)	(-0.57)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 10th March 2011 –11th March 2011.

Taking the exact day of Fukushima Disaster and one day prior the event, the negative reaction appears. Despite the fact that petroleum industry is assumed to be a substitute to nuclear power during and after the disaster, the reaction of investors is negative. As far as the assumption of market efficiency is taken into

account in the model, the information about the stock is reflected in its price. And the day of Fukushima disaster was not the exception. Those days, the energy sector faced a great economic threat. The events unfolded very quickly and no one could predict what will happen till the end of the day.

However, what was the response of the stock market to Fukushima disaster during the first working day after the event? In general, the first news about the disaster on nuclear plant due to the powerful earthquake had appeared on 11th March. But, on 12th March, which was Saturday and the day off of NYSE, more information appeared. During that weekend, the particular consequences were presented to people; it became clear how serious the accident was. Exactly on 12th March, the first explosion which resulted in the release of radioactive materials to the atmosphere happened. Hence, it is possible to assume that the preferences and expectations of the investors changed and it was also reflected on the stock returns of oil corporations.

The other side of the coin could be that the investors of the energy sector have treated Fukushima disaster as negative for the whole energy industry. That could be also a possible reason why CAR of oil corporations is negative and the results are significant not only within the nuclear sector, as it was estimated by Ferstl, Utz and Wimmer (2011).

However, due to general instability of the region during the series of earthquakes, the reaction of investors was negative prior 11th March. In the next table, CAR in the event window after the disaster is presented. The situation on the stock markets of CNOOC, CGG, ExxonMobil, Interoil and Statoil after the event is illustrated there. During the first working days of NYSE after the disaster, it is possible that the market could adjust to the news and some different reaction could appear.

Table 7. The results of CAR estimation in event window [-0;+3] for oil companies.

	CNOOC	**CGG**	**EXXMOB**	**INTEROIL**	**STATIOL**
CAR	-795.74***	-804.07***	-785.78***	-1034.31***	0.99***
t-stat	(-5.55)	(-5.81)	(-8.21)	(-51.33)	(3.10)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 11th March 2011 –16th March 2011.

The exact day of Fukushima disaster and few days after it show the negative impact; however, with one exception. CNOOC, CGG, ExxonMobil and Interoil show a strongly negative impact which increases during the first few days after the accident. More and more investors have changed the preferences and

expectations, because the accident was not the only case, the information about destruction was constantly updating. During 14th and 15th March, two more explosions at the station happened. And in this event window, CAR of the corporations illustrates negative reaction which is equal to -795.74 for CNOOC, -804.07 for CGG, -785.78 for ExxonMobil and -1034.31 for Interoil. These four corporations are showing approximately the same negative reaction to the disaster.

However, the geographical distance between the regions where the corporations are operating could possibly affect the reaction. It is possible that the resources of the corporations which are closely located to Japan could be influenced by this fact. In addition, the stocks of companies that trade with Japan or do business there could be affected more than stocks of companies that do not have such an economic relationship with the country.The spread of information was very quick during those days and there was no precise information about further spread of nuclear emission, its amount and direction. Hence, the resources of the corporations which were located more closely to the region could be affected mostly than those ones which were far away from Japan. The distance could affect the expectations of investors and make geographically distant regions more attractive, because it seemed to be safer. Interoil sources of crude oil are located in Papua New Guinea, which is the closest region to Japan as well as Chinese CNOOC. For Interoil corporation, the most negative and significant results could be observed. In addition, Papua New Guinea has survived its own earthquake which could possibly affect the active production of oil in that region. Chinese CNOOC's resources are located mostly on the shelf of East China Sea which is very close to Japan in comparison to other regions. ExxonMobil is a huge multinational corporation which actively develops and owns many sources of oil all around the world. The big source of oil is located on Russian Sakhalin, where ExxonMobil drilled the deepest well in the world in January 2011 (Lenta.ru, 2011). The distance between Sakhalin and Japan is equal to 42 km in the narrowest point. French CGG is a geological, oil-oriented corporation, which also operates all around the world, where it analyzes new possible sources of petroleum by conducting many kinds of exploration.

On the other hand, Norwegian Statoil rates reflect not only significant, but even positive results. For Statoil rates, Fukushima disaster was treated as positive event during the first few days after disaster indicating 0.99 CAR. This fact could be connected with the sources of the corporation, the greatest part of which is equal to 60% and is located in the Norwegian Sea (Statoil, 2016). Statoil does not have its resources in the Pacific Ocean. It is possible that due to such a geographical isolation of the resources, the position of corporation was treated as safe and it has attracted more investors due to the fact that people were searching

for something safer to invest in. In addition, apart from the presence of domestic recourses, Statoil is a very Europe-oriented corporation which operates in more than 11 EU countries. In total, Statoil has more than 32 connections in other parts of the world, but, Japan is not in the list (Statoil, 2016).

Such a positive effect could also be a sign of substitution effect inside the energy sector, when nuclear-oriented investors have started to invest inside oil sector.

In addition, Norway is the only country in the selected sample which does not have nuclear power stations. Currently, further construction of atomic plants is planned. It is possible that Norwegian oil market was treated as safest after Fukushima accident. Hence, energy-oriented investors have switched their preferences in the favor of the country without nuclear stations inside.

The positive impact for oil industry could also be connected with the fact that in Japan, where 26% of total electricity was generated from nuclear power, it was clear that the situation inside the nuclear sector is very critical and the country's authority would reconsider the energy policy (The World Bank, 2016). As Japan has a very limited amount of natural resources, it was clear that the government will be looking for new resources and buying them from other countries. According to the World Bank (2016), in 2011, Japan imported approximately 14500 million liters of oil; in 2012 this figure was equal to 18000 million liters. In addition, oil consumption rose by 255 thousand bbl/d in 2012 in comparison with the level of 2011 (The World Bank, 2016). That could also be the reason why in geographically distanced regions the event was treated as positive for oil corporations, Japan was actively seeking alternative energy resources from other countries. In general, according to the statistics, this assumption was quite reasonable, because the substitution in the sources from which the energy is generated in Japan was observed. According to the World Bank, the electricity production from oil sources in 2010 was 6,5% of total amount produced; in 2011 it was already 9,9% and 12,2% in 2012 in Japan (The World Bank, 2016).

According to Shell (2011), the shift was also observed on the financial markets; however, a few months later. According to the author, funds that invested in companies in renewable energy and oil industry increased by 13.7% in the first six months of 2011 and it was described as benefits "from turmoil in the oil-rich Middle East and the anti-nuclear sentiment after the accident in Japan (Shell, 2011)."

As the result, in few event windows which are showing the days prior and after the event, different reaction could be observed and the results are statistically significant. While, initially, the reaction of all the corporations is strongly negative, few days after Fukushima disaster the reaction of Norwegian Statoil has

changed and became positive. It is possible that the investors reacted negatively to the news about the earthquake. However, later, the reaction has changed due to the fact of geographically located resources, the absence of nuclear power inside the country and the substitution effect, when nuclear-oriented investors have started to invest inside oil sector.

Summary and Conclusions

This paper estimates the impact of Fukushima Daiichi nuclear disaster on the stock returns of oil corporations in the USA, France, Norway, China and Papua New Guinea. The countries selected are located far from each other. This topic was not discussed and analyzed previously. The impact of Fukushima accident was analyzed by many scientists; however, the analysis of the disaster in nuclear industry on the corporations in the petroleum sector has been implemented in this paper. With the help of event study methodology and under the assumption of efficient market hypothesis, the influence of Fukushima Daiichi nuclear disaster on stock returns of oil corporations was measured.

The main hypothesis of the paper was that the stock returns of Statoil, ExxonMobil, CGG, CNOOC and Interoil were affected positively by Fukushima disaster and the substitution of investors' preferences between oil and nuclear powers exists. However, the hypothesis was partially rejected and the results of the paper suggest that the event was negatively perceived by the investors in 4 out of 5 selected companies.

The identified CARs illustrated negative influence of the Fukushima disaster on stock returns. In addition, the oil resources of ExxonMobil, Interoil and CNOOC are located relatively closely to Japan and earthquake region. That could be a possible reason why the reaction of investors was negative for the corporations analyzed.

Norwegian Statoil appeared to be the only exception in the sample; CARs were positive there. This could be explained by the fact that Norwegian oil resources are located at the greatest distance from Japan, where the accident has happened. It is possible that this fact could be treated by investors positively, because Norwegian region was treated as safer place to invest during the turbulence in the East.

In addition, the expectations of the people and the general mood regarding nuclear technologies after the accident have changed. On this background, Norway has appeared to be the only country in the sample which does not have nuclear power stations. The absolute absence of dangerous and uncontrolled

energy power source was also a plus for the Norwegian oil sector during that period.

Generally, results of the paper suggest that the reaction of investors to Fukushima Daiichi was significant. Even despite the fact that in some regions the reaction was different, it was proved in the research that the events outside petroleum industry could influence the stock return of petroleum corporations.

The limitations of the paper, first of all, are connected with the lack of prior research studies on the topic. Very often, an event study methodology is used in order to assess the impact of an event on the value of a firm. Usually, internal events inside corporations are taken into account or those ones which do not relate to the natural or technological catastrophes. The external event which happened outside the petroleum industry and its impact on corporations' stock returns was considered in this paper. However, it generates the opportunities of further research. More events that influence the corporations could be analyzed; more corporations from different sectors of economy could be selected for the analysis as well.

Regarding the recommendations based on the results, it was proved that Fukushima disaster that is not connected with the petroleum sector at first sight could influence the firm's value and the reaction of the investors. Hence, the number of significant events for companies is much higher than it is often assumed. In addition, it is a well-known fact that the amount of oil on Earth is limited and, according to Miller and Sorrell (2014), peak of oil production will occur in 2035. However, petroleum still remains the most universal fuel and the society needs to develop other alternative sources of energy. With the diversification of energy sources, the world economy will be less sensitive to oil price volatility and the quantity of resources left.

Bibliography

Boyer, M.M., Filton, D. (2004). *Common and Fundamental Factors in Stock Returns of Canadian Oil and Gas Companies*, Cirano.

Dhaoui A., Kharief N., (2014). *Empirical Linkage between Oil Price and Stock Market Returns and Volatility: Evidence from International Developed Markets,* No. 2014–12, "Economics Ejournal".

Fukushima Disaster: *Impacts and Continuing Threats, Physicians for Social Responsibility*, (access: 30.03.2016) http://www.psr.org/assets/pdfs/fukushima-fact-sheet.pdf.

Holt M., Campbel R.J. Nikitin, M.B., (2012)*Fukushima Nuclear Disaster, "*Congressional Research Service".

MacDonald G.J. (1978). *Long-Term Availability of Natural Resources, "*NBER".
Metcalf G.E., (2013). *The Economics of Energy Security*, NBER.
Toth, F.L. and Rogner, H.H., (2005). *Oil and nuclear power: Past, present, and future, "*Energy Economics 28" (2006) 1–25, Elsevier.
Nuclear Energy Institute, http://www.nei.org/Knowledge-Center/Nuclear-Statistics/World-Statistics (access: 30.03.2016).
US Energy Information Administration, International Energy Statistics, (access: 30.03.2016) http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=53&aid=1 (access: 30.03.2016).
The Institute of Mechanical Engineers, http://www.imeche.org/ (access: 30.03.2016).
The World Bank Statistics Database, http://data.worldbank.org/ (access: 30.03.2016).
Fortune Global 500 2015 list, http://fortune.com/global500/(access: 30.03.2016).
The New York Stock Exchange, <https://www.nyse.com> (access: 30.03.2016).
BP, (2011). *Statistical Review of World Energy*,http://web.archive.org/web/20110626032546/http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2011.pdf (access: 30.03.2016).
Green, D.W., Willhite, G.P., (2003). *Enhanced Oil Recovery*, Society of Petroleum Engineers, "SPE Textbook Series Vol. 6.
Hubbert, M.K., (1956). *Nuclear Energy and The Fossil Fuels*, "Drilling and Production Practice, American Petroleum Institute".
Miller, R.G. and Sorrell, S.R., (2014). *The Future of Oil Supply*, "The Royal Society Publishing."
US Energy Information Administration (2014), *Assumptions to the Annual Energy Outlook*.
OECD, (2000). *Nuclear Power in Competitive Energy Markets*.
International Monetary Fund Database,http://www.imf.org/en/Data(access: 30.03.2016)
Hayek, F.A. (1945). *The Usage of Knowledge in Society*, "The American Economic Review", Volume 35, Issue 4, 519–530.
Fama, E.F., (1970). *Efficient Capital Markets: A Review of Theory and Empirical Work*, "The Journal of Finance", Vol. 25, No. 2, 383–417.
S&P Dow Jones Indices LLC, ,http://www.djaverages.com/?go=industrial-components(access: 30.03.2016).
Statista Database,http://www.statista.com/statistics/217556/percentage-of-gdp-from-energy-in-selected-countries/, (access: 30.03.2016)
International Atomic Energy Agency, (2003). *Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts*.
Sokolov, J., McDonald, A., (2007). *Nuclear Power – Global Status and Trends, "*International Atomic Energy Agency".

Schneider, M., Froggatt, A., (2015). *World Nuclear Industry Status Report 2015*.

Nocera, J., (2009). *Poking Holes in a Theory on Markets, "*The New York Times".

McKinley, A.C., (1997). *Event Studies in Economics and Finance*, "Journal of Economic Literature", Vol. XXXV, 13–39.

Brown, S.J., Warner, J.B., (1985). *Using Daily Stock Returns. The Case of Event Studies*, "Journal of Financial Economics" 14 (1985), 3–21, North-Holland.

Khotari, S.P., Warner, J.B., (2006). Econometrics of Event Studies, Handbooks in Finance Series, Elsevier/North-Holland.

Chen, M.Y., (2014). *I Just Did 400 Million Event Studies" – A Study of Market Model Robustness and Deterioration in Times of Crisis, "*London School of Economics & Political Science".

McWilliams, A. and Siegel, D., (1997). *Event Studies in Management Research: Theoretical and Empirical Issues*, "Academy of Management Journal 1997", Vol. 40, No. 3, 626–657.

China National Offshore Oil Corporation Official Webpage, http://www.cnoocltd.com/ (access: 30.03.2016).

China National Offshore Oil Corporation Annual Report 2014,<http://www.cnoocltd.com/attach/0/1504090826531711217.PDF> (access: 30.03.2016).

CGG Annual Report (2014),http://www.cgg.com/data/1/rec_docs/3043_CGG_2014-GB-MAIL.pdf (access: 30.03.2016).

Google Finance Database,https://www.google.com/finance, (access: 30.03.2016).

InterOil Annual Report 2013,http://www.interoil.com/iocfiles/documents/investorrelations/financialreports/2013/IOC_2013_AnnualReport.pdf, (access: 30.03.2016).

Torres, N., (2015). *InterOil Finds Onshore Papua New Guinea Reservoir, Petro Global News, 2015*.

ExxonMobil Annual Report 2014,http://cdn.exxonmobil.com/~/media/Global/Files/Summary-Annual-Report/2014_Summary_Annual_Report.pdf (access: 30.03.2016).

Statoil Annual Report 2015,http://www.statoil.com/no/InvestorCentre/AnnualReport/AnnualReport2015/Documents/DownloadCentreFiles/01_KeyDownloads/Annual_report_on_form_20-F.pdf (access: 30.03.2016)

Lambrecht, S., (2014). *The Clean Energy Sector in Japan An Analysis on Investment and Industrial Cooperation Opportunities for EU SMEs*, EU-Japan Centre for Industrial Cooperation.

Yahoo! Finance Financial Database, http://finance.yahoo.com/> (access: 30.03.2016)

US Geological Survey Database, http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usc0001wfq/, (access: 30.03.2016).

Shell, A., (2011). *Chaos in energy sector drives gains in clean energy,* USA Today, http://usatoday30.usatoday.com/money/perfi/funds/2011-04-05-natural-resources-funds.htm, (access: 30.03.2016).

Collins, T., (2012). Great East Japan Earthquake: economic and trade impact, Australian Government, Department of Foreign Affairs and Trade, https://dfat.gov.au/news/news/Documents/great-east-japan-earthquake-economic-and-trade-impact.pdf, (access: 30.03.2016).

Vercelli, A., (2014). *Nuclear and financial meltdowns: The impact of the Fukushima accident on the transition to a low-carbon economy*, "FESSUD Working Paper:http://fessud.eu/wp-content/uploads/2015/01/Fukushima-accident-and-impact-on-transition-to-sustainable-energy-system-working-paper-76.pdf, (access: 30.03.2016).

Lenta.ru, (2011). *The deepest well in the world was drilled on Sakhalin*, https://lenta.ru/news/2011/01/28/sakhalin/, (access: 30.03.2016).

Ye, S., Karali, B., Ramirez, O.A., (2014). *Event Study of Energy Price Volatility: An Application of Distributional Event Response Model*, "Agricultural & Applied Economics Association."

Naser, H., (2014). *Oil Market, Nuclear Energy Consumption and Economic Growth: Evidence from Emerging Economies*, "International Journal of Energy Economics and Policy Vol. 4", No. 2, 2014, 288–296.

Kiany, D., (2014). *Relationship between Iran's Nuclear Power and Oil, Persian Gulf*, "Indian Journal of Fundamental and Applied Life Sciences."

Demirer, L., Kutan, A.M., (2010). *The Behavior of Crude Oil Spot and Futures Prices around OPEC and SPR Announcements: An Event Study Perspective, Southern Illinois University Edwardsville*.

Hall, S.G.,Kenjegaliev, A., (2009). *Effect of oil price changes on the price of Russian and Chinese oil shares*, University of Leicester.

Muller, A.,Kraussl, R., (2007). *Do Markets Love Misery? Stock Prices and Corporate Philanthropic Disaster Response, Center for Financial Studies*.

Masumoto, T., (2014). *Impact and Current Status of the Accident at Fukushima Daiichi Nuclear Power Plant and Future Challenges, World Energy Council*.

Appendix

Table A. The results of CAR estimation in event window [-2;+2] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-724.89***	-723.31***	-653.87***	-718.13***	-0.73
t-stat	(-4.51)	(-4.54)	(-5.47)	(-33.23)	(-0.81)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 9th March 2011 –15th March 2011.

Table B. The results of CAR estimation in event window [-2;+1] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-996.38***	-997.18***	-919.72***	-1062.96***	-0.4
t-stat	(-6.31)	(-6.35)	(-8.61)	(-50.27)	(-0.56)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 9th March 2011 –14th March 2011.

Table C. The results of CAR estimation in event window [-0;+0] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-271.49	-273.87	-265.84	-344.82	0.34

The date of event window is 11th March 2011.

Table D. The results of CAR estimation in event window [-1;+1] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-825.54***	-827.83***	-804.04***	-1040.41***	0.09
t-stat	(-26.82)	(-31.07)	(-38.92)	(-163.0)	(-0.15)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 10th March 2011 –14th March 2011.

Table E. The results of CAR estimation in event window [-1;+2] for oil companies

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-1090.34***	-1096.36***	-1066.54***	-1385.37***	0.61
t-stat	(-35.34)	(-41,85)	(-39.68)	(-220.07)	(0.79)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 10th March 2011 –15th March 2011.

Table F. The results of CAR estimation in event window [-0;+1] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-531.03***	-535.58***	-525.16***	-689.35***	0.48***
t-stat	(-44.45)	(-44.04)	(-61.37)	(-375.27)	(2.56)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 11th March 2011 –13th March 2011.

Table G. The results of CAR estimation in event window [-0;+2] for oil companies.

	CNOOC	CGG	EXXMOB	INTEROIL	STATIOL
CAR	-795.74***	-804.07***	-785.58***	-1034.31***	0.99***
t-stat	(-76.67)	(-76.18)	(-105.74)	(-601.45)	(3.1)

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10% level. The dates of event window are 11th March 2011 –15th March 2011.

Chapter IV.

The Impact of Terrorist Attacks on Stock Returns for Airline Industry: the Example of US Airline Companies

Svetlana Li, Standard Chartered / Lazarski University
0000-0002-4008-1162
Olha Zadorozhna, Lazarski University
0000-0002-2160-6904

Terrorism is a threat to the economic development, as well as the stable functioning of financial markets. Terrorist acts, as unexpected and uncontrolled events, can cause panic among market participants and affect their behavior on the market. This work discusses the impact of terrorist attacks on the US economy in general and airline companies in particular.

Among the different types of crime, terrorism has a special paradoxical place. It is very difficult to quantify all costs, direct and indirect, caused by terrorism. Moreover, it is difficult to predict how different sectors of the economy will react to the catastrophe. Companies of such industries as the defense and insurance industry can increase their profits after terrorist attacks, while tourism and airline companies will most probably suffer losses. Gong (2009) considered outcomes for airline industry after 9/11. He came to the conclusion that the four large airports of the USA (Atlanta International Airport, O'Hare International Airport, Logan Airport, and Denver International Airport) took two years after the September 11 to restore the volume of passenger traffic, which was before the disaster. Certainly, it had a negative impact on airlines' profits. Cordesman (2004) states arms sales in the USA increased by 17% after 9/11, while the US government increased spending on the war against terrorism by $390 million. Terrorist crimes are perceived as the most dangerous threat to society destabilizing its socio-political and economiclife.

In this research work, terrorism means the use of extraordinary violence to achieve any political or economic goals with the help of intimidation of society (Sandler, Enders, 2004, p. 302). This definition does not contradict the everyday understanding of terrorism involving violence against civilians in the political struggle, for example, mass murder, hostage-taking etc. This interpretation excludes from the analysis mafia terrorism related to activities of organized crime.

The main problem of the economic analysis of terrorism is the economic explanation of its causes, as well as the quantification of the costs of terrorist attacks to the world.

In the research paper "The Impact of Terrorism on Financial Markets", Johnston and Nedelescu (2005) analyze the economic impact of major terrorist attacks on the pace of development of the affected countries' economies. They take into account September 11 in the USA, the bombings in Bali in Indonesia, and bombings at a train station in Madrid which took place in October 2002 and in March 2004, respectively, as well as the bombings in the London Underground in July 2005. As it turned out, the economy of these countries showed a negative development results within 3–6 months after the attack, but then they quickly recovered from the shock. By the degree of the devastating impact on stock exchanges, the negative effect of terrorist attacks is considerably smaller in comparison with other events, such as World War I, World War II, or the Vietnam War. Similar disasters have a negative impact on the economy of the affected states for at least a year. After the declaration of war between the Austro-Hungarian Empire and Serbia which marked the beginning of WWI, the US stock market was closed as there was a fear that European investors will try to pull all their money out of US public companies' securities (Broadberry and Harrison, 2005). The market was opened after 5 months, on December 12, 1914. Dow Jones was 24% lower than during the period of closing in July (Murphy, 2004). During the Second World War, DJA decreased from November 1941 till May 1942. In December 1941, it fell by 6.3% in two days; DJA exceeded the mark 200, its previous level before WWII, in 1947 (Stock Trader's Almanac, 2002). The September 11 attacks led to the biggest collapse of DJA in the history of the American Stock Exchange: a decrease by 7.1% during the first session. However, two months later, the market regained all the losses (Quillen, 2002). The terrorist attacks in London and Madrid had even smaller influence on the stock markets. According to BK Asset Management, after the London bombings in 2005, FTSE index showed a sharp decline, but the minimum values were reached on the first day. The pound lost 250 points, but two days later, it increased by 475 points. Although during the explosions in Madrid in 2004, the Spani stock market lost 5%, this movement ended in three trading sessions (Lien, 2015). These events demonstrate that terrorist acts have a very short-term impact on the markets.

The above data indicate that terrorist attacks do affect the financial performance to a greater or lesser extent depending on the scope of the event or the country. This paper conducts a study on the US economy and US airline companies. It includes the companies' performance after the terrorist attacks from 1999 to 2013 in the USA. The USA as a country of the research was made based on the

work of two economists, Blomberg and Hess. The reasons for choosing the airline industry and events directly related to airline companies are presentedbelow.

In 2004, Blomberg and Hess (2004) published a report entitled "Macroeconomic Consequences of Terrorism". The authors of this study analyze the terrorist attacks committed in 177 countries for the period from 1968 to 2000. The authors have made a number of conclusions. Firstly, attacks occurred more frequently in the industrialized countries than in the developing countries, but the economic damage caused by terrorists was less significant. Secondly, the investment patterns are changed as a result of a major terrorist attack. The number of private investments declines. The volume of public investment, on the contrary, grows as the government hires more security personnel and increases the size of the armed forces. In the paper "Economic Consequences of Terrorism in developed and developing countries", Sandler and Enders (2006) conclude that despite the fact that an act of terrorism has little effect on a particular developed country, the consequences will be more noticeable to other developed countries than in the case of a terrorist act on the territory of a developing country. Due to the active trade and common markets among developed countries and due to a huge dependence on each other as a result, a negative change in one market can cause a negative wave in other countries. Basing on the above conclusions, the United States was chosen as the object of the research. It is one of the most developed countries in the world that is able to affect other countries' economies. Moreover, on the US territory, there was a significant act of terrorism – September 11 attacks – that affected financial markets, which entailed the closing of US stock exchanges for five days. A large number of terrorist attacks in the United States, which differ in the impact on the markets, allows the author to expand the field of research covering a long period of time. In the United States, there were several terrorist attacks which are differentiated on the basis of the scale of the consequences and the impact on the US economy. It was decided to select a few of terrorist events that could have an impact on the US economy that have occurred in different periods. In the research into consequences for the Turkish Stock Market after terrorist attacks, Aksoy (2014) concludes the market becomes more flexible, and it reacts more quickly to events because of the availability of information, but it defies the growing panic that could cover the world in the late 20th century. For this reason, it was decided to choose seven events occurring in different years in the United States to compare their impact on the market. All events were officially recognized as terrorist attacks by the US government. They are directly related to airline industry: terrorist attacks or attempts of terrorist attacks happened either in an airport or on an airplane.

As it was said, consequences of terrorism can be different for each individual sector. There are studies by different researchers who considered outcomes for industries and economies after terrorist events. John Robb (2007), a military analyst, has come to the conclusion that the actions of today's terrorists are gradually acquiring the business features. Robb notes that the number of attacks against individual private companies has been significantly increased in recent years. Also, terrorist attacks have been more frequent in the oil infrastructure as this allows to have an impact on global oil prices and individual states. Terrorists are trying to worsen the situation in their economies and to reduce investment attractiveness. Thus, the terrorist attacks have gradually become an important factor in the world economy. Moreover, terrorism has become a part of life in such countries as Iraq, Afghanistan, Nigeria, Pakistan, and Syria.

Counter-terrorism measures are costly to their economies. As a result, consumers are faced with a gradual increase in prices of goods and services. The fight against terrorism is reflected seriously on the cost of goods, which are transported by air and sea. Moreover, the country's position in international trade can be seriously weakened if the terrorist threat has a significant scale, and security measures are beginning to have a negative impact on business travel, transport and investment (Report of the World Trade Organization "World Trade2006").

According to estimates by the US Department of Commerce (2002), the US economy has lost $80 billion after the terrorist attacks in September 2001; retail sales fell by 2.1%; the volume of new orders for durable goods fell by 6.8%. The number of new applications for unemployment benefits rose by $50 thousand; it was the biggest jump during one month after August 1982.

For the research, the airline industry was chosen. This choice is motivated by the fact that the September 11 attacks occurred as a result of explosions of planes in New York, which had a direct impact on the airline industry. Makinen (2002), Johnson (2002), Rhoades and Reynolds (2005) consider the negative trends for the industry after 9/11. This event was selected because of its scale and the huge consequences for the entire industry. Aksoy (2014) considers the theory of the reduction of the impact of the terrorist attacks on the market in the course of time. For this reason, other terrorist events that took place in different years in the USA were included in the study. Ultimately, the choice included seven events that occurred from 1999 to 2013.

According to the data from the Statistics Portal, the official website of the statistical agency Statista Inc. (2015), airlines reduced the number of flights by 30% immediately but despite this fact remaining planes were not fully filled. Obviously, airline companies suffered huge losses. As a result of the major attack of 9/11, airline stocks traditionally showed a negative trend. In 2001, the passenger

turnover of airports in New York fell by 16%, and in general, the global aviation industry missed 90 million passengers which corresponded to a decline of 3.8%. Furthermore, quotes on the NYSE returned to the levels preceding the attacks just two months later. However, it should be noted that the sphere of tourism and transport remains one of the most dynamic in the US. From 1985 to 2014, the scale of international tourism increased by 3.5 times. In 2004, the volume of air traffic in the United States exceeded the level of 2000 (World Bank's database, 2016.

Research aim. The aim of this work is to explore the reaction of stock exchanges and the behavior of American airlines after significant terrorist attacks in the USA. The aim includes the testing of the assumption of the existence of considerable market reaction to the terrorist attack and impact of terrorism on returns of airlines' companies. In order to understand how the size of a company helps to overcome consequences after terrorist attacks, not only large airline corporations were chosen for this investigation, but small local companies as well.

Event study analysis (ESA) is the foundation of the paper. ESA is one of the possible ways of assessing the impact of events on a company's value and its share prices. This method is based on the efficient market hypothesis which states that prices reflect all available information to the market (Fama, 1970, p. 383).

Recently, after the financial crisis, there have been many disputes about whether this hypothesis on real markets performs or not (Krugman, 2009; Fama, 2010).

The main hypothesis of the paper is:

Information on the occurrence of terrorist attacks is able to influence the changes in stock prices of airlines through investors' perceptions.

Abnormal returns were measured to determine the impact of the events on airline companies. The abnormal return is the difference between the actual return and the return which was expected before the event. The cumulative abnormal return (CAR), the sum of abnormal returns over the event window, is used to measure the effect that events such as terrorist attacks have on stock prices. In the research, the results of CAR covered the event window[1].

The major aims considered in the paper are presented below:

- To figure out whether terrorist attacks are able to affect the airline industry of countries;

[1] i.e. two days before the event and two days after the event.

- To investigate how the news about the terrorist attack may change the preferences and behavior of market participants, and therefore the share price of the airlines;
- To measure the impact of terrorist attacks on the US airlines' stock prices that are listed on two main stock exchanges of the USA, NASDAQ andNYSE.

Research objectives. Objectives of the study are presented below:

- To review and compare the views of different economists about the economic state of countries after the terrorist attacks;
- To explore significant terrorist attacks in the United States and their consequences for the airline industry;
- To investigate the advantages and disadvantages of the Efficient Market Hypothesis and how it explains the market reaction to the information;
- To analyze how share prices of the airline companies are changing after terrorist attacks.

The significance of the study. It is impossible to be prepared for such an event as terrorism and therefore it is difficult to predict how long it will have an impact on the behavior of market participants. However, the experience of past years and the analysis of the market changes may smooth the panic on the stock exchanges among their participants and reduce surges in stock prices. So, the results of the research show that the reaction to an event was more palpable in 1999 than in 2013. Certainly, the share prices change depending on the size of companies.

After studying the works relating to the impact of terrorism on the global economy, it turned out a lot of authors (Johnston and Nedelescu, 2005; Lenain, Bonturi, and Koen, 2002)) who have studied the impact of terrorist attacks which happened before 2001 mention a huge negative impact and long-term consequences for the market and the economy. Nowadays, the market is becoming more stable in comparison with the beginning of the 21st century, and there is a contrary view stating that due to the fact that terrorist acts are not an unexpected phenomenon anymore, the markets are not so sensitive to acts of terrorism. In order to confirm or refute this assumption, the broad range of events from 1999 to 2013 was investigated.

The structure of the paper. The work consists of three sections. The first part begins with the consequences for the economy after terrorist attacks. It includes information on countries that are faced with terrorism, and it compares their state before and after the event. Also, it describes September 11 attacks, the most significant event in the research, and airline industry inthe USA after the event. The second section reveals approaches of economists to measure the impact of

terrorism and the Efficient Market Hypothesis with its pros and cons. The third section describes the Event Study Analysis, the method used in the research to measure the changes of companies' share prices due to terrorist attacks. Also, it provides and describes the results of the research. The final part of the paper includes the author's conclusions of thework.

The Impact of Terrorism on the Economic State of the Countries

It is possible to calculate the number of deaths as a result of a terrorist act. However, it is difficult to assess the damage to the economy. Nedelescu and Johnston (2005), Todd and Walter (2004), and Brian (2004) mention that terrorism has an extremely negative impact on the economic situation. Nedelescu and Johnston (2005) and Chen and Siems (2004) study how terrorist attacks happened in one country affect the capital markets of others.

Most terrorist attacks have a relatively short-term negative effect. Rarely, separate terrorist attacks, such as bombings or murders, might have a long-term and very serious impact on the economy. Such a huge effect can be caused by either terrorist campaigns continuing for a long time or by particularly large and bloody attacks that have a significant psychological effect (Zicher, 1976).

The danger of a terrorist attack lies in the fact that it may give the impression that such attacks will continue. People are waiting for the terrible continuation and meet their expectations. Primarily, it has an impact on business. Investors and companies begin to consider their investments in cities, regions, or countries as unnecessary risk. They try to put an additional risk premium in the cost of their products or services. This leads to lower business activity and higher prices. Fear of terrorist attacks also enforces companies to spend more on their own security by doing less productive investments (for example, the development of innovations, improvement of working processes, or investment inscience).

According to the annual report of the Institute for Economics and Peace (2015), the annual decline in investment in the countries attacked by terrorists is on average from 1.3% to 2.1%. Bykov and Vlasov (2005) believe that the activity of the Basque terrorist groups was the reason why the Basque Country was the least economically developed region of Spain Economic growth in the Basque Country was 10% lower than the average for Spain (OECD report, 2004). In Colombia, at the time of high activity of terrorist groups, foreign investments were a rarity, and the standard of living was 45% lower than the average for Latin America.

Among all terrorist attacks in the United States directly related to the hijacking or bombing of aircrafts, the September 11 attacks are most massive: 2993

killed and 8900 injured (Johnston, 2016). But compared with the number of victims per population in Northern Ireland or Israel, the September 11 attacks were relatively small. For example, members of the Irish Republican Army and similar organizations made tens of thousands of terrorist attacks during the period from 1969 to 2002. They made more than 10 thousand bombings and almost 36 thousands of attacks using firearms. The result of their activity was the death of 3.5 thousand people, and approximately 36 thousand were wounded (Burleig, 2009). According to the RAND Institute, if a similar number of people were killed and wounded in proportion to the total population in the USA, it would kill annually more than 3.8 million Americans, while more than 240 thousand would have been wounded (2004).

The Impact of 9/11 on the US Economy and Stock Exchange

Indirect damage of September 11 attacks that turned out to be very significant spread to all regions of the world and many sectors of the global economy. The combination of lower demand and increasing transaction costs causes additional harm. After September 11, many companies and governments significantly increased security costs. This required the use of new tools for processing additional information, improving coordination, and increasing the number of staff. Such measures reduce the productivity of companies and, as a result, cause an increase in costs, which are ultimately passed on to consumers. This, in turn, reduces purchasing power and aggregate demand. Security in different modes of transport leads to an increase in transport costs, which, according to OECD (2001), account for 3% of the value of sold goods on world markets. The costs of private American companies to improve safety led to the decline of their outputs by 1.12%, which corresponds to a decrease in US GDP by $70 billion.

In contrast to the political events of the past (the Cuban missile crisis, the war in Kuwait, etc.) that affected the financial markets of particular regions, the events in September 2001 affected the state of the global financial markets as a whole. This is due to the fact that globalization of financial markets has reinforced their dependence on political developments. Overall, however, the global financial markets demonstrated the ability to resist: in comparison with the stock market crash of 1929 or 1987, after the September 11 disaster, Dow Jones quickly regained its position. An important mechanism for transferring the negative consequences of these events was a decline in demand, which was only partially offset by an increase in government spending (World Bank, 2003).

The terrorist attacks of Al-Qaeda on New York and Washington had a huge impact on the global economy and on international politics. According to the International Monetary Fund (2002), the losses from these acts of terrorism amounted to $21 billion. It included losses of insurance companies and property. Experts of the National Center for Policy Analysis (2001) came to different conclusions. The damage to the US economy due to destruction of buildings and other facilities and job losses was approximately $100 billion. In addition to the huge expenses for repair and restoration of buildings, the US federal government paid from $500 thousand to $3 million to the families of killed people. However, this is only the tip of the iceberg. Within a month after the September 11 attacks, the retail volume declined by 2.1% in the United States, the portfolio of orders of industrial enterprises decreased by 6.8%, industrial production decreased by 1%; 50 thousand Americans applied for unemployment benefits. According to Milken Institute, as a result of terrorist attacks, the US lost 1.8 million jobs.

Tourism and entertainment industries were particularly affected. According to Smith Travel Research (2008), the occupancy rate of hotels and motels did not exceed 60%.This was 6% less than in 2000. According to Travel Industry Association of America (2009), five months after the terrorist attacks, 237,000 people employed in the tourism business lost their jobs. During the year, because of the threat of terrorist attacks and the tightening of procedures for the admission of foreigners to the United States, the flow of foreign tourists decreased by 20%; the industry lost $15 billion.

Airlines began to experience serious difficulties; their direct losses reached $30 billion, while the world's largest airline US Airways was on the verge of bankruptcy. According to Forecast International (2001), after the September 11 attacks, airlines decreased orders for new aircraft. As a result, the decline in production in this sector of the world economy amounted to 15–20%. The loss of U.S. insurance companies totaled $40-$50 billion. Terrorists caused damage to insurers more harm than the most devastating natural disasters. According to estimates of the Insurance Information Institute (2001), at that time, the most destructive in U.S. history hurricane Andrew caused damages in the amount of $15.5 billion. The terrorist attacks exacerbated the process of falling equity prices on the stock market: the loss for the year amounted to $2 trillion. Significant funds were spent by the US government on medical and financial assistance to victims. Total US spending on the security of the country reached $100 billion. For these purposes, Federal government spending was $17 billion in 2001, it increased to $29 billion in 2002. After the attack on 11 September, 2001, the US government had to spend approximately $6 billion on improving the safety

level. For the same purpose, municipalities of cities and settlements spent $2.6 billion (FED, 2001).

Definitely, 11 September had to be reflected in the stock market. Primarily, there was reaction of the shares of companies that were directly related to these events and their direct consequences: airlines, insurance companies, firms in the World Trade Center, as well as manufacturers of weapons and ammunition that were used in the subsequent wars in Afghanistan and Iraq. After September 11, the price of United Airlines' shares fell from $30.82 to $17.50; that was more than 43%. American Airlines' shares fell from $29.70 to $18.00; it was almost 40% (NASDAQ and NYSE websites). Insurance and financial companies also suffered from terrorist attacks. According to Ernst & Young (2008), Munich Re of Germany suffered losses amounting to $2 billion, AXA Group of France lost $0.55 billion, and Swiss Re of Switzerland lost 1.2 billion pounds. Shares of companies which had occupied the WTC also dropped after September 11. For example, Morgan Stanley lost 13%, while share prices of Merrill-Lynch and Bank of America decreased by 11.5%.

Analysis of Empirical Results of Changes in Stock Prices of US Airlines After

Terrorist attacks

The third chapter reveals the method that was used in the research to analyze the changes of US airlines' share prices as a result of terrorist attacks. The first part describes the Event Study Analysis. The second section contains the brief description of airline companies selected for the research and the stock exchanges where the companies are listed on. The final part includes the derived results and conclusions of the author basing on the data.

Data description

The airlines' share prices and their returns were used in the model. 14 US airline companies listed on NASDAQ and NYSE were selected as objects of the study. They are presented below:

- Air Transport ServicesGroup,
- Alaska AirGroup,
- Allegiant TravelCompany,
- American AirlinesGroup,
- Atlas Air WorldwideHoldings,
- Delta Air Lines, Inc.,

- FedExCorporation,
- HawaiianHoldings,
- JetBlue AirwaysCorporation,
- Republic AirwaysHoldings,
- SkyWest,Inc.,
- Southwest AirlinesCo.,
- Spirit Airlines, Inc.,
- United ContinentalHoldings.

NASDAQ (National Association of Securities Dealers Automated Quotation) is one of the three national US stock exchanges with AMEX and NYSE and the largest US electronic stock exchange on which the shares of approximately 3,700 companies and corporations are listed and traded. NASDAQ Composite is a composite index of 5,000 stocks traded on the electronic stock exchange NASDAQ. The index is calculated based on the weighted average price at the time of the end of trading on the stock exchange.

Air Transport Services Group (ATSG) is a US cargo airline with headquarters in Airborne-Airpark, in unincorporated Clinton County, Ohio. The company provides a full range of scheduled and charter freight services including overnight express flights. It covers the whole territory of the United States, Canada, and Puerto Rico. The airline provides professional training, technical and engineering services including outsourcing. After the merger of DHL and Airborne Freight in 2003, the airline took the corporatization process and listed its shares on the NASDAQ stock market.

Allegiant Travel Company (ALGT) is a budget airline, headquartered in Las Vegas, a subsidiary of the holding company Allegiant Travel Co (ALGT website). In 1997, the airline received an operating certificate of the operator of the US Federal Aviation Administration to perform scheduled and charter air transportation. In early 1999, Allegiant Air acquired the rights to charter flights to Canada and Mexico. In November 2006, Allegiant Air announced the initial public offering of its common shares on the stock exchange NASDAQ where its shares received "ALGT" as a ticker.

American Airlines Group (AAL) is one of the biggest airlines in the world according to such parameters as the amount of passenger ships (655 units), as well as the total number of passenger kilometers. This company is a leader in the field of air transport between the United States and Latin America (AAL website). On September 11, 2001, the flight 11 of American Airlines was the first airliner captured during the terrorist attacks. The airliner Boeing 767-223ER carried out a regular commercial flight from Boston's Logan Airport to Los Angeles International Airport. It was captured during the flight and crashed into the north tower

of the World Trade Center in New York (Report of the US Department of Justice, 2001). Among all four planes hijacked on that day, Flight 11 had the greatest number of people on board (92 people). Flight 77, another plane of "American Airlines", was also captures and directed to Pentagon. After the scandals associated with the terrorist attacks of 11 September 2001, the company suffered losses for several years. In 2003, the company was on the verge of bankruptcy, and it began negotiations with Wall Street's companies about obtaining DIP financing scheme. However, in the same year, the company was able to get out of the crisis (Assotiated press, 2007). In 2015, American Airlines' net profit amounted to $ 7,610 billion. Company's shares are traded on the stock exchange NASDAQ and included in the S& P500.

Atlas Air Worldwide Holdings (AAWW) is an American cargo airline based in New York. Atlas Air Worldwide is the parent company for the cargo carrier Atlas Air and Titan Aviation Holdings, a leasing company, specializing in freighters (AAWW website). In addition, Atlas owns a controlling stake in cargo airline Polar Air Cargo (51%). In 1995, the company's shares were on the NASDAQ quotation system.

Hawaiian Holdings (HA) is the largest airline in Hawaii. Hawaiian Airlines is the oldest airline in the United States, which boasts that it has never had accidents in its history (HA website). Initially, the company sold its shares on the American Stock Exchange, but in June 2008 it was moved to NASDAQ. Hawaiian Holdings was added to the Russell 3000 Index on June 30, 2008 American City Business Journals, 2011).

JetBlue Airways Corporation (JBLU) is an American budget airline headquartered in New York, with home airport at John F. Kennedy International Airport. In early 2000, the airline was granted a license for passenger transport, and it proceeded to the regular flights immediately. JetBlue Airways was one of the few US airlines that managed not only to survive, but also to earn money in the aftermath of terrorist attacks of September 11, 2001. This stability helped the company when it placed its shares on the stock exchange in 2002. Thanks to successful trading, JetBlue capitalization reached two billion dollars.

Republic Airways Holdings (RJET) is an aviation holding company of the United States of America, headquartered in Indianapolis, Indiana (RJET website). It is an owner of five US airlines: Chautauqua Airlines, Republic Airlines, Shuttle America, Midwest Airlines, and Frontier Airlines.

SkyWest, Inc. (SKYW) is an American company that owns two airlines, SkyWest Airlines and ExpressJet. It has been listed on NASDAQ since December 1986 (SkyWestwebsite).

Spirit Airlines, Inc. (SAVE) is an American low-cost airline based in Miramar, Florida with the main directions of flights in North and South America (Spirit Airlines Fact Sheet, 2011). Currently, Spirit Airlines uses hubs in Fort Lauderdale (Florida) and Detroit (Michigan). More than half of the company's flights are made to the Bahamas, the Caribbean Islands, and Latin America (SAVE website).

NYSE (New York Stock Exchange) is the major US stock exchange, the largest in the world in terms of turnover. The stock exchange determines the world famous Dow Jones index for shares of industrial companies (Dow Jones Industrial Average), as well as NYSE Composite and NYSE ARCA Tech 100 Index. New York Stock Exchange is considered the largest in terms of capitalization, because the volume of shares listed on it is more than 60%.

Alaska Air Group (ALK) is an American aviation holding company headquartered in SeaTac, Seattle suburbs, which owns two certified commercial air carriers: Alaska Airlines mainline airline and the regional airline Horizon Air (Corporate Structure of American Airlines, 2009). The holding was established in 1985 on the basis of an air carrier Alaska Airlines and a year later it acquired the local airline Jet America Airlines and Alaska Horizon Air.

Delta Air Lines, Inc. (DAL) is an American airline with headquarters in Atlanta, Georgia. It is one of the four companies which founded SkyTeam, the airline alliance of passenger traffic. Delta Air Lines is the world's largest airline in three significant criteria: the size of the fleet, the volume of passenger traffic, and the number of destinations. Its route network covers countries of North America, South America, Europe, Asia, Africa, the Middle East, and the Caribbean. In 2009, Delta opened flights to Australia, which gave it the status of the only US carrier that connects all the continents of the world except Antarctica. On October 29, 2008 Delta acquired 100% stake in another US airline Northwest Airlines. After a long merger and reorganization of companies routes, in the beginning of 2010, Delta became the world's largest commercial airline (DAL website).

FedEx Corporation (FDX) is an American company providing postal, courier, and other logistics services worldwide. FedEx Express is an American cargo airline based in Memphis, Tennessee (Kjelgaard, 1981). It is a subsidiary of FedEx Corporation, delivers daily loads and parcels to more than 375 destinations in almost all countries of the world.

Southwest Airlines Co. (LUV) is an American low-cost airline, founded in 1971. Southwest Airlines is the largest low-cost airline in the US and in the world by the number of passengers (LUV website). It has been listed on NYSE since February 1980.

United Continental Holdings (UAL) is an American Airlines, one of the largest in the United States and the world. After the merger with Continental Airlines

Table 1. Terroristic attacks that are investigated in the paper.

Date	Location	Killed	Injured	Type	Description
1 Nov 2013	Los Angeles, CA	1	7	TER	Shooting attack at Los Angeles International Airport; 1 TSA officer killed, 2 TSA officers and several civilians injured.
18 Feb 2010	Austin, Texas	2	13	TER	Suicide crash of small plane into federal office building.
25 Dec 2009	Michigan	0	3	TER-islm	Yemeni terrorist attempts to detonate bomb on flight from Amsterdam to Detroit; bomb only ignites, and passengers and crew subdue the terrorist.
4 Jul 2002	Los Angeles, California	2	4	TER-islm	Egyptian gunman kills two Israelis, injures four at the El Al ticket counter at the Los Angeles International Airport.
22 Dec 2001	Atlantic Ocean, Florida	0	1	THW	British citizen prevented from igniting shoe bomb on flight from Paris to Miami.
11 Sep 2001	New York City, New York	2759	8700	TER-islm	Crashing of two hijacked planes into World Trade Center towers, causing fires and collapse.
11 Sep 2001	Alexandria, Virginia	189	200	TER-islm	Crashing of hijacked plane into Pentagon.
11 Sep 2001	Somerset County, Pennsylvania	45	0	TER-islm	Crashing of hijacked plane into rural area of Pennsylvania, following attempt by passengers to regain control of aircraft.
14 Dec 1999	Port Angeles, Washington	0	0	THW	Terrorist arrested crossing from Canada with material to bomb Los Angeles International Airport.

Source: based on the work "Terrorism, Counterterrorism, and Unconventional Warfare" written by Wm. Robert Johnston, 2016.
*in the table, TER – terrorist attack, THW – thwarted terrorist attack, islm–islamist.

airline in 2010, United Airlines became the largest airline in the world (UAL website). The airline was also the first in the world, where the plane was the victim of a terrorist act. On October 11, 1933 Boeing 247 was blown up in the air and fell on the territory of the State of Indiana. On September 11, 2001 two airplanes of

the company were captured by terrorists. Boeing 767 Flight 175 was sent to the south tower of the World Trade Center, and the Boeing 757 Flight 93 was crashed in Pennsylvania (the report of US Department of Justice).

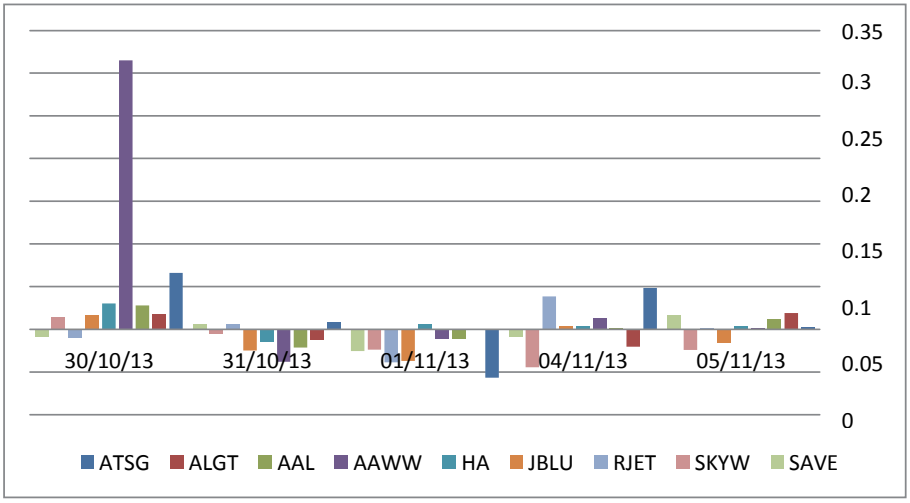
The following events have been considered in this paper. All these events are officially recognized as terrorist attacks by the US government and directly related to the hijacking or bombing of aircraft.

Graphs below present returns of companies listed on NASDAQ and NYSE in the period of the event window of investigated terrorist attacks.

Graphs below present abnormal returns of companies listed on NASDAQ and NYSE in the period of the event window of investigated terrorist attacks. The share prices of the companies were taken from the database of NYSE and NASDAQ. Event window is calculated for each event from table 1, and it covers the date of the event, two days before and after the event.

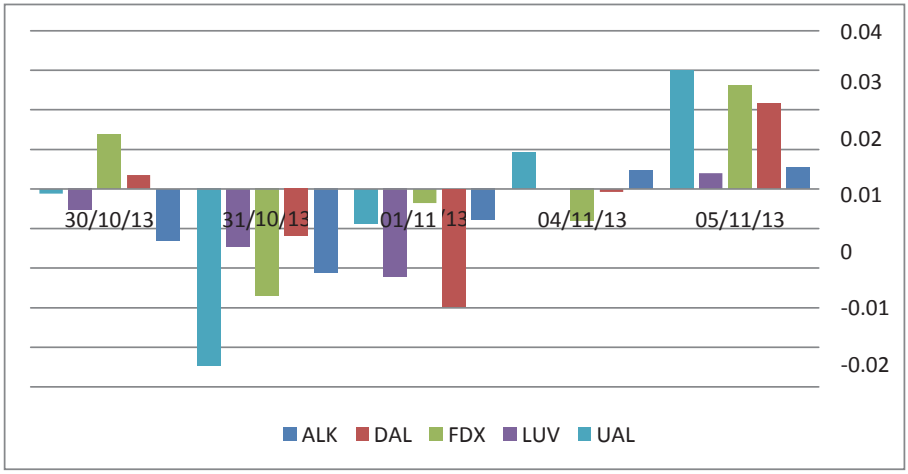
In the figures 3 and 4, the returns from 30.10.2013 till 05.11.2013 of fourteen companies listed on NASDAQ and NYSE can be seen. The returns were generated on the basis of adjusted stock. So it is seen on November 1, the date of the terrorist attack in Los Angeles, the return of one company, Hawaiian Holdings, was higher than zero, while all others were negative. During the next working days, more than half of the companies achieved a positivemark.

Figure 3. Returns of companies listed on NASDAQ (30th October 2013 – 5th November 2013).



Source: database of NASDAQ.

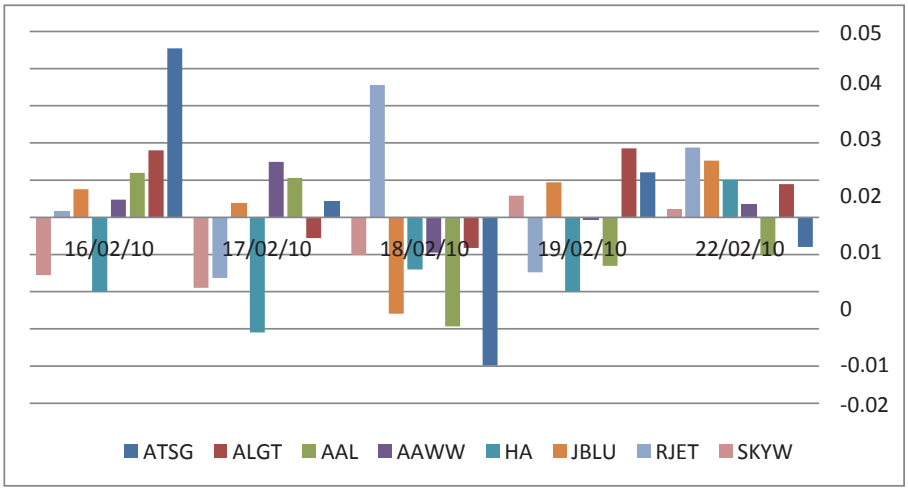
Figure 4. Returns of companies listed on NYSE (30th October 2013 – 5th November 2013).



Source: database of NYSE.

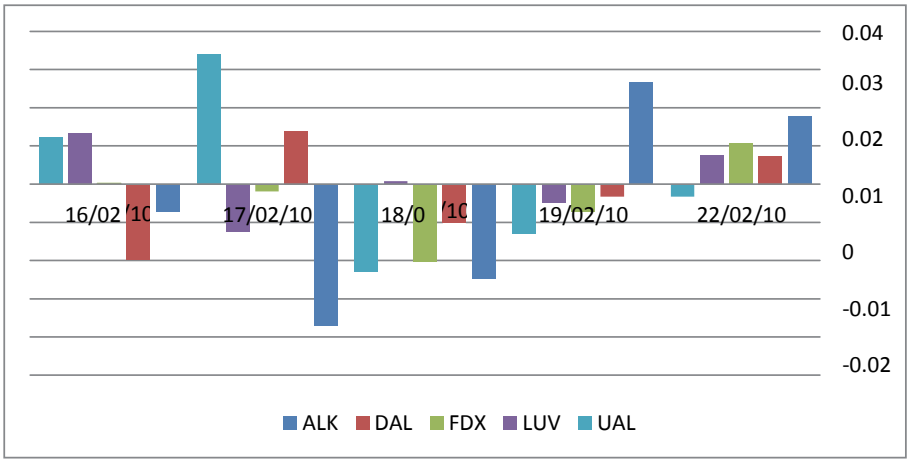
On November 18th, 2010, another terroristic act occurred in Texas. Figures 5 and 6 show how share prices of the companies were changing during this event. When comparing returns of the companies before the terroristic act and on the event day, there is a significant decreasing for most companies.

Figure 5. Returns of companies listed on NASDAQ (16th February 2010 – 22nd February 2010).



Source: Database of NASDAQ.

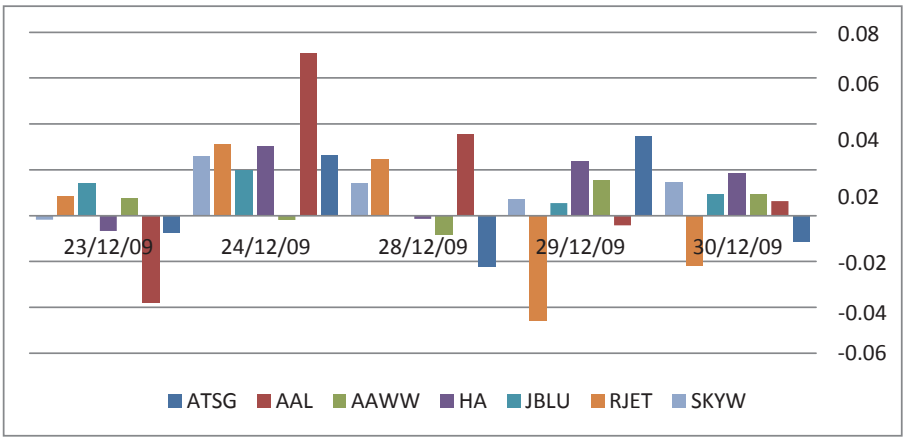
Figure 6. Returns of companies listed on NYSE (16th February 2010 – 22nd February 2010).



Source: Database of NYSE.

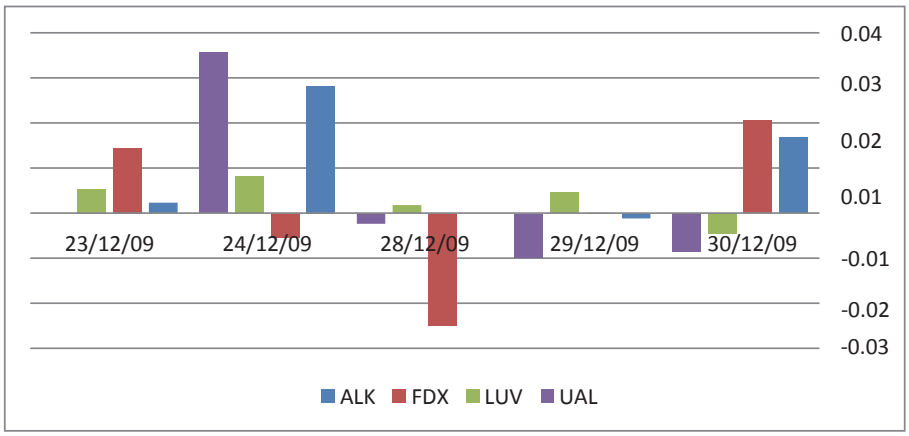
The next two events investigated in the research happened during the holidays when the stock exchanges are closed: at Christmas 2009 and on Independence Day 2002. Two days after the events were Saturday and Sunday that are not working days. Thus, it is possible to compare values of the day before the event with values obtained in three days after the event. The figures below show most companies were able to generate the positive value after the event. Negative values for the few companies, with the exception of FDX, were not significant.

Figure 7. Returns of companies listed on NASDAQ (23rd December 2009 – 30th December 2009).



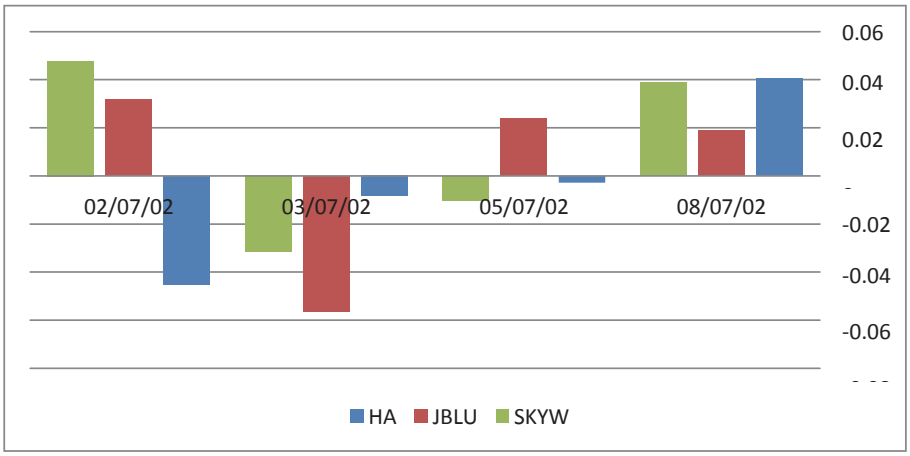
Source: Database of NASDAQ.

Figure 8. Returns of companies listed on NYSE (23rd December 2009 – 30th December 2009).



Source: Database of NYSE.

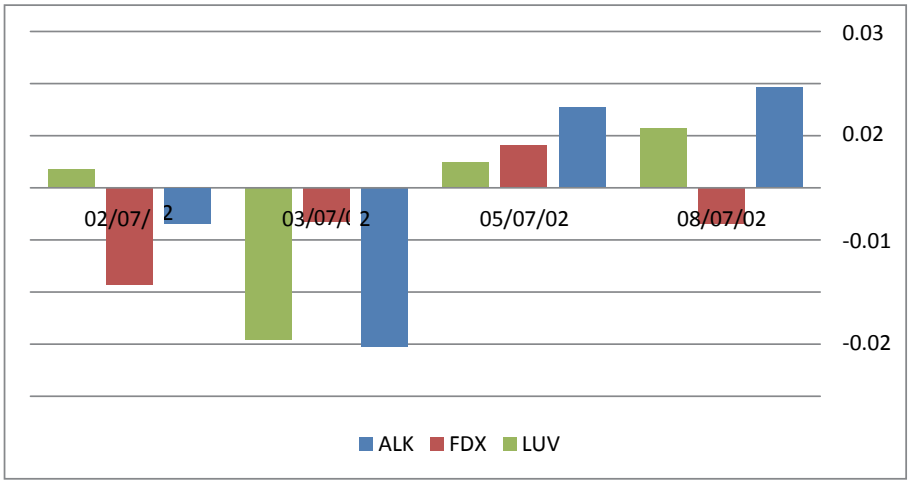
Figure 9. Returns of companies listed on NASDAQ (2nd July 2002 – 8th July 2002).



Source: Database of NASDAQ.

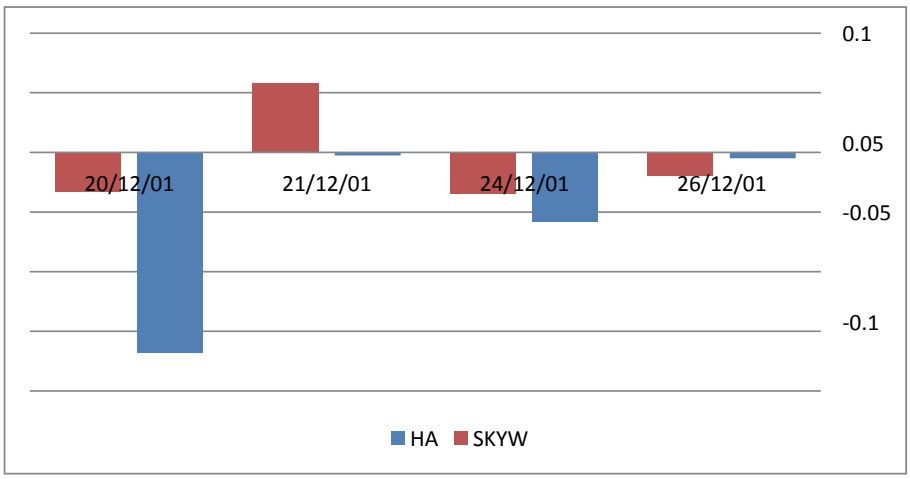
The terroristic act which happened on 22nd December 2001 was only an attempt to ignite the shoe bomb in the airport of Florida. As a result of the attempt, there was only one victim and the event did not receive such a huge response. The values of the companies were either improved or remained unchanged (figures 10 and 11).

Figure 10. Returns of companies listed on NYSE (2nd July 2002 – 8th July 2002).



Source: Database of NYSE.

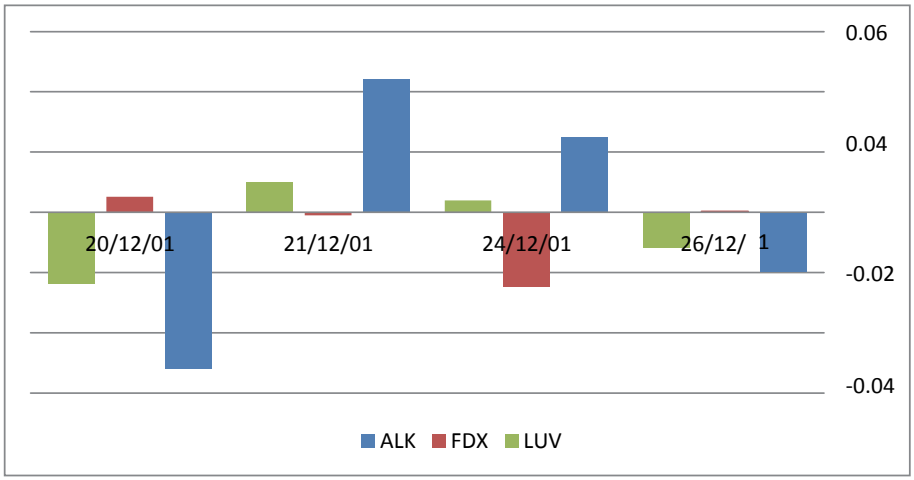
Figure 11. Returns of companies listed on NASDAQ (20th December 2001 – 26th December 2001).



Source: Database of NASDAQ.

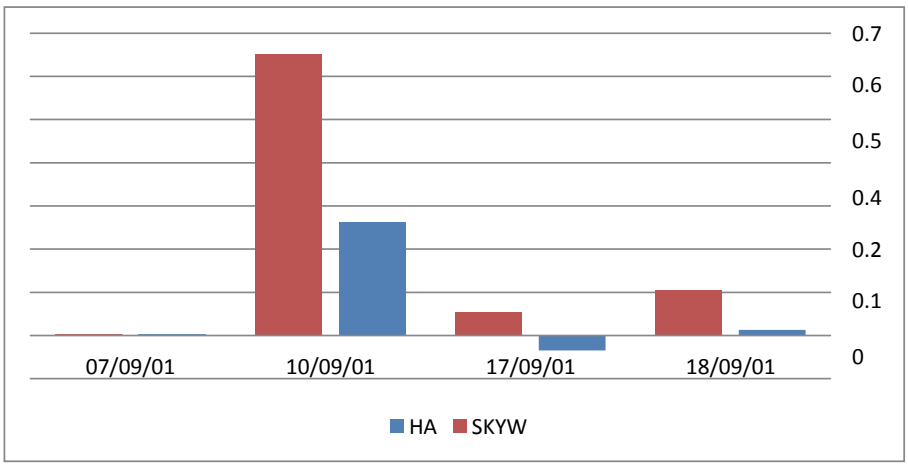
The September 11 attacks had a crucial economic impact on the US and world markets. NYSE and NASDAQ did not open on September 11th and stayed closed during five days. After the longest period of inactivity, the Dow Jones Index ("DJIA") lost 684 points or 7.1%. It was the largest fall in a single day. By the end of the week, DJIA fell to1369.7 points (14.3%). It was the biggest weekly drop in history (Jim Ritter, 2002). Figures 13 and 14 show the significant decrease in share prices for the companies.

Figure 12. Returns of companies listed on NYSE (20nd December 2001 – 26th December 2001).



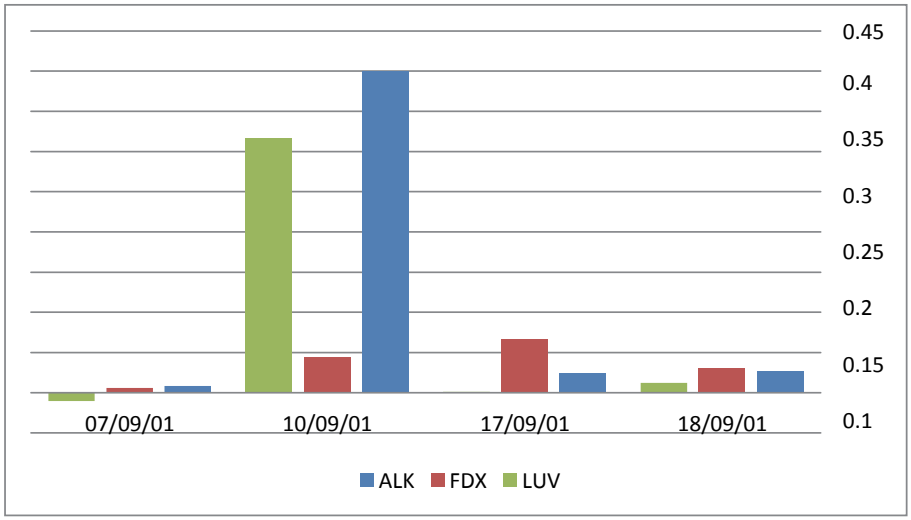
Source: Database of NYSE.

Figure 13. Returns of companies listed on NASDAQ (7th September 2001 – 18th September 2001).



Source: Database of NASDAQ.

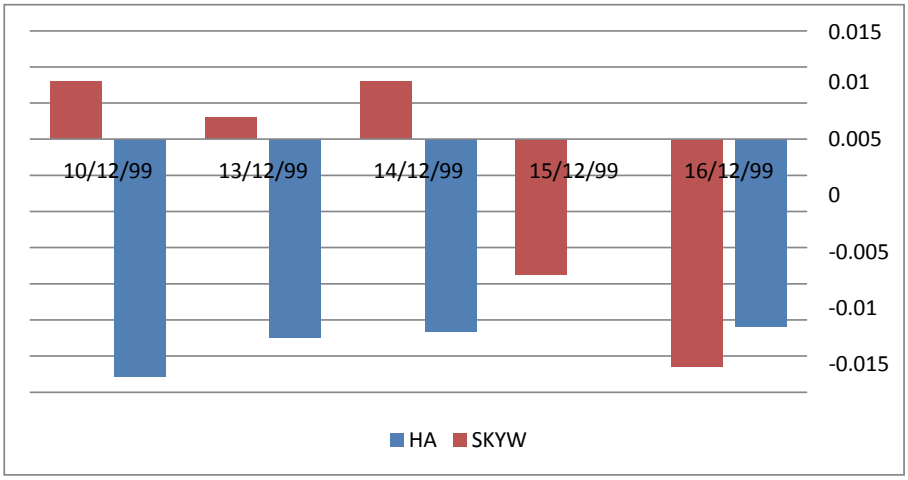
Figure 14. Returns of companies listed on NYSE (7th September 2001 – 18th September 2001).



Source: Database of NYSE.

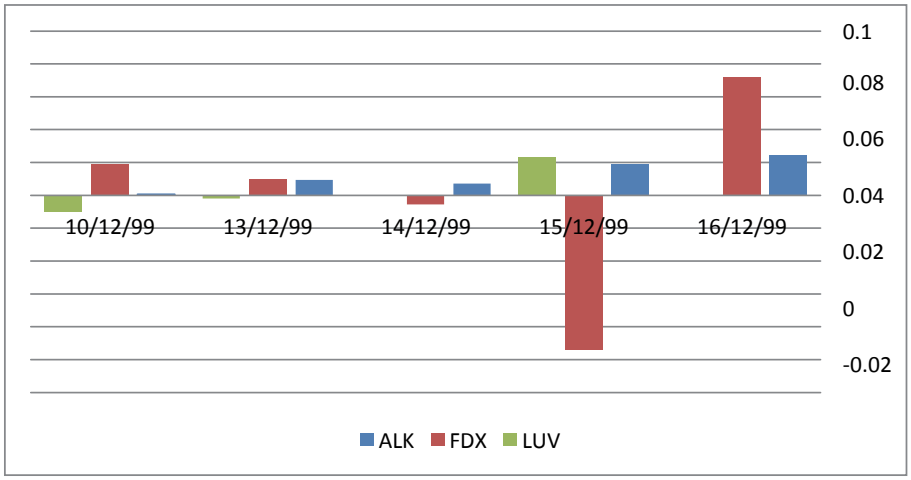
Figures 15 and 16 show the returns of the companies during the period from 10th December 199 till 16th December 1999. It was an attempt to smuggle bombs across the border with Canada.

Figure 15. Returns of companies listed on NASDAQ (10th December 1999 – 16th December 1999).



Source: Database of NASDAQ.

Figure 16. Returns of companies listed on NYSE (10th December 1999 – 16th December 1999).



Source: Database of NYSE.

Two next parts of the chapter describe the ESA used to make research and results obtained in STATA.

Event Study Analysis

The major aim of this work is to investigate how terrorist attacks affected the share prices of US airlines. To measure the impact of terrorism, Event Study Analysis was applied. It is assumed that all relevant information is immediately and fully reflected in the share prices (Jegadeesh and Kim 2006).

Traditional event analysis method is described in detail in the work written by Kothari and Warner (1997).

$$r_t = \alpha + \beta r_t^M + \gamma r_t^I + e_t$$

where r_t is the daily stock return, r_t^M is the market return during estimation window, r_t^I is the return of an index for considered industry, e_t is the abnormal return.

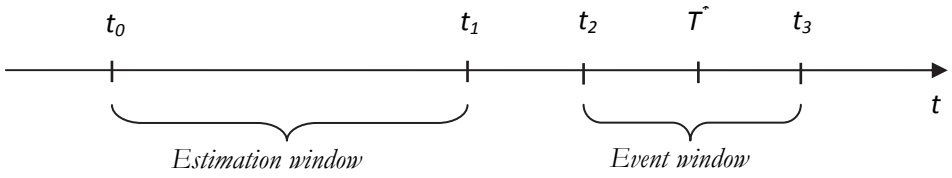
In this method, r_t^M is defined as the average market rate of return calculated on the basis of daily changes of the market index.

The ESA includes steps described below.

The first step is to choose a model that describes the daily returns R_t of the investigated financial instrument (for example, the company's shares). The model is built on the basis of historical data. The model parameters are

estimated in the estimation window (Picture 1). Typically, the model is estimated in the estimation window lasting at least 3 months. Based on the economic point of the task, the selection of the event window is the second step of the model. In most cases, the period $[t_2 - t_3]$ covers a few days. Researchers take into account when the market and its participants get information. For example, when analyzing the effect of securitization on share prices, it is considered that some investors might be aware of the upcoming event in advance. Thus, the required number of days is included in the event window. Additionally, it should be mentioned that the effect of an event may happen after the event. This also affects the range of the event window. Depending on the task, the period $[t_2 - t_3]$ may cover even a month. In this research, event window covers five days. It is described below.

Picture 1. Event Study Periodization.



Source: Zadorozhna and Zaderey (2013).

For this investigation, estimation window includes 180 working days for stock exchanges NASDAQ and NYSE. Event Study Analysis is used to measure the effect of events on stock market. For many studies, estimation window covered the period of more than 3 months (Okulov, 2010). For this study, the length of the event window was chosen based on the paper of Khotari and Warner(2006).

The event window consists of five days: 2 days before the event and 2 days after the event. The event window was divided into several groups of days' combination: [-2; +2], [-2; +1], [-2; 0], [-1;+2], [-1;+1], [-1;0], [0;+1],[0;+2], and [0], where 0 – the event's day. This length of the event window is usual for event studies. Basing on the research described in chapter I, it is assumed that terrorist attacks have a short-term effect on the market. Thus, only two days after the event were included in the event. Moreover, a longer period might be a source of additional noise that discredits the results.

In some studies, event window is more expanded, as information or rumors concerning investigated event (for example, coming dealings) can penetrate into the market before its announcement. Moreover, market may require a large

amount of time to generate an adequate reaction to the received information, and the actual reaction may not immediately be reflected in the prices. However, in this study, it was preferred to avoid "noise" described in the section 2 and its effect on the market prices and get the results of immediate reaction on the event.

Correcting data on the availability of omissions is a necessary procedure before starting calculations. Missing values in the data may be caused by several reasons. Firstly, it is unclear values of which days should be considered: trading or calendar. In the case of calendar days, it would be incorrect to carry out adjustments on the weekend ignoring price changes during this period. This will lead to an underestimation of dispersion for profitability: during the weekend, there will be created a low volatility zone. All this leads to the fact that it makes sense to consider the financial quotes of trading days. In the database for this research, missing values were fulfilled basing on the method of Little and Rubin (2002) that is described below.

Secondly, missing data may be caused by the lack of trading in a particular date. There are many ways of dealing with missing data (Little, Rubin, 2002). For example, data can be filled at the price of the last transaction. However, this filling is not correct, since the potential share price reflecting investor sentiment can change, and the lack of trading is explained only by the fact that there are no counter orders on the stock exchange. In addition to the previous method, missing values can be filled with average values as well as the moving average method (Little, Rubin, 2002, p. 16).

Returns were calculated according to the following formula:

$$r_t = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{2}$$

where P_t is the share price at the close of trading on a particular day.

Using CAR assumes the calculation of normal stock returns k_t. Normal profitability means the rate of return of a company's shares in the absence of a specific event.

The next step is to calculate e_t, error term for each event in the event window:

$$e_t = r_t - \left(\alpha + \beta r_t^M + \gamma r_t^I\right) \tag{3}$$

Then, it is needed to calculate CAR with the following formula:

$$CAR_t = \sum_{j=t_0}^{t} e_j \tag{4}$$

It is important to explain values of CAR correctly. In case of CAR's significance, it will serve as proof that the terrorist attacks have an impact on the market return. Its absence will mean the opposite. The value of CAR can be positive, negative, or zero. The positive value will mean positive influence of the event on the return, while the negative value will mean that the event had a negative effect on the return. The results are explained below.

In the model, t-test was used in order to check the impact of the event on the return and determine if this indicator is statistically significant.

The t- statistic is found by the formula below (Ahern, 2009):

$$T - test = \frac{\frac{\sum AR}{N}}{\frac{AR_{SD}}{sqrt(N)}}$$

where *AR* is the abnormal return,
AR_{SD} is the abnormal return standard deviation,
N is the number or days in the event window (Princeton University Library, 2008).

Based on this methodology, the model was built and its results are presented in the next chapter.

Empirical Results

The data used in the econometric model represents the daily performance of shares of fourteen American airlines that are listed on two stock exchanges, NYSE and NASDAQ. Changes in prices for shares of companies were considered in different periods, focusing on the events that may affect the companies' stock. In this study, terrorist acts directly connected with the airlines and their transportation (e.g. aircraft hijacking, explosion at the airport, etc.) are considered to be the event having a possible impact on companies' share prices.

The aim of the research is to figure out whether such a type of chosen events may have an impact on stock prices of companies. With a positive result of the study, the second aim is to analyze how stock prices of the companies changed under the influence of a particular event.

In the research, nine event windows were tested. All results of the model are presented in Appendices 1–14. A particular interest is caused by the results obtained from the data of the event day and two days after the terroristic act. Basing on the papers and investigations mentioned above, it is assumed that

terrorist events have a short-term impact on the economy and the behavior of investors. It is figured out that terrorist attacks happened in the recent time have even less impact on the market than events of the beginning of the 21st century. Lien (2013) mentioned that bombings in Madrid caused no reaction of the US stock exchanges. Table 2 and table 3 present the retrieved data.

Basing on the results from table 2 and the table 3, the value of CAR is negative in most cases. From Table 2 and Table 3, it is seen that CAR of American Airlines Group (AAL) decreased by 1.5% and by 1.9% due to "1 Nov 2013" and "18 Feb 2010" events, respectively. During the terrorist attack in Los Angeles which happened on the 1st November, 2013, CAR for Atlas Air Worldwide Holdings (AAWW) dropped by 14.7%. During "18 Feb 2010" and "29 Dec 2009" events, CAR of FedEx (FDX) decreased by 1.9% and 5.3%. Hawaiian Holdings (HA) experienced a huge loss in CAR due to "24 Dec 2001" and "14 Dec 1999" events. It fell by 11.6% and 10.5%. After the terrorist attack on the 24th December, CAR for SkyWest (SKYW) decreased by 6.4%. As a result of the terrorist attack on the 1st November, 2013, CAR of Spirit Airlines (SAVE) decreased by 3.3%. Due to "18 Feb 2010" and "28 Dec 2009" events, CAR for United Continental Holding (UAL) decreased by 0.9% and 2%. Only, as a result of "28 Dec 2009", CAR for SkyWest (SKYW) shows an increasing value. It grew by 3.3%. Table 4 shows the difference between abnormal returns of the day of the event and the day after the event. Table 5includes the difference of two days after the event. Tables are made up of two columns. The first column shows if the value of CAR was positive or negative on the next day after the event. The second column shows how CAR changed after the day of the event, whether it was a positive or negative change. If for AAL, it was equal to – 0.018701 on the day of the "18 Feb 2010" event and then it decreased to - .0332001 on the nextday after the event. Column B for AAL reflects "-", as the value decreased. Column A reflect "-"as well because CAR was negative on the next day after the event. Table 5 shows the value of CAR and its changed happened in two days after the event.

Table 2. The summary of the results for [0; +1] event window for the whole data sample.

Company		1 Nov 2013	18 Feb 2010	28 Dec 2009	5 Jul 2002	24 Dec 2001	17 Sep 2001	14 Dec 1999
ATSG	CAR	-0.0533279	-0.0405235					
	t-stat	-0.5365278	-0.8210205					
ALK	CAR	-0.0067784	-0.0166724	-0.0034714	0.0135789	0.0261375	0.0845208**	0.0046849
	t-stat	-1.290308	-0.3771943	-0.6924477	0.6240196	0.4922119	2.004168	0.5817595
ALGT	CAR	0.0020209	-0.0036003					
	t-stat	0.099131	-0.1569041					
AAL	CAR	-0.014659***	-0.018701***	0.0263548				
	t-stat	-4.683468	-4.4507	0.7319473				
AAWW	CAR	-0.146604***	-0.007803	-0.0115693				
	t-stat	-2.691467	-1.485234	-0.3593314				
DAL	CAR	-0.0283448	0.0000292					
	t-stat	-0.9558927	0.0109139					
FDX	CAR	0.0003695	-0.0187948*	-0.0532997*	0.0005106	-0.0205199	0.2086113***	-0.0209656
	t-stat	0.0253248	-1.705348	-1.797239	0.0147394	-0.684411	2.789034	-0.1529894
HA	CAR	0.0054752	-0.0102268	-0.0060413		-0.1158408*	-0.0333015	-0.1052633***
	t-stat	0.6306805	-1.048813	-0.1816639		-1.936065	-0.5741864	-2.48478
JBLU	CAR	-0.0381086	-0.019093	-0.0039149				
	t-stat	-1.127767	-0.6701545	-0.3188898				
RJET	CAR	-0.0389488	0.0390114	0.0421564				
	t-stat	-0.5636244	0.7097796	0.5490991				

Company		1 Nov 2013	18 Feb 2010	28 Dec 2009	5 Jul 2002	24 Dec 2001	17 Sep 2001	14 Dec 1999
SKYW	CAR	-0.0240552	-0.0049336	0.0229048***		-0.064166***	0.1276066***	0.0328292
	t-stat	-0.9157034	-0.4611429	6.151947		-4.797311	3.272357	0.7776984
LUV	CAR	-0.0220658	0.004677	-0.0013678	0.0041216	0.0134034	0.0189864	-0.0046743
	t-stat	-1.41124	0.4873886	-0.2266385	0.2773488	0.6621285	0.7089317	-0.1863215
SAVE	CAR	-0.0229059*						
	t-stat	-1.950349						
UAL	CAR	-0.0117014	-0.008990***	-0.0206144***				
	t-stat	-0.8894109	-2.686713	-6.637991				

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10 % level.

Table 3. The summary of the results for [0; +2] event window for the whole data sample.

Company		1 Nov 2013	18 Feb 2010	28 Dec 2009	5 Jul 2002	24 Dec 2001	17 Sep 2001	14 Dec 1999
ATSG	CAR	-0.0533279	-0.0405235	-0.0532208				
	t-stat	-0.6188183	-0.9458268	-0.7556931				
ALK	CAR	-0.0067784	-0.0166724	-0.0034714	0.0135789	0.0261375	0.0845208	0.0046849
	t-stat	-0.7662801	-0.4317726	-0.164998	0.6240196	0.499488	0.9904747	0.1153147
ALGT	CAR	0.0020209	-0.0036003					
	t-stat	0.0599295	-0.1721406					
AAL	CAR	-0.0146594	-0.018701**	0.0263548				
	t-stat	-0.9550151	-2.080042	0.7257101				
AAWW	CAR	-0.146604	-0.007803	-0.0115693				
	t-stat	-0.9338247	-0.6605568	-0.3609894				
DAL	CAR	-0.0283448	0.0000292					
	t-stat	-0.6818711	0.0120111					
FDX	CAR	0.0003695	-0.0187948	-0.0532997	0.0005106	-0.0205199	0.2086113	-0.0209656
	t-stat	0.0106347	-1.263496	-1.174185	0.0147394	-0.4611677	1.32762	-0.0831007
HA	CAR	0.0054752	-0.0102268	-0.0060413	-0.00222	-0.1158408	-0.0333015	-0.1052633**
	t-stat	0.2573902	-0.6588894	-0.1914743	-0.063338	-1.284537	-0.4655972	-2.228559
JBLU	CAR	-0.0381086	-0.019093	-0.0039149	0.0456323			
	t-stat	-1.055646	-0.7185888	-0.3122465	1.543183			
RJET	CAR	-0.0389488	0.0390114	0.0421564				
	t-stat	-0.6120514	0.816163	0.556488				

Company		1 Nov 2013	18 Feb 2010	28 Dec 2009	5 Jul 2002	24 Dec 2001	17 Sep 2001	14 Dec 1999
SKYW	CAR	-0.0240552	-0.0049336	0.0229048***	-0.012399	-0.064166	0.1276066	0.0328292
	t-stat	-1.013664	-0.3934178	6.424819	-0.504293	-1.190943	0.5402728	0.5998117
LUV	CAR	-0.0220658	0.004677	-0.0013678	0.0041216	0.0134034	0.0189864	-0.0046743
	t-stat	-1.612774	0.5595701	-0.0957303	0.2773488	0.5337886	0.1306755	-0.1906937
SAVE	CAR	-0.0229059						
	t-stat	-1.014675						
UAL	CAR	-0.0117014	-0.0089906***	-0.0206144***				
	t-stat	-1.026886	-2.373746	-5.261341				

Notes: *** – significance at 1% level; ** – significance at 5% level; * – significance at 10 % level.

Table 4. The changes in the volatility of returns for [0; +1] event window.

Company	1 Nov 2013		18 Feb 2010		28 Dec 2009		5 July 2002		24 Dec 2001		17 Sep 2001		14 Dec 1999	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
ATSG	-	+	-	+										
ALK	-	-	-	+	-	-	+	-	+	+	+	+	+	+
ALGT	+	-	-	+										
AAL	-	-	-	-	+	+								
AAWW	-	+	-	-	-	+								
DAL	-	+	+	-										
FDX	+	-	-	-	-	-	+	-	-	-	+	+	-	-
HA	+	-	-	-	-	+			-	-	-	-	-	+
JBLU	-	-	-	+	-	+								
RJET	-	+	+	-	+	-								
SKYW	-	-	-	+	+	+			-	-	+	+	+	-
LUV	-	-	+	-	-	+	+	-	+	-	+	+	-	+
SAVE	-	-												
UAL	-	+	-	-	-	-								

Notes: A: the value of the return on the event date. "+" means a positive value; "-" means a negative value. B: the returns' changes after the event. "+" means a positive change, "-" means a negative change. Purple color stands for significant results.

Table 5. The changes in the volatility of returns for [0; +2] event window.

Company	1 Nov 2013		18 Feb 2010		28 Dec 2009		5 July 2002		24 Dec 2001		17 Sep 2001		14 Dec 1999	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
ATSG	-	+	-	-	-	+								
ALK	-	-	-	+	-	+	+	-	+	-	+	+	+	+
ALGT	+	+	-	+										
AAL	-	-	-	-	+	+								
AAWW	-	+	-	-	-	+								
DAL	-	+	+	-										
FDX	+	+	-	-	-	+	+	-	-	+	+	-	-	-
HA	+	-	-	-	-	+	-	+	-	+	-	-	-	-
JBLU	-	-	-	+	-	+	+	+						
RJET	-	+	+	-	+	-								
SKYW	-	-	-	-	+	+	-	-	-	-	+	+	+	-
LUV	-	-	+	-	-	+	+	-	+	-	+	-	-	+
SAVE	-	-												
UAL	-	-	-	-	-	-								

Notes: A: the value of the return on the event date. "+" means a positive value; "-" means a negative value. B: the returns' changes after the event. "+" means a positive change, "-" means a negative change. Purple color stands for significant results.

From tables 4 and 5, it is seen that for all companies, during all events, CAR was negative, except for SKYW after the "28 Dec 209" event. It is interesting that the "11 Sep 2001", the most large-scale terrorist event, shows the opposite result. It should be taken into consideration that on the 11th September stock exchanges were closed during the working day and were opened after 5 days. Thus, it is difficult to assume how CAR will change, if stock exchanges work without interruption.

Despite the fact that there are more results representing the negative impact than the positive one, it should be mentioned that there are many results showing

a non-significant reaction. This fact requires a deeper analysis of the impact of terrorism on the economy. The general opinion about the economic impact of terrorism is that such events involve significant negative consequences. For sure, it is not a positive sign for a country as terrorism and its threat cause panic among the people and form the instability in the country. Furthermore, the government has to allocate additional funds for the fight against terrorism and the protection of the population. However, as it was mentioned in chapter I, due to growing demand and needs of the population such industries as defense industry and insurance industry may gain profit after terrorist attacks. Analyzing the impact of terrorism on airline industry, the first reaction is to say that it will lead to disastrous effect for the whole industry. This paper does not focus on the reaction of ordinary people to terrorist attack. The work investigates how the market and its participants behave during such events. Eldor and Melnick (2004) noticed that the markets always do their best. Markets do not have human traits; they are able to assess the information and respond to it rationally. Many economists (Evan Lucas (2015),Howard Archer (2015), Ferguson (2003), Chen and Siems (2004)) mentioned the short- term effect after huge terrorist attacks and no reaction after non significant events.

In order to check how terrorist attacks affected share prices of the airlines, the difference between share prices on the day of the event and the next trading day was calculated. The results are presented in the table 6. It can be seen that there was no collapse in prices excluding the "11th September attacks" event. In most cases, share prices increased. The biggest decrease in share prices was recorded for AAL after the event "28th December 2009". It decreased by 7%. Analyzing positive changes, it cannot be said that there was an unprecedented increase of share prices. The highest positive change was fixed at7%.

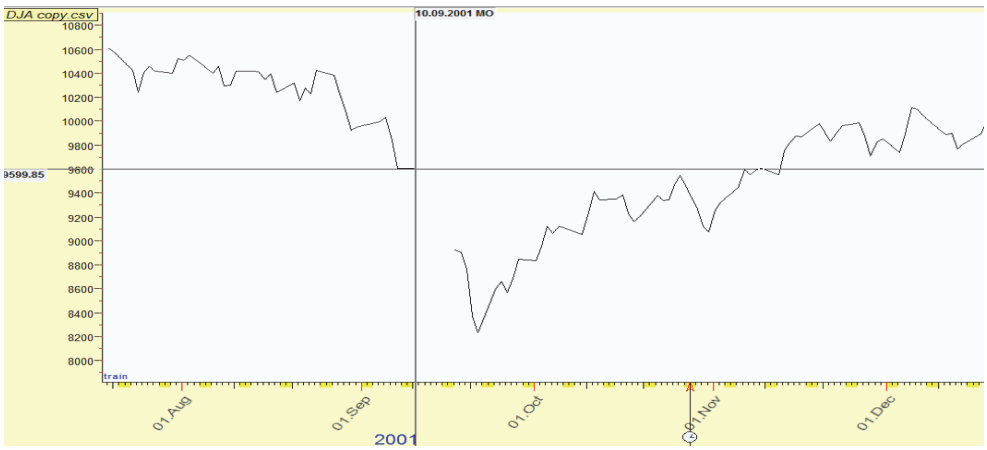
Table 6 shows the change in real share prices of the airline companies in percentage terms on the next day after the terrorist attacks.

From table 6, it is seen that there was no decrease in share prices after the event. Only the "11th September attacks" event can be considered an exception. It is obvious as this event led to the greatest number of deaths among all other events, and it was the first mass terrorist attack involving aircrafts in the United States. At that time, the US economy experienced not the best period in history, and this event only aggravated the situation. As a result of these attacks, the WTC was ruined damaging the communication network between stock exchanges and corporations. It caused chaos and panic on the market. In general, it affected negatively all industries, not only airline industry. Due to unstable and unclear situation on the market, DJIA dropped by 684 points. The behavior of DJIA can be seen on the figure below.

Table 6. The change in real share prices of the airline companies.

Company	1 Nov 2013	18 Feb 2010	28 Dec 2009	5July 2002	24 Dec 2001	17 Sep 2001	14 Dec 1999
ATSG	6%	4%	-3%				
ALK	1%	3%	0%	3%	-4%	-29%	-1%
ALGT	0%	1%					
AAL	1%	3%	-7%				
AAWW	1%	1%	0%				
DAL	3%	1%					
FDX	0%	2%	1%	1%	0%	-4%	1%
HA	-1%	1%	-3%	1%	0%	-21%	3%
JBLU	4%	3%	-2%	6%			
RJET	4%	-3%	-3%				
SKYW	2%	1%	-3%	3%	-5%	-39%	-1%
LUV	2%	0%	-1%	3%	-1%	-24%	0%
SAVE	3%						
UAL	1%	-1%	-3%				

Figure 17. The behavior of Dow Jones Industrial Average during September 11th Attacks.



Source: The project of Golubitskiy, 2016.

It is not surprising that a disaster of this scale had a huge impact on the stock exchanges and companies' share prices. Among all companies considered in the research, five airlines – ALK, FDX, HA, SKYW, and LUV – were listed on NASDAQ or NYSE in that time frame. The share prices of four companies collapsed by more than 20% on the next trading day after the September 11th attacks. The stock prices of FedEx Corporation decreased by only 4%. FedEx is not an airline, but this corporation owns a huge number of airplanes as it is engaged in delivery of items all over the world and provides logistics services. The company is highly dependent on the security of transportation. It is impossible to exclude that the increasing panic on the markets and concerns regarding aviation security reflected negatively on the company's share prices. However, it should be appreciated that compared with ALK, HA, SKYW, and LUV, drop in prices of other airline companies was not dramatic. After 2 months, the market recovered its losses. Terrorists could not inflict a significant blow to the US economy with the disastrous attacks of 11 September in New York (Kramer, 2015).

The probability of terrorist attacks always increases during public holidays and Christmas, and the government always warns of a possible imminent threat. Markets are aware of this fact. In 2001, on Christmas Eve, there was an attempt of a terrorist attack in Florida. On December 25, 2009, there was another attempt to blast the plane flying from Amsterdam. After these two terror attacks, share prices of most companies showed a negative trend. However, the greatest negative change does not exceed 7% (AAL).These attacks did not have any impact on ALK and AAWW in 2009 and FDX in 2001. At least, it was not reflected in their share prices. In 2003, the aggravation of the threat of international terrorism on Christmas holidays did not cause a significant reaction of the US stock market (Economist, 2003). On December 21, the US government raised the level of warnings about the threat of a terrorist attack to "orange" level, which is only one step below the highest "red" mark. During the next trading days, the major stock indexes finished trading with an increase. In those days, DJA and S&P 500 closed at the record level during the last 19 months (Economist, 2003). Scott Wren (2003) explained the stability of the markets to the threats of terrorism pointed out that there are plenty of things like Iraq policy or corporative scandals that can be confusing for investors. But the market is able to overcome these unpleasant moments taking into account favorable underlying fundamentals. Wren meant considerable economic growth and corporate profits at that time.

Another terrorist event happened on the Independence Day, the fourth of July. On the next trading day, stock of all companies showed only positive growth. JBLU share prices increased by 6%. Eiji Kinouchi (2015) analyzing the market behavior after terrorist attacks in Paris in 2015 mentioned that if this

happens during the trading hours, it will cause a great panic on the markets, but markets had the weekend to digest all the information. After attacks in Paris, CAC-40 decreased by 2%, while DAX and FTSE increased by 0.15% and 0.11% respectively (Colas, 2015). For comparison, after 9/11, S&P 500 dropped by 11.6% (Nedelescu and Johnston, 2005). The attack on the Independence Day had even less impact than attacks in Paris. In the case of favorable economic conditions and confidence in the companies based on their stable earnings, investors will not overreact to such events as a terrorist attack or a threat to the country. Furthermore, markets learn from the past and their participants are able to assess the impact of an event on the economy. Howard Archer (2015) stated that previous similar events over the past 15 years, as a rule, did not have long-term economic consequences. The results of the 1st November 2013 and 18th February 2010 show that all airlines' stock prices did not decrease after the terrorist attacks.

Different levels of market reactions to the event may have several explanations. First, the scale of events plays a significant role in the behavior of markets and market participants, which reflect in the companies' stocks. The September 11 attacks had an impact on the markets of all developed countries, while other events had a localeffect.

The second fact influencing the market reaction to terrorism is the government policy and actions regarding the event. If the government announces immediately how it plans to solve the problem and help the economy by reducing the negative impact on the market, as much as it is possible, the panic among the participants of the market will be reduced. This happened after 11 September attacks. Indeed, it caused a collapse on the US market but it was less significant that on the capital markets of London, Frankfurt, Tokyo, Hong Kong etc. (Chen and Siems, 2004).

The next fact that should be mentioned is that economic conditions in the country during an event can make a difference. In 2001, during two events, the US economy experienced a severe crisis due to the dotcom crisis mentioned in chapter I. In 2009, there was a post-crisis period. Negative changes in companies' prices cannot be explained only by terrorist attacks. It is needed to take into consideration the economic situation in the country and the world.

In conclusion, it can be said that the market is becoming more flexible and stable to terrorist attacks basing on the previous experience. It is difficult to make the market overreact to events, especially if in the past the market has already experienced similar events with a huge impact.

Conclusions

The normal human reaction to severe stress, in particular to the terroristic attack, is a deep shock. In this state, people are prone to emotional and illogical actions. Judging by the behavior of the stock market, the world of finance is prone to making money and as a result it does not overreact to unexpected events. The reason for the so-called calmness is the experience gained in many years. In the 20th century, the attacks have ceased to be exceptional and extraordinary incidents. They have become a part of daily life of the community. However, the importance of terrorism in the decision making and on the market was not apparent for a longperiod.

It is believed that market represents billions of decisions, and the results of these decisions are reflected primarily in stock prices, the volume of transactions, interest for the loan etc. The purpose of terrorism is not only killing and explosions, but also the general information about the committed terrorist acts. The primary effect of terror is information: how it may affect the stock exchanges and share prices of companies.

Certainly, not all companies will face the same consequences caused by terrorism. It is necessary to take into account the scale of an event, its number of injured and killed as well as economic and political conditions. The biggest act of terrorism which had an impact on the entire financial world is the September 11 attacks. After the disaster, NYSE was closed, and after the restoration, the market was essentially lower than the closing level. FED was forced to reduce the base rate to unprecedented 3% to help collapsed stock market. Most American indexes fell to the lowest mark in three years; Dow Jones, the most affected, decreased by more than 7%. Most suffered industries belong to airlines, touristic and insurance companies.

It is needed to note September 11 attacks which took place against the backdrop of the general economic downturn had an impact on many countries. It was the time of the biggest corporate scandals in large companies. According to the official statistics, only two months later, there was a new cycle of economic growth in the USA.

Next major terrorist attacks did not affect the world markets to the same extent as the 9/11. The attacks in Madrid in 2004 and London in 2005 were also accompanied by a drop in prices. However the London events did not affect the US stock exchanges.

World business is gradually adapted to all kinds of eventualities, including massive events. The attack is a deterrent, and serious companies and serious investors have a high psychological stability. In addition, the economic mechanisms of

protection against these risks were found. Federal Commission for the Securities and Exchange Commission took unprecedented measures: it lifted restrictions on the purchase of companies' own shares. Large speculators refrain voluntarily from deals that could bring down the stock prices of securities (Low, 2001).

The September 11 attacks have had an immeasurable indirect impact on the whole world. In addition to the crisis and panic in the markets, terrorist attacks changed the attitude of people to safety. Market participants and governments have increased the chances of continuation of the business during and after disasters.

The US government has taken care that the financial institutions have invested millions of dollars in upgrading internal IT systems to ensure compliance with the adopted Patriot Act in October 2001.This law, in particular, requires financiers to empower the identification of suspicious transactions and customers. Companies are seeking to change their technological infrastructure so that in the event of a disaster they will be able to return to work as soon as possible. For this, it is necessary that all the data accumulated up to the time of the accident will remain intact. Naturally, the increasing level of security is more attractive and makes the financial world more stable as people feel more confident.

A proof of this is the fact that the market's reaction to the terrorist attacks decreases with each successive year. Lien (2015) measured it with the changes of major stock indexes of countries. In UK, for instance, she analyzed the behavior of FTSE after the terrorist attack.

- The attack on Charlie Hebdo magazine in January 2015 – a two-day marketreaction;
- The bombings in London in July 2005 – a two-day marketreaction;
- The bombings in Madrid in 2004 – a three-day marketreaction;
- September 11 attacks in New York in 2001 – an eight-day marketreaction.

These examples show that historically terrorist acts have a very short-term impact on markets, as investors as well as society will not be terrorized for a long time.

The research's results also show that in the course of time overreaction of markets is reduced and it does not bring an excessive havoc on the stock exchange. Basing on the results from table 1 and table 2, it is seen that CAR of the biggest part of the investigated companies was decreasing. Other results are not significant, and it explains non-significant reaction to terrorist attacks. The market is more stable as it was assumed. Certainly, it is impossible to explain the drop of share prices only with the event which happened in the USA. It is needed to consider a company's position before the attack and the level of trust on the part of market participants. However, it is impossible not to notice

a significant difference in the companies' share prices before and after the terroristattack.

In conclusion, it can be said that the terrorist attacks caused a negative drop in prices only in the short term and in case of significant terrorist attacks. In most cases, the market does not overreact to this type of events. In the future, the market is trying to compensate for lost opportunities during theevent.

Bibliography

Abadie, A and Gardeazabal J. (2003). *The Economic Costs on Conflict: A Case Study of the Basque Country*. "American Economic Review" 93(1),113–132.

Abadie, A and Gardeazabal J. (2008). *Terrorism and the World Economy*. "European Economic Review" 52(1),1–27.

Aksoy, M. (2014). *The Effect of Terrorism on Turkish Stock Market*. Ege Academic Review

Bandyopadhyay,S.andSandler,T.(2014).*ImmigrationPolicyandCounterterrorism*. "Journal of Public Economics" 110, 112–123.

Bandyopadhyay, S. and Sandler, T. (2014). *The Effects of Terrorism on Trade: A Factor Supply Analysis*. "Federal Reserve Bank of St. Louis Review" 96(2), 229–241.

Bandyopadhyay, S., Sandler, T., and Younas, J. (2014). *Foreign Direct Investment, Aid, and Terrorism*. "Oxford Economic Papers" 66(1), 25–50.

Black F. (1986). *Noise*. "The Journal of Finance" 41(3), 529–543.

Blomberg, S.B. and Hess, G.D. (2006). *How Much Does Violence Tax Trade?"*The Review of Economics and Statistics" 88(4), 599–612.

Blomberg, S.B., Hess, G.D., and Orphanides, A. (2004). *The Macroeconomic Consequences of Terrorism*. "Journal of Monetary Economics" 51(5), 1007–1032.

Broadberry, S. and Harrison, M. (2005). *The Economics of World War I*. Cambridge UniversityPress.

Burleigh, M. (2009).*Blood & Rage: A Cultural History of Terrorism*. New York: Harper CollinsPublishers.

Christopher, J. W. (2003). "It's up. It's down. Wait, it's back up, … The US economy in 2002". Kentucky Annual Economic Report, Center for Business and Economic Research, University ofKentucky.

Cordesman, A. (2004). *The Military Balance in the Middle East*. Center for Strategic and InternationalStudies.

De Jong, J.B., Shleifer A.M., Summers, L.H., and Waldmann, R.J. (1990). *Positive Feedback Investment and Destabilizing Rational Speculation*. "Journal of Finance" 45(2), 379–395.

De Jong, J.B., Shleifer A.M., Summers, L.H., and Waldmann, R.J. (1991). *The Survival of Noise Traders in Financial Markets*. "Journal of Business" 64, 1–19.

De Jong, J.B., Shleifer A.M., Summers, L.H., and Waldmann, R.J. (1990). *Noise Trader Risk in Financial Markets."*Journal of Political Economy" 98, 703–738.

Egger, P. and Gassebner, M. (2015). *International Terrorism as a Trade Impediment?*,"Oxford Economic Papers" 67(1), 42–62.

Enders, W. and Sandler, T. (1996). *Terrorism and Foreign Direct Investment in Spain and Greece*. Kyklos 49(3), 331–352.

Enders, W. and Sandler, T. (2000). *Is Transnational Terrorism Becoming More Threatening?*,"Journal of Conflict Resolution"44(3), 307–332.

Enders, W. and Sandler, T. (2012). *The Political Economy of Terrorism*, 2nd edn. New York: Cambridge University Press.

Fama E. (1965). *The Behavior of Stock Market Prices*. "Journal of Business" 38, 34–105.

Fama E. (1970). *Efficient Capital Markets: A Review of Theory and Empirical Work*. "The Journal of Finance" 25(2), 383–417.

Fama E. and Macbeth J.(1973). *Risk, Return and Equilibrium: Empirical Tests*. "Journal of Political Economy" 81, 609–636.

Fama E., Fisher L., Jensen M., and Roll R. (1969). *The Adjustment of Stock Prices to New Information*. "International Economic Review" 10(1), 1–21.

Fama F. and French K. (1993). *Common Risk Factors in the Returns on Stocks and Bonds "*Journal of Financial Economics" 33, 3–56.

Fama F. and French K. (1988). *Business cycles and the behavior of metals prices*. "The Journal of Finance" 43(5), 1075–1093.

Ferson, W., Heuson A., and Su, T. (2005). *Weak and Semi-strong Form Stock Return Predictability Revisited*. "Management Science" 51, 1582–1592.

Gaibulloev, K. and Sandler, T. (2009). "The Impact of Terrorism and Conflicts on Growth in Asia". Economics and Politics 21(3), 359–383.

Gencay, R., Dacorogna, M., Muller, U., Pictet, O., and Olsen, R. (2001). *An Introduction to High Frequency Finance*. 1st ed. California: Academic Press.

Gong, F. (2009). *Global Anti-terrorism Law and Policy*. Oxford University Press.

Grossman S. and Stiglitz J. (1980). *On the Impossibility of Informationally Efficient Markets*. "The American Economic Review" 70(3), 393–408.

James K. Galbraith and Travis Hale (2004). "Income Distribution and the Information Technology Bubble". University of Texas Inequality Project Working Paper.

Jensen M. (1968). *The Performance of Mutual Funds in the Period 1945–1964*. "Journal of Finance" 23(2), 389–416.

Johnston, R.B. and Nedelescu, O.M. (2005). "The Impact of Terrorism on Financial Markets". N.Y.: IMF, 21–22.

Landes, W.M. (1978). *An Economic Study of US Aircraft Hijackings 1961–1976*, "Journal of Law and Economics" 21(1), 1–31.

Legaspi, A. (2014). "Global Terrorism Index: PHL 9th country most affected by terrorism in 2013", GMA NewsOnline.

Lenain, P., Bonturi, M., and Koen, V. (2002). *The Economic Consequencesof Terrorism* OECS Economics Department Working Papers, 334.

Line, K. (2015). "Terror and its Impact on FOREX" [online] Available at:http://www.bkass-etmanagement.com/featured/terror-and-its-impact-on-forex_8847/ [viewed 3rd Jan. 2017].

Lo A. (2004). *The Adaptive Markets Hypothesis: Market Efficiency from an Evolutionary Perspective*. "Journal of Portfolio Management" 30, 15–29.

Moody's Investors Service (2015). *Terrorism has a long-term negative effect on economic activity and the cost of the stateloan*.

Murphy, J. (2004). *Inter market analysis: principles of interaction of financial markets*.

Nitsch V. and Schumacher D. (2004). *Terrorism and International Investigation*. "European Journal of Political Economy" 20(2), 423–433.

Nordhaus, W.D. (2002). *The Economic Consequences of War with Iraq*. "The New York Review of Books", 49(19).

Palombi, S. and Gomis, B (2016). *Lone-Actor Terrorism*. The Royal Institute of Inernational Affairs.

Quillen, Chris (2002). *A Historical Analysis of Mass Casualty Bombers*. "Studies in Conflict & Terrorism", 25(5), 279–292.

Raby, G. (2003). "The Cost of Terrorism and the Benefits of Cooperating to Combat Terrorism". Secure Trades in the APEC Region (STAR)Conference.

Rhoades, D. and Reynolds, R. (2005). *The Effect of Line Maintenance Activity on Airline Safety Quality*. "Journal of Air Transportation", 10(1).

Robb, J. (2007). *Brave New War: The Next Stage of Terrorism and the End of Globalization*

Roberts H. (1967). *Statistical Versus Clinical Prediction of the Stock Market*.

Rockinger, M. and Urga, G. (2000). *The Evolution of Stock Markets in Transition Economies*. "Journal of Comparative Economics" 28, 456–472.

Rockinger, M. and Urga, G. (2001). *A Time Varying Parameter Model to Test for Predictability and Integration in Stock Markets of Transition Economies*. "Journal of Business of Economics andStatistics".

SamuelsonP.(1965).*Proof that Properly Anticipated Prices Fluctuate Randomly*. "Industrial Management Review" 6, 41–49.

Sandler, T. and Enders, W. (2004). *An Economic Perspective on Transnational Terrorism*."European Journal of Political Economy" 20(2), 301–316.

Schmid, A. (2016). *Links between Terrorism and Migration*. ICCT Research paper.

Sheffi, Y. (2001). *Supply Chain Management infers the Threat of International Terrorism*. "The International Journal of Logistics Management" 12, 1–11.

Shiller, R. (1981). *Do Stock Prices Move Too Much to Be Justified by Subsequent Changes in Dividends?* "American Economic Review" 71(3), 421–436.

Sunstein, C. R. (2003*). Terrorism and Probability Neglect*. "The Journal of Risk and Uncertainty" 26, 126–136.

Zalewska-Mitura, A. and Hall, S.G. (1999). *Examining the First Stages of Market Performance. A Tests for Evolving Market Efficiency*. "Economics Letters" 64, 1–12.

Zicher , B. (1972). *Trouble with terrorism*. "Economist" 244, 42.

Appendix

APPENDIX 1. Car Estimation Results for American for American Airlines Group (AAL)

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**	**CAR**	**ttest**
30 oct 2013	0.0467769	0.7264093	0.0467769	0.8162056	0.0467769	0.8291003		
31 oct 2013	0.0440667	0.6843219	0.0440667	0.7689154	0.0440667	0.781063	-0.0027102	-0.1281556
01 nov 2013	0.0294073	0.4566725	0.0294073	0.5131248	0.0294073	0.5212312	-0.0173696	-0.8213441
04 nov 2013	0.0178779	0.2776301	0.0178779	0.3119498			-0.028899	-1.366525
05 nov 2013	-0.0103252	-0.1603421					-0.0571021	-2.700143
16 feb 2010	0.0081264	0.275357	0.0081264	0.3352087	0.0081264	0.3475588		
17 feb 2010	0.0054677	0.1852678	0.0054677	0.2255377	0.0054677	0.2338472	-0.0026587	-0.1420887
18 feb 2010	-0.0132333	-0.4483991	-0.0132333	-0.5458633	-0.0132333	-0.5659747	-0.0213597	-1.141508
19 feb 2010	-0.0277325	-0.9396914	-0.0277325	-1.143943			-0.0358589	-1.916375
22 feb 2010	-0.0525539	-1.780745					-0.0606803	-3.242884
23 dec 2009	-0.046958	-0.4844079	-0.046958	-0.4777723	-0.046958	-0.4705666		
24 dec 2009	-0.0208657	-0.2152461	-0.0208657	-0.2122975	-0.0208657	-0.2090957	0.730502	1.406158
28 dec 2009	0.0054891	0.0566241	0.0054891	0.0558484	0.0054891	0.0550061	0.099405	1.913467
29 dec 2009	0.221885	0.2288919	0.221885	0.2257565			0.1161045	2.234917
30 dec 2009	0.232044	0.2393717					0.1171204	2.254472

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0027102	-0.2525317	-0.0027102	-0.2268109					
-0.0173696	-1.618465	-0.0173696	-1.453622	-0.0146594	-0.9550151	-0.0146594	-4.683468	-0.0146594
-0.028899	-2.691749			-0.0261888	-1.706118	-0.0261888	-8.366935	
				-0.0543919	-3.543461			

-0.0026587	-0.1845271	-0.0026587	-0.1657338					
-0.0213597	-1.482448	-0.0213597	-1.331468	-0.018701	-2.080042	-0.018701	-4.4507	-0.018701
-0.0358589	-2.488748			-0.0332001	-3.692733	-0.0332001	-7.9014	
				-0.0580216	-6.453531			

0.730502	1.547387	0.730502	6.22039					
0.099405	2.105648	0.099405	8.464561	0.0263548	0.7257101	0.0263548	0.7319473	0.0263548
0.1161045	2.459384			0.0430542	1.185549	0.0430542	1.195738	
				0.0440701	1.213523			

vent, and b stands for the number of days after the event.

APPENDIX 2. Car Estimation Results for Air Transport Serivices Group (ATSG).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**
30 oct 2013	0.0651674	0.6268826	0.0651674	0.6254561	0.0651674	0.6341345		
31 oct 2013	0.0765632	0.7365051	0.0765632	0.7348291	0.0765632	0.7450252	0.0113958	0.1374849
01 nov 2013	0.0232353	0.223514	0.0232353	0.2230053	0.0232353	0.2260996	-0.419321	-0.505892
04 nov 2013	0.0693019	0.6666542	0.0693019	0.6651372			0.0041344	0.0498802
05 nov 2013	0.0615445	0.5920321					-0.0036229	-0.0437083
16 feb 2010	0.0447281	0.6264299	0.0447281	0.6397466	0.0447281	0.6058034		
17 feb 2010	0.0474485	0.6645299	0.0474485	0.6786565	0.0474485	0.6426489	0.0027204	0.0606263
18 feb 2010	0.0069249	0.0969857	0.0069249	0.0990474	0.0069249	0.0937923	-0.0378031	-0.8424731
19 feb 2010	0.0157589	0.2207083	0.0157589	0.2254002			-0.0289692	-0.6456007
22 feb 2010	-0.003007	-0.0421132					-0.047735	-1.063813
23 dec 2009	-0.0160623	-0.2116394	-0.0160623	-0.2291855	-0.0160623	-0.3119326		
24 dec 2009	0.0040109	0.052848	0.0040109	0.0572294	0.0040109	0.077892	0.0200732	0.2646963
28 dec 2009	-0.0291367	-0.383909	-0.0291367	-0.415737	-0.0291367	-0.5658384	-0.0130743	-0.1724055
29 dec 2009	0.0033189	0.0437303	0.0033189	0.0473558			0.0193812	0.2555714
30 dec 2009	0.0167122	0.2202018					0.0327745	0.4321823

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.0113958	0.1304166	0.0113958	0.1760682					
-0.419321	-0.4798832	-0.419321	-0.6478636	-0.0533279	-0.6188183	-0.0533279	-0.5365278	-0.0533279
0.0041344	0.0473158			-0.0072613	-0.0842607	-0.0072613	-0.0730557	
				-0.0150186	-0.1742769			

0.0027204	0.0583746	0.0027204	0.0629083					
-0.0378031	-0.811832	-0.0378031	-0.8741835	-0.0405235	-0.9458268	-0.0405235	-0.8210205	-0.0405235
-0.0289692	-0.6216227			-0.0316896	-0.73964	-0.0316896	-0.642041	
				-0.0504554	-1.177639			

0.0200732	0.294141	0.0200732	0.3723773					
-0.0130743	-0.1915838	-0.0130743	-0.2425417	-0.0532208	-0.7556931			-0.0532208
0.0193812	0.284001			-0.0207652	-0.2948495			
				-0.0073719	-0.1046757			

vent, and b stands for the number of days after the event.

APPENDIX 3. Car EstimationResults for AllegiantTravel Company (ALGT).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**
30 oct 2013	0.0206156	0.5228521	0.0206156	0.6097592	0.0206156	0.7727913		
31 oct 2013	0.0106658	0.2705059	0.0106658	0.3154687	0.0106658	0.3998159	-0.0099498	-0.2947259
01 nov 2013	0.0126867	0.32176	0.0126867	0.3752421	0.0126867	0.475571	-0.0079289	-0.2348641
04 nov 2013	-0.0056786	-0.1440195	-0.0056786	-0.1679581			-0.0262941	-0.7788678
05 nov 2013	0.0148795	0.3773748					-0.005736	-0.1699092
16 feb 2010	0.0207834	0.7443479	0.0207834	0.7417239	0.0207834	0.8323371		
17 feb 2010	0.0160493	0.5747986	0.0160493	0.5727723	0.0160493	0.6427454	-0.0047341	-0.2122089
18 feb 2010	0.012449	0.4458539	0.012449	0.4442821	0.012449	0.4985582	-0.0083344	-0.3735969
19 feb 2010	0.0317948	1.138715	0.0317948	1.134701			0.0110114	0.4935918
22 feb 2010	0.0331446	1.187057					0.0123612	0.5540966

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0099498	-0.5607344	-0.0099498	-0.8311791					
-0.0079289	-0.4468436	-0.0079289	-0.6623582	0.0020209	0.0599295	0.0020209	0.099131	0.0020209
-0.0262941	-1.481845			-0.0163443	-0.4846896	-0.0163443	-0.801738	
				0.0042137	0.1249579			

-0.0047341	-0.2011639	-0.0047341	-4.175612					
-0.0083344	-0.3541519	-0.0083344	-7.351225	-0.0036003	-0.1721406	-0.0036003	-0.1569041	-0.0036003
0.0110114	0.4679014			0.0157455	0.7528257	0.0157455	0.6861917	
				0.0170952	0.8173618			

vent, and b stands for the number of days after the event.

APPENDIX 4. Car Estimation Results for Atlas Air Worldwide Holdings (AAWW).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**
30 oct 2013	0.083379	0.8373438	0.083379	0.883895	0.083379	0.8766621		
31 oct 2013	0.0748775	0.7519663	0.0748775	0.793771	0.0748775	0.7872757	-0.0085015	-0.4991479
01 nov 2013	0.0602171	0.6047377	0.0602171	0.6383574	0.0602171	0.6331338	-0.0231619	-1.3599
04 nov 2013	0.0510037	0.512211	0.0510037	0.5406868			-0.0323753	-1.900845
05 nov 2013	0.024093	0.241957					-0.059286	-3.480849
16 feb 2010	0.0113274	0.3275705	0.0113274	0.4109524	0.0113274	0.4246381		
17 feb 2010	0.0339963	0.9831228	0.0339963	1.233373	0.0339963	1.274448	0.0226689	0.6788931
18 feb 2010	0.0261932	0.7574704	0.0261932	0.9502818	0.0261932	0.9819285	0.0148659	0.4452064
19 feb 2010	0.023644	0.6837485	0.023644	0.8577342			0.0123166	0.3688596
22 feb 2010	0.0075663	0.2188076					-0.003761	-0.1126353
23 dec 2009	0.0316091	0.8320891	0.0316091	0.8745759	0.0316091	1.036453		
24 dec 2009	0.0293322	0.7721496	0.0293322	0.8115758	0.0293322	0.9617923	-0.002277	-0.0725239
28 dec 2009	0.015486	0.4076572	0.015486	0.4284723	0.015486	0.5077793	-0.0161232	-0.5135412
29 dec 2009	0.0202305	0.532555	0.0202305	0.5597475			-0.0113786	-0.3624212
30 dec 2009	0.0259461	0.6830124					-0.0056631	-0.1803753

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0085015	-1.45684	-0.0085015	-1.380369					
-0.0231619	-3.969079	-0.0231619	-3.760738	-0.146604	-0.9338247	-0.146604	-2.691467	-0.0146604
-0.0323753	-5.547909			-0.0238738	-1.520692	-0.0238738	-4.382934	
				-0.0507845	-3.234828			

0.0226689	0.8034533	0.0226689	0.7439274					
0.0148659	0.5268908	0.0148659	0.4878547	-0.007803	-0.6605568	-0.007803	-1.485234	-0.007803
0.0123166	0.4365363			-0.0103523	-0.8763644	-0.0103523	-1.970469	
				-0.0264299	-2.237395			

-0.002277	-0.0732017	-0.002277	-0.2122093					
-0.0161232	-0.5183407	-0.0161232	-1.502653	-0.0115693	-0.3609894	-0.0115693	-0.3593314	-0.0115693
-0.0113786	-0.3658083			-0.0068247	-0.2129468	-0.0068247	-0.2119687	
				-0.0011091	-0.0346081			

vent, and b stands for the number of days after the event.

APPENDIX 5. Car Estimation Results for Hawaiian Holdings (HA).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
30 oct 2013	0.0388122	0.8048779	0.0388122	0.9544252	0.0388122	0.9830385		
31 oct 2013	0.0340244	0.7055908	0.0340244	0.8366905	0.0340244	0.8617742	-0.0047877	-0.2385739
01 nov 2013	0.0394997	0.819135	0.0394997	0.9713314	0.0394997	0.9713314	0.0006875	0.0342583
04 nov 2013	0.0362934	0.7526448	0.0362934	0.8924872			-0.0025187	-0.1255092
05 nov 2013	0.0175288	0.3635073					-0.0212834	-1.060557
16 feb 2010	-0.0155602	-0.7277535	-0.0155602	-1.078186	-0.0155602	-1.029535		
17 feb 2010	-0.0428445	-2.003843	-0.0428445	-2.968745	-0.0428445	-2.834788	-0.0272843	-1.236172
18 feb 2010	-0.0530714	-2.482153	-0.0530714	-3.677374	-0.0530714	-3.511441	-0.0375111	-1.69952
19 feb 2010	-0.0730491	-3.416512	-0.0730491	-5.061651			-0.0574888	-2.604651
22 feb 2010	-0.0751282	-3.513753					-0.059568	-2.698851
23 dec 2009	-0.0038557	-0.0906148	-0.0038557	-0.089371	-0.0038557	-0.1058105		
24 dec 2009	0.0487803	1.146425	0.0487803	1.130688	0.0487803	1.338675	0.052636	1.439938
28 dec 2009	0.042739	1.004444	0.042739	0.9906563	0.042739	1.172884	0.0465947	1.27467
29 dec 2009	0.0942975	2.21616	0.0942975	2.18574			0.0981532	2.685131
30 dec 2009	0.1164062	2.735755					0.1202619	3.28995
02 jul 2002	-0.0494042	-0.7283161	-0.0494042	-0.7283161	-0.0494042	-1.004819		
03 jul 2002	-0.0478732	-0.7057463	-0.0478732	-0.7057463	-0.0478732	-0.9736809	0.001531	0.045936
05 jul 2002	-0.050093	-0.7384692	-0.050093	-0.7384692	-0.050093	-1.018827	-0.0006887	-0.0206646
08 jul 2002	-0.0172672	-0.2545531	-0.0172672	-0.2545531			0.032137	0.9642426
20 dec 2001	-0.3230501	-1.537824	-0.3230501	-1.718377	-0.3230501	-1.931503		
21 dec 2001	-0.3356487	-1.597798	-0.3356487	-1.785393	-0.3356487	-2.00683	-0.0125987	-0.1441139
24 dec 2001	-0.4640882	-2.209211	-0.4640882	-2.468591	-0.4640882	-2.774764	-0.1410381	-1.613311
26 dec 2001	-0.476295	-2.26732	-0.476295	-2.533522			-0.1532449	-1.752942
27 dec 2001	-0.4391958	-2.090715					-0.1161457	-1.32857

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0047877	-0.5002478	-0.0047877	-0.4665058					
0.0006875	0.0718336	0.0006875	0.0669884	0.0054752	0.2573902	0.0054752	0.6306805	0.0054752
-0.0025187	-0.2631709			0.002269	0.1066654	0.002269	0.261361	
				-0.0164957	-0.7754599			

-0.0272843	-1.840712	-0.0272843	-1.599552					
-0.0375111	-2.53066	-0.0375111	-2.199103	-0.0102268	-0.6588894	-0.0102268	-1.048813	-0.0102268
-0.0574888	-3.87844			-0.0302045	-1.946003	-0.0302045	-3.097626	
				-0.0322837	-2.079956			

0.052636	1.431308	0.052636	1.553723					
0.0465947	1.26703	0.0465947	1.375395	-0.0060413	-0.1914743	-0.0060413	-0.1816639	-0.0060413
0.0981532	2.669037			0.0455172	1.442638	0.0455172	1.368723	
				0.0676259	2.143361			

0.001531	0.045936	0.001531	0.4081874					
-0.0006887	-0.0206646	-0.0006887	-0.1836252	-0.0022197	-0.0633382			-0.0022197
0.032137	0.9642426			0.030606	0.8733236			

-0.0125987	-0.2037082	-0.0125987	-0.2407401					
-0.1410381	-2.280451	-0.1410381	-2.695011	-0.1158408	-1.284537	-0.1158408	-1.936065	-0.1158408
-0.1532449	-2.477823			-0.1280476	-1.419896	-0.1280476	-2.140079	
				-0.0909483	-1.00851			

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
07 sep 2001	0.004203	0.0131581	0.004203	0.0140146	0.004203	0.0141054		
10 sep 2001	0.3650262	1.142766	0.3650262	1.217149	0.3650262	1.225033	0.3608232	1.133373
17 sep 2001	0.5121363	1.603315	0.5121363	1.707675	0.5121363	1.718737	0.5079333	1.595457
18 sep 2001	0.4653882	1.456963	0.4653882	1.551798			0.4611852	1.448617
19 sep 2001	0.4302306	1.346897					0.4260275	1.338185
10 dec 1999	-0.1259819	-2.188435	-0.1259819	-2.188003	-0.1259819	-13.1127		
13 dec 1999	-0.2229204	-3.872357	-0.2229204	-3.871592	-0.2229204	-23.20244	-0.0969385	-1.78292
14 dec 1999	-0.3604965	-6.262197	-0.3604965	-6.26096	-0.3604965	-37.52192	-0.2345147	-4.313259
15 dec 1999	-0.3553821	-6.173353	-0.3553821	-6.172311			-0.2294002	-4.219193
16 dec 1999	-0.4049754	-7.03484					-0.2789935	-5.131327

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.3608232	1.229092	0.3608232	1.258424					
0.5079333	1.730201	0.5079333	1.771492	-0.0333015	-0.4655972	-0.0333015	-0.5741864	-0.0333015
0.4611852	1.57096			-0.0800496	-1.119195	-0.0800496	-1.38022	
				-0.1152072	-1.610743			
-0.0969385	-1.807109	-0.0969385	-10.69181					
-0.2345147	-4.371777	-0.2345147	-25.86574	-0.1052633	-2.228559	-0.1052633	-2.48478	-0.1052633
-0.2294002	-4.276434			-0.1001489	-2.1202879	-0.1001489	-2.364052	
				-0.1497422	-3.170232			

vent, and b stands for the number of days after the event.

APPENDIX 6. Car Esitmation Results for Jetblue AirwaysCorporation (JBLU).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**
30 oct 2013	0.0270868	0.4305192	0.0270868	0.5024893	0.0270868	0.4749754		
31 oct 2013	0.0135547	0.2154396	0.0135547	0.2514548	0.0135547	0.2376863	-0.0135321	-0.3648959
01 nov 2013	-0.0245539	0.3902608	-0.0245539	-0.4555009	-0.0245539	0.4305598	-0.0516407	-1.392505
04 nov 2013	-0.0288713	-0.4588817	-0.0288713	-0.5355932			-0.0559581	-1.508924
05 nov 2013	-0.0712222	-1.13201					-0.098309	-2.650928
16 feb 2010	0.0081025	0.3114255	0.0081025	0.3083824	0.0081025	0.3355586		
17 feb 2010	0.0079322	0.3048765	0.0079322	0.3018975	0.0079322	0.3285022	-0.0001704	-0.0067913
18 feb 2010	-0.0111608	-0.4289714	-0.0111608	-0.4247797	-0.0111608	-0.4622134	-0.0192634	-0.7677972
19 feb 2010	-0.0017634	-0.0677764	-0.0017634	-0.0671141			-0.0098659	-0.3932352
22 feb 2010	0.0032475	0.1248184					-0.0048551	-0.193513
23 dec 2009	0.0125227	0.7089998	0.0125227	0.6992584	0.0125227	0.6949756		
24 dec 2009	0.0325937	1.845361	0.0325937	1.820006	0.0325937	1.808859	0.0075483	0.6122957
28 dec 2009	0.0286789	1.623713	0.0286789	1.601403	0.0286789	1.591595	0.0036334	0.2947325
29 dec 2009	0.0381978	2.16265	0.0381978	2.132936			0.0131524	1.066888
30 dec 2009	0.0483403	2.736887					0.0232949	1.889619
02 jul 2002	0.0153306	0.1675061	0.0153306	0.1675061	0.0153306	0.1604608		
03 jul 2002	-0.0460546	-0.5032034	-0.0460546	-0.5032034	-0.0460546	-0.4820388	-0.0613852	-0.6412895
05 jul 2002	-0.0004223	-0.004614	-0.0004223	-0.004614	-0.0004223	-0.0044199	-0.0157529	-0.1645702
08 jul 2002	0.0156398	0.1708838	0.0156398	0.1708838			0.0003091	0.0032296

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0135321	-0.4472633	-0.0135321	-0.5506095					
-0.0516407	-1.706833	-0.0516407	-2.101219	-0.0381086	-1.055646	-0.0381086	-1.127767	-0.0381086
-0.0559581	-1.849531			-0.042426	-1.175242	-0.042426	-1.255533	
				-0.0847769	-2.348403			

-0.0001704	-0.0067849	-0.0001704	-0.0090044					
-0.0192634	-0.7670718	-0.0192634	-1.018009	-0.019093	-0.7185888	-0.019093	-0.6701545	-0.019093
-0.0098659	-0.3928637			-0.0096955	-0.3649042	-0.0096955	-0.340309	
				-0.0046847	-0.1763142			

0.0075483	0.6276021	0.0075483	0.8501751					
0.0036334	0.3021003	0.0036334	0.4092373	-0.0039149	-0.3122465	-0.0039149	-0.3188898	-0.0039149
0.0131524	1.093559			0.0056041	0.4469818	0.0056041	0.45664916	
				0.0157466	1.255938			

-0.0613852	-0.6412895	-0.0613852	-0.5735997					
-0.0157529	-0.1645702	-0.0157529	-0.1471994	0.0456323	1.543183			0.0456323
0.0003091	0.0032296			0.0616944	2.086366			

vent, and b stands for the number of days after the event.

APPENDIX 7. Car EstimationResults for Republic Airways Holdings (RJET).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**
30 oct 2013	0.0017968	0.0275476	0.0017968	0.0297491	0.0017968	0.0351492		
31 oct 2013	0.0202074	0.3098101	0.0202074	0.3345683	0.0202074	0.3952996	0.0184106	0.2744246
01 nov 2013	-0.0187415	-0.2873357	-0.0187415	-0.3102979	-0.0187415	-0.3666237	-0.0205383	-0.3061397
04 nov 2013	0.0114139	0.1749931	0.0114139	0.1889776			0.0096171	0.1433513
05 nov 2013	-0.0146175	-0.2241096					-0.0164143	-0.2446692
16 feb 2010	0.0032331	0.0635273	0.0032331	0.06179	0.0032331	0.0658353		
17 feb 2010	-0.0137444	-0.2700666	-0.0137444	-0.2626809	-0.0137444	-0.2798782	-0.0169775	-0.3230013
18 feb 2010	0.025267	0.4964744	0.025267	0.4828972	0.025267	0.5145116	0.0220339	0.4191997
19 feb 2010	0.0093157	0.183045	0.0093157	0.1780392			0.0060826	0.1157226
22 feb 2010	0.0164837	0.3238904					0.0132506	0.2520957
23 dec 2009	0.0180873	0.1970755	0.0180873	0.2163901	0.0180873	1.147261		
24 dec 2009	0.0618801	0.6742334	0.0618801	0.7403142	0.0618801	3.925002	0.0437928	0.485176
28 dec 2009	0.1040365	1.133561	0.1040365	1.24466	0.1040365	6.598947	0.0859492	0.9522224
29 dec 2009	0.0132168	0.1440081	0.0132168	0.1581222			-0.0048704	-0.0539592
30 dec 2009	-0.0154174	-0.1679854					-0.0335047	-0.3711953

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.0184106	0.2874645	0.0184106	0.3209686					
-0.0205383	-0.3206866	-0.0205383	-0.3580628	-0.0389488	-0.6120514	-0.0389488	-0.5636244	-0.0389488
0.0096171	0.1501629			-0.0087934	-0.1381821	-0.0087934	-0.1272488	
				-0.0348249	-0.5472471			

-0.0169775	-0.3059954	-0.0169775	-0.30323					
0.0220339	0.397129	0.0220339	0.39354	0.0390114	0.816163	0.0390114	0.7097796	0.0390114
0.0060826	0.1096299			0.0230601	0.4824437	0.0230601	0.4195592	
				0.0302281	0.6324068			

0.0437928	0.5175007	0.0437928	46.35235					
0.0859492	1.015664	0.0859492	90.97264	0.0421564	0.556488	0.0421564	0.5490991	0.0421564
-0.0048704	-0.0575542			-0.0486633	-0.642382	-0.0486633	-0.6338527	
				-0.0772975	-1.02037			

vent, and b stands for the number of days after the event.

APPENDIX 8. Car Estimation Results for Skywest, Inc. (SKYW).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
30 oct 2013	0.0206197	0.3041998	0.0206197	0.3318105	0.0206197	0.5292894		
31 oct 2013	0.0234616	0.3461265	0.0234616	0.3775427	0.0234616	0.6022394	0.0028419	0.0594086
01 nov 2013	-0.0005935	-0.0087562	-0.0005935	-0.009551	-0.0005935	-0.0152353	-0.0212132	-0.4434468
04 nov 2013	-0.0509183	-0.7511911	-0.0509183	-0.8193731			-0.071538	-1.495449
05 nov 2013	-0.09486	-1.399458					-0.1154797	-2.414018
16 feb 2010	-0.0137051	-0.63621	-0.0137051	-0.6160208	-0.0137051	-1.056897		
17 feb 2010	-0.0335337	-1.556687	-0.0335337	-1.507288	-0.0335337	-2.586031	-0.0198286	-0.9415526
18 feb 2010	-0.0384673	-1.785713	-0.0384673	-1.729046	-0.0384673	-2.966497	-0.0247623	-1.175822
19 feb 2010	-0.0327023	-1.51809	-0.0327023	-1.469916			-0.0189972	-0.9020723
22 feb 2010	-0.0407373	-1.891089					-0.0270322	-1.283611
23 dec 2009	-0.0020881	-0.115327	-0.0020881	-0.1140002	-0.0020881	-0.1112892		
24 dec 2009	0.0286094	1.580089	0.0286094	1.561911	0.0286094	1.524768	0.0306975	3.762768
28 dec 2009	0.0515142	2.845116	0.0515142	2.812384	0.0515142	2.745503	0.0536023	6.570338
29 dec 2009	0.0597422	3.299548	0.0597422	3.261588			0.0618303	7.578895
30 dec 2009	0.0774282	4.276344					0.0795164	9.746774
02 jul 2002	0.037453	0.9186803	0.037453	0.9186803	0.037453	0.8661935		
03 jul 2002	0.047606	1.167721	0.047606	1.167721	0.047606	1.101006	0.010153	0.4295601
05 jul 2002	0.0352067	0.8635793	0.0352067	0.8635793	0.0352067	0.8142406	-0.0022464	-0.0950412
08 jul 2002	0.0473949	1.162543	0.0473949	1.162543			0.0099419	0.4206274
20 dec 2001	-0.0074655	-0.0986167	-0.0074655	-0.109525	-0.0074655	-0.1128113		
21 dec 2001	0.0410733	0.5425659	0.0410733	0.602581	0.0410733	0.620661	0.0560043	0.7283937
24 dec 2001	-0.0230927	-0.3050475	-0.0230927	-0.3387898	-0.0230927	-0.348955	-0.0081617	-0.1061518
26 dec 2001	-0.0435923	-0.5758404	-0.0435923	-0.639536			-0.0286613	-0.3727699
27 dec 2001	-0.0380844	-0.5030833					-0.0231534	-0.3011345

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.0028419	0.0617212	0.0028419	0.1056597					
-0.0212132	-0.4607085	-0.0212132	-0.7886806	-0.0240552	-1.013664	-0.0240552	-0.9157034	-0.0240552
-0.071538	-1.553661			-0.0743799	-3.134308	-0.0743799	-2.831407	
				-0.1183216	-4.985976			

-0.0198286	-0.8906198	-0.0198286	-1.331225					
-0.0247623	-1.112217	-0.0247623	-1.662449	-0.0049336	-0.3934178	-0.0049336	-0.4611429	-0.0049336
-0.0189972	-0.8532751			0.0008314	0.0663009	0.0008314	0.0777142	
				-0.0072036	-0.5744319			

0.0306975	3.929567	0.0306975	6.822995					
0.0536023	6.861594	0.0536023	11.91394	0.0229048	6.424819	0.0229048	6.151947	0.0229048
0.0618303	7.914858			0.0311328	8.73279	0.0311328	8.361896	
				0.0488189	13.69374			

0.010153	0.4295601	0.010153	0.4501964	-0.0002111	-0.0085869			
-0.0022464	-0.0950412	-0.0022464	-0.0996071	-0.0123994	-0.5042934			-0.0123994
0.0099419	0.4206274							

0.0560043		0.0560043						
-0.0081617	-0.1168654	-0.0081617	-0.1176376	-0.064166	-1.190943	-0.064166	-4.797311	
-0.0286613	-0.4103924			-0.0846656	-1.571422	-0.0846656	-6.329942	
	0.8019082		0.8072066	-0.0791577	-1.469194			

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
07 sep 2001	-0.00576	-0.0155844	-0.00576	-0.0193644	-0.00576	-0.0190688		
10 sep 2001	0.4250743	1.150085	0.4250743	1.429037	0.4250743	1.407219	0.4423544	1.595175
17 sep 2001	0.7738581	2.093757	0.7738581	2.601597	0.7738581	2.561877	0.7911382	2.852925
18 sep 2001	1.116267	3.020183	1.116267	3.752727			1.133548	4.087688
19 sep 2001	1.629011	4.407465					1.646291	5.936693
10 dec 1999	0.0220163	0.2668364	0.0220163	0.3537077	0.0220163	0.7022446		
13 dec 1999	0.0915231	1.109256	0.0915231	1.470386	0.0915231	2.919276	0.003458	0.0580316
14 dec 1999	0.1255049	1.521115	0.1255049	2.016329	0.1255049	4.003181	0.0374398	0.6283105
15 dec 1999	0.1057908	1.28218	0.1057908	1.699607			0.0177257	0.2974702
16 dec 1999	0.0197988	0.2399612					-0.0682663	-1.145637

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

APPENDIX 9. Car Estimation Results for Spirit Airlines, Inc. (SAVE).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
30 oct 2013	-0.0033105	-0.1058821	-0.0033105	-0.107026	-0.0033105	-0.1036508		
31 oct 2013	0.0106391	0.340275	0.0106391	0.3439513	0.0106391	0.3331045	0.0139496	0.4321846
01 nov 2013	-0.0122668	-0.3923365	-0.0122668	-0.3965753	-0.0122668	-0.3840689	-0.0089563	-0.2774835
04 nov 2013	-0.0234282	-0.749317	-0.0234282	-0.7574127			-0.0201177	-0.6232843
05 nov 2013	-0.0203083	-0.649533					-0.0169978	-0.5266253

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.4423544	2.033223	0.4423544	2.095084					
0.7911382	3.636362	0.7911382	3.746998	0.1276066	0.5402728	0.1276066	3.272357	0.1276066
1.133548	5.210201			0.470016	1.989998	0.470016	12.05314	
				0.9827591	4.160897			

0.003458	0.0806213	0.003458	0.3242191					
0.0374398	0.8728902	0.0374398	3.510335	0.0328292	0.5998117	0.0328292	0.7776984	0.0328292
0.0177257	0.4132651			0.013115	0.2396207	0.013115	0.3106858	
				-0.0728769	-1.331513			

vent, and b stands for the number of days after the event.

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
0.0139496	0.4277705	0.0139496	0.3784942					
-0.0089563	-0.2746494	-0.0089563	-0.2430116	-0.0229059	-1.014675	-0.0229059	-1.950349	-0.0229059
-0.0201177	-0.6169184			-0.0340672	-1.509097	-0.0340672	-2.900698	
				-0.0309474	-1.370895			

vent, and b stands for the number of days after the event.

APPENDIX 10. Car Estimation Resultsfor Alaska Air Group (ALK).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**
30 oct 2013	-0.0052993	-0.5387859	-0.0052993	-0.6236597	-0.0052993	-0.8995355		
31 oct 2013	-0.0170884	-1.737391	-0.0170884	-2.011078	-0.0170884	-2.900679	-0.0117891	-1.205404
01 nov 2013	-0.0238667	-2.426553	-0.0238667	-2.808802	-0.0238667	-4.051275	-0.0185674	-1.898475
04 nov 2013	-0.0253918	-2.581608	-0.0253918	-2.988283			-0.0200925	-2.05441
05 nov 2013	-0.0371297	-3.775011					-0.318304	-3.254583
16 feb 2010	-0.0070044	-0.1182069	-0.0070044	-0.1216287	-0.0070044	-0.2220155		
17 feb 2010	-0.0495146	-0.830911	-0.0495146	-0.8549639	-0.0495146	-1.560612	-0.0424706	-0.6903759
18 feb 2010	-0.066187	-1.110693	-0.066187	-1.142844	-0.066187	-2.086096	-0.059143	-0.961392
19 feb 2010	-0.0386583	-0.6487305	-0.0386583	-0.6675096			-0.0316143	-0.5139028
22 feb 2010	-0.028158	-0.4725232					-0.021114	-0.3432159
23 dec 2009	-0.0005262	-0.0225915	-0.0005262	-0.033682	-0.0005262	-0.0330491		
24 dec 2009	0.0092739	0.3981949	0.0092739	0.5936747	0.0092739	0.5825186	0.0103262	0.4674389
28 dec 2009	0.0161286	0.6925212	0.0161286	1.03249	0.0161286	1.013088	0.0171809	0.7777374
29 dec 2009	0.0143976	0.6181958	0.0143976	0.9216774			0.0154499	0.6993787
30 dec 2009	0.0292992	1.25803					0.0303515	1.373935
02 jul 2002	-0.0180959	-0.637047	-0.0180959	-0.637047	-0.0180959	-0.631013		
03 jul 2002	-0.0119919	-0.4221635	-0.0119919	-0.4221635	-0.0119919	-0.4181649	0.0061039	0.3187404
05 jul 2002	0.001587	0.055868	0.001587	0.055868	0.001587	0.0553388	0.0196828	1.027813
08 jul 2002	-0.0065945	-0.2321527	-0.0065945	-0.2321527			0.0115014	0.600587
20 dec 2001	-0.0307611	-0.4262823	-0.0307611	-0.4238608	-0.0307611	-0.4590108		
21 dec 2001	-0.027216	-0.3771548	-0.027216	-0.3750123	-0.027216	-0.4061114	0.0343062	0.6284375
24 dec 2001	-0.0010785	-0.0149454	-0.0010785	-0.0148605	-0.0010785	-0.0160928	0.0604437	1.107237
26 dec 2001	0.0052087	0.0721817	0.0052087	0.0717717			0.0667309	1.222409
27 dec 2001	-0.0212286	-0.2941822					0.0402936	0.07381179

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0117891	-1.326148	-0.0117891	-2.352774					
-0.0185674	-2.088642	-0.0185674	-3.705548	-0.0067784	-0.7662801	-0.0067784	-1.290308	-0.0067784
-0.0200925	-2.260197			-0.0083034	-0.9386862	-0.0083034	-1.580615	
				-0.0200413	-2.265634			

-0.0424706	-0.6926568	-0.0424706	-1.646262					
-0.059143	-0.9645684	-0.059143	-2.292523	-0.0166724	-0.4317726	-0.0166724	-0.3771943	-0.0166724
-0.0316143	-0.5156007			0.0108563	0.2811501	0.0108563	0.2456114	
				0.0213566	0.553082			

0.0103262	0.6680705	0.0103262	0.6481386					
0.0171809	1.111554	0.0171809	1.078391	-0.0034714	-0.164998	-0.0034714	-0.6924477	-0.0034714
0.0154499	0.9995623			-0.0052024	-0.247275	-0.0052024	-1.03774	
				0.0096992	0.4610116			

0.0061039	0.3187404	0.0061039	0.8165876					
0.0196828	1.027813	0.0196828	2.633175	0.0135789	0.6240196	0.0135789	0.6240196	0.0135789
0.0115014	0.600587			0.0053974	0.2480391	0.0053974	0.2480391	

0.0343062	0.6424023	0.0343062	3.306847					
0.0604437	1.131841	0.0604437	5.826296	0.0261375	0.499488	0.0261375	0.4922119	0.0261375
0.0667309	1.249573			0.0324247	0.6196365	0.0324247	0.6106101	
				0.0059874	0.1144195			

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**
07 sep 2001	-0.0089057	-0.0210268	-0.0089057	-0.0209427	-0.0089057	-0.0216925		
10 sep 2001	-0.7869369	-1.858002	-0.7869369	-1.850567	-0.7869369	-1.916824	-0.7602198	-1.809992
17 sep 2001	-0.7024161	-1.658444	-0.7024161	-1.651807	-0.7024161	-1.710948	-0.6756991	-1.608758
18 sep 2001	-0.6276751	-1.481976	-0.6276751	-1.476045			-0.6009581	-1.430809
19 sep 2001	-0.6887748	-1.626236					-0.6620578	-1.57628

10 dec 1999	0.0190068	0.4463099	0.0190068	0.6184575	0.0190068	0.6532101		
13 dec 1999	0.0942356	2.2128	0.0942356	3.066305	0.0942356	3.238608	0.0182083	0.4369327
14 dec 1999	0.1535454	3.605488	0.1535454	4.996171	0.1535454	5.276918	0.0775182	1.860151
15 dec 1999	0.1688834	3.965648	0.1688834	5.495251			0.0928561	2.228207
16 dec 1999	0.2930346	6.880913					0.2170073	5.207379

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

APPENDIX 11. Car Estimation Results for Delta Airlines, Inc. (DAL).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**ttest**
30 oct 2013	0.0077553	1.928533	0.0077553	0.2459964	0.0077553	0.2477618		
31 oct 2013	-0.0010001	-0.0248702	-0.0010001	-0.0317235	-0.0010001	-0.0319512	-0.0087554	-0.2207136
01 nov 2013	-0.0293449	-0.7297274	-0.0293449	-0.9308129	-0.0293449	-0.9374928	-0.0371002	-0.9352509
04 nov 2013	-0.028037	-0.6972035	-0.028037	-0.8893266			-0.0357923	-0.9022803
05 nov 2013	-0.0088671	-0.2204995					-0.0166224	-0.4190296

16 feb 2010	-0.0206018	-0.9579507	-0.0206018	-0.9459478	-0.0206018	-0.8996957		
17 feb 2010	-0.0165661	-0.7702974	-0.0165661	-0.7606458	-0.0165661	-0.7234541	0.0040357	0.7222903
18 feb 2010	-0.0165369	-0.7689419	-0.0165369	-0.7593073	-0.0165369	-0.722181	0.0040648	0.727508
19 feb 2010	-0.019179	-0.8917924	-0.019179	-0.8806185			0.0014228	0.2546475
22 feb 2010	-0.0197508	-0.9183793					0.000851	0.1523129

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.7602198	-1.80187	-0.7602198	-1.916461					
-0.6756991	-1.601539	-0.6756991	-1.70339	0.0845208	0.9904747	0.0845208	2.004168	0.0845208
-0.6009581	-1.424389			0.1592618	1.866342	0.1592618	3.776435	
				0.0981621	1.150333			

0.0182083	0.7250145	0.0182083	0.7234877					
0.0775182	3.086601	0.0775182	3.0801	0.0046849	0.1153147	0.0046849	0.5817595	0.0046849
0.0928561	3.697325			0.0200229	0.4928462	0.0200229	2.486395	
				0.1441741	3.548719			

vent, and b stands for the number of days after the event.

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0087554	-0.3352264	-0.0087554	-0.4469481					
-0.0371002	-1.420487	-0.0371002	-1.893896	-0.0283448	-0.6818711	-0.0283448	-0.9558927	-0.0283448
-0.0357923	-1.37041			-0.0270369	-0.6504079	-0.0270369	-0.9117854	
				-0.0078669	-0.1892496			

0.0040357	0.6932392	0.0040357	1.007276					
0.0040648	0.6982471	0.0040648	1.014553	0.0000292	0.0120111	0.0000292	0.0109139	0.0000292
0.0014228	0.2444054			-0.0026129	-1.076513	-0.0026129	-0.9781722	
				-0.0031847	-1.312087			

vent, and b stands for the number of days after the event.

APPENDIX 12. Car Estimation Results for FEDEX Corporation(FDX).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**ttest**	**CAR**	**t test**	**CAR**	**t test**
30 oct 2013	0.011836	0.2670905	0.011836	0.3734908	0.011836	0.3721453		
31 oct 2013	-0.012276	-0.2770203	-0.012276	-0.3873763	-0.012276	-0.3859809	-0.24112	-0.5597224
01 nov 2013	-0.0119065	-0.2686818	-0.0119065	-0.375716	-0.0119065	-0.3743626	-0.0237425	-0.5511447
04 nov 2013	-0.0261281	-0.5896056	-0.0261281	-0.8244855			-0.0379641	-0.8812763
05 nov 2013	-0.0006871	-0.015504					-0.012523	-0.2907026
16 feb 2010	0.0025899	0.1314812	0.0025899	0.1295996	0.0025899	0.1235375		
17 feb 2010	0.004312	0.218909	0.004312	0.2157762	0.004312	0.2056832	0.0017221	0.0959405
18 feb 2010	-0.0144828	-0.7352545	-0.0144828	-0.7247321	-0.0144828	-0.6908323	-0.0170727	-0.9511285
19 feb 2010	-0.0222565	-1.129905	-0.0222565	-1.113735			-0.0248464	-1.384206
22 feb 2010	-0.0241314	-1.225087					-0.0267213	-1.488655
23 dec 2009	0.0177332	0.3307142	0.0177332	0.3690768	0.0177332	0.3631575		
24 dec 2009	0.0193725	0.3612867	0.0193725	0.4031957	0.0193725	0.3967292	-0.0160939	-0.3612331
28 dec 2009	-0.0339271	-0.6327215	-0.0339271	-0.7061167	-0.0339271	-0.694792	-0.0693936	-1.557563
29 dec 2009	-0.0348938	-0.6507484	-0.0348938	-0.7262347			-0.0703602	-1.579259
30 dec 2009	-0.0071527	-0.133393					-0.0426191	-0.9566006
02 jul 2002	-0.0201835	-0.3725673	-0.0201835	-0.3725673	-0.0201835	-0.4804666		
03 jul 2002	0.0079734	0.1471819	0.0079734	0.1471819	0.0079734	0.1898073	0.0281569	0.5208526
05 jul 2002	0.0084841	0.156608	0.0084841	0.156608	0.0084841	0.2019632	0.0286676	0.5302987
08 jul 2002	-0.0256503	-0.4734804	-0.0256503	-0.4734804			-0.0054669	-0.1011274
20 dec 2001	0.0264385	0.5588228	0.0264385	0.6890123	0.0264385	0.7134762		
21 dec 2001	0.0206758	0.4370182	0.0206758	0.5388308	0.0206758	0.5579623	-0.0057627	-0.1325888
24 dec 2001	-0.0056069	-0.1185106	-0.0056069	-0.1461201	-0.0056069	-0.1513082	-0.0320454	-0.7373023
26 dec 2001	-0.0152365	-0.3220499	-0.0152365	-0.3970782			-0.041675	-0.9588624
27 dec 2001	0.0109474	0.2313922					-0.0154911	-0.3564202

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.24112	-1.130348	-0.24112	-0.9849063					
-0.0237425	-1.113025	-0.0237425	-0.9698126	0.0003695	0.0106347	0.0003695	0.0253248	0.0003695
-0.0379641	-1.779719			-0.0138521	-0.3986635	-0.0138521	-0.9493504	
				0.011589	0.3335315			

0.0017221	0.0968326	0.0017221	0.0839367					
-0.0170727	-0.9599731	-0.0170727	-0.8321266	-0.0187948	-1.263496	-0.0187948	-1.705348	-0.0187948
-0.0248464	-1.397078			-0.0265685	-1.78609	-0.0265685	-2.410695	
				-0.0284434	-1.912129			

-0.0160939	-0.5537577	-0.0160939	-0.7492232					
-0.0693936	-2.38769	-0.0693936	-3.230497	-0.0532997	-1.174185	-0.0532997	-1.797239	-0.0532997
-0.0703602	-2.42095			-0.0542663	-1.195479	-0.0542663	-1.829833	
				-0.0265252	-0.5843465			

0.0281569	0.5208526	0.0281569	1.018471					
0.0286676	0.5302987	0.0286676	1.036942	0.0005106	0.0147394	0.0005106	0.0147394	0.0005106
-0.0054669	-0.1011274			-0.0336238	-0.9705212	-0.0336238	-0.9705212	

-0.0057627	-0.201975	-0.0057627	-0.3381831					
-0.0320454	-1.123146	-0.0320454	-1.880575	-0.0205199	-0.4611677	-0.0205199	-0.684411	-0.0205199
-0.041675	-1.460653			-0.0301496	-0.6775858	-0.0301496	-1.005594	
				-0.0039657	-0.0891251			

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**t test**	**CAR**	**ttest**	**CAR**	**t test**	**CAR**	**t test**
07 sep 2001	0.001988	0.0047315	0.001988	0.0047197	0.001988	0.0048034		
10 sep 2001	-0.2279236	-0.5424497	-0.2279236	-0.2279236	-0.2279236	-0.5506939	-0.2338877	-0.5630642
17 sep 2001	-0.4870878	-1.159251	-0.4870878	-1.156367	-0.4870878	-1.176869	-0.4930519	-1.186979
18 sep 2001	-0.4457275	-1.060815	-0.4457275	-1.058176			-0.4516917	-1.087408
19 sep 2001	-0.5749562	-1.368374					-0.5809203	-1.398515
10 dec 1999	0.0642595	0.2520959	0.0642595	0.33429	0.0642595	1.531308		
13 dec 1999	0.1005754	0.3945665	0.1005754	0.5232121	0.1005754	2.396719	0.0148961	0.0592209
14 dec 1999	0.0945059	0.3707554	0.0945059	0.4916376	0.0945059	2.252083	0.0088266	0.035091
15 dec 1999	-0.010114	-0.0396783	-0.010114	-0.0526151			-0.0957934	-0.3808367
16 dec 1999	-0.2299476	-0.9021055					-0.3156269	-1.254808

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.2338877	-0.5573781	-0.2338877	-0.5745397					
-0.4930519	-1.174992	-0.4930519	-1.21117	0.2086113	1.32762	0.2086113	2.789034	0.2086113
-0.4516917	-1.076427			0.2499715	1.590839	0.2499715	3.342001	
				0.1207429	0.7684177			

0.0148961	0.0885252	0.0148961	0.6824915					
0.0088266	0.0524551	0.0088266	0.4044068	-0.0209656	-0.0831007	-0.0209656	-0.1529894	-0.0209656
-0.0957934	-0.5692862			-0.1255855	-0.4977805	-0.1255855	-0.9164201	
				-0.3454191	-1.36913			

vent, and b stands for the number of days after the event.

APPENDIX 13. Car Estimation Results for Southwest Airlines Co. (LUV).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**
30 oct 2013	0.0009367	0.0490962	0.0009367	0.0484569	0.0009367	0.0462012		
31 oct 2013	-0.0058629	-0.3073149	-0.0058629	-0.3033138	-0.0058629	-0.2891938	-0.0067996	-0.4663684
01 nov 2013	-0.0279287	-1.463928	-0.0279287	-1.444868	-0.0279287	-1.377607	-0.0288654	-1.979211
04 nov 2013	-0.0343588	-1.800969	-0.0343588	-1.777521			-0.0352954	-2.420834
05 nov 2013	-0.0466479	-2.445126					-0.0475846	-3.263721
16 feb 2010	0.0143683	0.6224552	0.0143683	0.6035887	0.0143683	0.5944896		
17 feb 2010	0.0012259	0.0531059	0.0012259	0.0514963	0.0012259	0.05072	-0.0131424	-0.8781255
18 feb 2010	0.0059028	0.2557197	0.0059028	0.2479689	0.0059028	0.2442307	-0.0084654	-0.5656278
19 feb 2010	0.0009838	0.0426204	0.0009838	0.0413286			-0.0133844	-0.8942976
22 feb 2010	-0.0000297	-0.0012861					-0.0143979	-0.962016
23 dec 2009	0.0107156	0.6539523	0.0107156	1.283624	0.0107156	1.435702		
24 dec 2009	0.0103249	0.6301117	0.0103249	1.236828	0.0103249	1.383361	-0.0003906	-0.0278595
28 dec 2009	0.0085665	0.5227958	0.0085665	1.026181	0.0085665	1.147758	-0.0021491	-0.1532661
29 dec 2009	0.017652	1.077268	0.017652	2.114537			0.0069364	0.494676
30 dec 2009	0.0008123	0.0495731					-0.0099033	-0.7062622
02 jul 2002	-0.0046053	-0.3383751	-0.0046053	-0.3383751	-0.0046053	-0.5775302		
03 jul 2002	-0.0023041	-0.1692962	-0.0023041	-0.1692962	-0.0023041	-0.2889506	0.0023012	0.1639069
05 jul 2002	0.0018175	0.1335437	0.0018175	0.1335437	0.0018175	0.2279291	0.0064228	0.4574832
08 jul 2002	-0.0089217	-0.6555262	-0.0089217	-0.6555262			-0.0043164	-0.3074498
20 dec 2001	-0.0091495	-0.3201589	-0.0091495	-0.4184067	-0.0091495	-0.4619963		
21 dec 2001	-0.0314982	-1.102179	-0.0314982	-1.440407	-0.0314982	-1.590468	-0.0223487	-0.7717608
24 dec 2001	-0.0180948	-0.6331695	-0.0180948	-0.8274716	-0.0180948	-0.9136775	-0.0089453	-0.3089042
26 dec 2001	-0.028924	-1.012102	-0.028924	-1.322687			-0.0197744	-0.6828653
27 dec 2001	-0.0261215	-0.9140374					-0.0169719	-0.5860875

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0067996	-0.4399806	-0.0067996	-0.4454013					
-0.0288654	-1.867791	-0.0288654	-1.890803	-0.0220658	-1.612774	-0.0220658	-1.41124	-0.0220658
-0.0352954	-2.28386			-0.0284958	-2.082742	-0.0284958	-1.82248	
				-0.040785	-2.98095			

-0.0131424	-0.8507904	-0.0131424	-0.7375343					
-0.0084654	-0.5480204	-0.0084654	-0.4750687	0.004677	0.5595701	0.004677	0.4873886	0.004677
-0.0133844	-0.8664591			-0.000242	-0.0289584	-0.000242	-0.0252229	
				-0.0012555	-0.1502175			

				-0.009122	-0.6384269			
-0.0003906	-0.0607181	-0.0003906	-1.153629					
-0.0021491	-0.334034	-0.0021491	-6.346566	-0.0013678	-0.0957303	-0.0013678	-0.2266385	-0.0013678
0.0069364	1.078116			0.0077177	0.540144	0.0077177	1.278774	

0.0023012	0.1639069	0.0023012	1.264036					
0.0064228	0.4574832	0.0064228	3.528072	0.0041216	0.2773488	0.0041216	0.2773488	0.0041216
-0.0043164	-0.3074498			-0.0066176	-0.4453023	-0.0066176	-0.4453023	

-0.0223487	-0.9978647	-0.0223487	-1.082707					
-0.0089453	-0.3994044	-0.0089453	-0.4333633	0.0134034	0.5337886	0.0134034	0.6621285	0.0134034
-0.0197744	-0.8829253			0.0025742	0.1025187	0.0025742	0.1271674	
				0.0053767	0.2141275			

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**t test**	**CAR**	**t test**	**CAR**	**t test**
07 sep 2001	-0.0483528	-0.1120995	-0.0483528	-0.1118691	-0.0483528	-0.1169527		
10 sep 2001	-0.3482036	-0.8072634	-0.3482036	-0.805604	-0.3482036	-0.8422131	-0.2756744	0.651006
17 sep 2001	-0.8805661	-2.041474	-0.8805661	-2.037278	-0.8805661	-2.129858	-0.8080368	-1.908181
18 sep 2001	-0.8435687	-1.955701	-0.8435687	-1.951681	-0.8435687		-0.7710395	-1.820812
19 sep 2001	-0.9456744	-2.19242					-0.8731452	-2.061935
10 dec 1999	0.00704	0.2815602	0.00704	0.2816295	0.00704	0.3687364		
13 dec 1999	0.0340742	1.362769	0.0340742	1.363105	0.0340742	1.784707	0.0059141	0.2404222
14 dec 1999	0.0471422	1.885411	0.0471422	1.885875	0.0471422	2.469169	0.018982	0.7716683
15 dec 1999	0.0807965	3.231387	0.0807965	3.232183			0.0526364	2.139803
16 dec 1999	0.0946304	3.784661					0.0664703	2.702185

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.2756744	-0.6443906	-0.2756744	-0.6973292					
-0.8080368	-1.888791	-0.8080368	-2.043961	0.0189864	0.1306755	0.0189864	0.7089317	0.0189864
-0.7710395	-1.80231			0.0559837	0.3853124	0.0559837	2.090371	
				-0.046122	-0.3174387			

0.0059141	0.238279	0.0059141	0.3694436					
0.018982	0.7647892	0.018982	1.18578	-0.0046743	-0.1906937	-0.0046743	-0.1863215	-0.0046743
0.0526364	2.120727			0.0289801	1.182287	0.0289801	1.155179	
				0.0428139	1.74666			

vent, and b stands for the number of days after the event.

APPENDIX 14. Car Estimation Results for United Continental Holdings (UAL).

	[-2;+2]		[-2;+1]		[-2;0]		[-1;+2]	
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**
30 oct 2013	0.0147839	0.397831	0.0147839	0.3854935	0.0147839	0.3778295		
31 oct 2013	-0.0153756	-0.4137529	-0.0153756	-0.4009217	-0.0153756	-0.3929509	-0.0301595	-1.104877
01 nov 2013	-0.027077	-0.728634	-0.027077	0.7060378	-0.027077	-0.6920009	-0.0418609	-1.533551
04 nov 2013	-0.025622	-0.6894818	-0.025622	-0.6680997			-0.0404059	-1.48025
05 nov 2013	-0.0305732	-0.8227158					-0.0453571	-1.661633
16 feb 2010	0.0101054	0.3000186	0.0101054	0.326206	0.0101054	0.3946297		
17 feb 2010	0.0302138	0.8970159	0.0302138	0.9753127	0.0302138	1.179891	0.0201084	0.6326139
18 feb 2010	0.0212232	0.6300952	0.0212232	0.6850936	0.0212232	0.8287963	0.0111178	0.3497689
19 feb 2010	0.0088863	0.2638262	0.0088863	0.2868545			-0.0012191	-0.0383516
22 feb 2010	-0.004216	-0.1251685					-0.0143214	-0.4505537
23 dec 2009	-0.0177673	-1.35659	-0.0177673	-1.486395	-0.0177673	-1.463178		
24 dec 2009	-0.0178424	-1.362322	-0.0178424	-1.492675	-0.0178424	-1.46936	-0.0000751	-0.0057315
28 dec 2009	-0.0385319	-2.94203	-0.0385319	-3.223537	-0.0385319	-3.173187	-0.0207646	-1.585312
29 dec 2009	-0.0537673	-4.105308	-0.0537673	-4.498124			-0.036	-2.748497
30 dec 209	-0.0647718	-4.945535					-0.0470045	-3.588657

Notes: The event window length is shows as [-a;+b], where a stands for the number of days before the

[-1;+1]		[-1;0]		[0;+2]		[0;+1]		[0;0]
CAR	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
-0.0301595	-1.096432	-0.0301595	-1.633943					
-0.0418609	-1.521829	-0.0418609	-2.267885	-0.0117014	-1.026886	-0.0117014	-0.8894109	-0.0117014
-0.0404059	-1.468936			-0.0102464	-0.8992032	-0.0102464	-0.7788216	
				-0.0151976	-1.333704			

0.0201084	0.6505828	0.0201084	0.6910347					
0.0111178	0.3597038	0.0111178	0.3820694	-0.0089906	-2.373746	-0.0089906	-2.686713	-0.0089906
-0.0012191	-0.039441			-0.0213275	-5.631007	-0.0213275	-6.373426	
				-0.0344298	-9.090367			

-0.0000751	-0.0064598	-0.0000751	-0.0063539					
-0.0207646	-1.786749	-0.0207646	-1.757466	-0.0206144	-5.261341	-0.0206144	-6.637991	-0.0206144
-0.036	-3.097733			-0.0358499	-9.149839	-0.0358499	-11.54393	
				-0.0468544	-11.95847			

vent, and b stands for the number of days after the event.

Chapter V.

The Effect of Announcements of CEO Change on Stock Prices: an Event Study for the Warsaw Stock Exchange

Iuliia Chernyshova, Royal Philips B.V / Lazarski University
0000-0002-3333-4037

Nowadays, the investigation of the company's announcement of CEO change is of great importance for investors, investment advisors, and management of publicly listed firms. Replacing a top manager of a firm sends a warning message to the public, as usually CEOs are replaced in case a company is not doing well. One of the aims of CEO is to increase the shareholder's wealth by making sensible decisions concerning dividends payment schedule or prices of company's shares. His/her CEO's abilities may affect company's policies or culture that would later on be translated into the performance of the company, hence, company's value, as having the right or wrong CEO can make a difference worth billions.

Before investing, investors always check the late news about, among others, company's corporate events, as stock prices are driven not only by financial results, but by company's announcements, industry fundamentals, and CEO performance. CEOs are vital in providing leadership to a company and to ensure its success; for the market and investors, the credibility of the CEO is one of the determinants whether the business is worth being invested into. As argued by Hambrick and Mason (1994) and Shen and Cannella (2002), the change of CEO is an important event for a company and market has to react to CEO change as investors believe that a capable and experienced CEO may bring a huge amount of benefits to the firm.

To determine whether CEO is performing in a proper way, investors consider, among others, total shareholder return and the change in company's market capitalization. Total shareholder return (TSR) stands for capital gain plus dividends. It is believed that good performing CEOs would not be replaced by new ones unless the company is in trouble; hence, if a firm replaces the CEO, it sends a signal to investors that something may go wrong in the company or have been going on wrong. Therefore, investors may consider other investment opportunities and sell their shares that would then have a negative effect on the share price and on the equity.

Usually, companies spend huge sums of money in order to provide CEOs with high salaries. This research is of great importance, because in recent years, certainly after the 2008 financial crisis, a lot of attention is paid to whether it is reasonable to provide CEO with high compensations and bonuses.

In general, CEOs leave or are forced to leave their positions due to several reasons. For example, some of them is of retirement age or health problems and inability to cope with the pace and complexity of their jobs anymore. Also, CEOs can be dismiss by the board of the company because of executive's underperformance, inefficiency or ineffectiveness in the decision-making process. Sometimes CEOs are replaced because of the strategic reasons. For example, when a company undergoes rebranding or repositioning, a CEO that has experience in a new important field may be more relevant for the company at that time.

This paper will examine the relationship between stock prices reaction and the CEO change announcement with an intention of increasing the understanding of the link between the two and quantification of the effect of a CEO change. The main aim of the paper is to add to previous research and answer the question whether a change of the CEO affects investors' decisions significantly. To the best of our knowledge, there are no other research papers that would answer the above-mentioned research question based on the data for Polish publicly traded companies. Existing research that discusses the effect of a CEO change on the value of the company focuses mainly on North American data, while this paper takes into account the Polish market only.

The results of the paper would be interesting to see as it is believed that they will be different from the ones for the US, for example. Poland is a developing country that has started its transition to the market economy relatively recently and market institutions are not yet developed to the same degree as the US ones. Hence, the results for Poland are expected to be significantly different than those for the US as investors of these two markets need to take into account specificities of the way of doing business in those countries. According to the Anglo-Saxon model of corporate governance, American companies are going to have stronger reaction on the CEO change than Polish companies, because US firms are more dependent on the situation on the market (stock prices) than on credits markets. Thus, this study complements and contrasts existing research on executive turnover in general. The results can help to understand any possible similarities or differences in CEO turnover valuation taking into account different reasons for succession.

CEO change announcement has an important impact on stock prices and, thus, on the value of the firm, given the market prices have to reflect all public information.

Investors are interested to increase the value of their investments, so they would like to have the return on their stocks to grow over time. However, the main assumption of the paper is that investors are rational market players who base their decisions on all relevant information available on the market, their decisions whether to buy a stock or not depend on the variety of market events, including the one of the change of the CEO of the company. If the company changes its CEO and investors decide that he/she is not good enough, they would start selling their stocks and this may lead to the fall of the stock price. While the opposite effect may happen, if investors find a new CEO suitable for the position. The main hypothesis of this paper is, therefore, that the change of the CEO significantly affects investors' decisions and the stock returns as a result.

The aim of this paper is to add to previous researches by studying an area that has not yet been widely studied, namely the Polish market, taking Warsaw Stock Exchange (WSE) as a study area. The population of the study is companies listed on WSE, particularly from mWIG40 index; thus, we analyze 40 middle size national companies. This study is about to use the market model derived from the CAPM model and the event study methodology is used to determine the effect that the change of the CEO has on stock prices.

The data used in the study has been gathered through companies' reports, WSE webpage, financial journals' websites (Bloomberg, Wall Street Journal) and from the regional newspapers ("Biznes Warszawski", "Warsaw Business Journal").

The paper consists of 4 parts. Research question and corresponding hypothesis are discussed and explained in the introduction. The existing literature concerning CEO change and its influence on Company's Performance is reviewed in section 1. In the second chapter, the theoretical background of the research is described. The third chapter of this paper presents an econometric approach, and the research design is also described. After that, the main findings are given, recommendations and results are discussed and conclusions are drawn.

Literature Review

A vast amount of research has been conducted about the stock prices reaction on the CEO change announcement, but the majority of existing researches (Dedman (2000), Grusky (1963)) used the data for the US or the UK. The intention of this paper is to answer the question how investors of companies from mWIG40 Index that are traded on the Warsaw Stock Exchange perceive the news about the change of a CEO.

My research is related to two main fields of research: finance and management, particularly to the literature concerning corporate finance and organizational management.

According to D.C. Hambrick (1984) and his strategic leadership theory, any company can be seen as a reflection of skills, experiences, perspectives and values of its CEO. Thus, it is clear that any change of top management will have an impact on the whole organization, its economic and political climate as well as its employees.

There can be different reasons for CEO changes that will lead to different companies' performances and market reactions. Among the most common reasons for top management changes we can distinguish the next ones: death, forced and nonconflictual resignations or retirements of CEOs.

The death of the managing person can have negative market and firms' performance consequences leading to negative stock price reactions. In those cases investors cannot be sure that the person who will be a new CEO will work in accordance with company's strategy and objectives. Usually, companies will appoint a temporary CEO first; but because this action is done fast, it can lead to a risky succession. In his findings, Johnson (1985) did not find any significant share price reaction around the announcement date of new CEO. Instead, he discovered that there was an increased volatility of abnormal returns following the announcement period was present. Abnormal returns are the crucial measure to assess the impact of an event. Abnormal returns are the returns above the indicative ones; in other words, it is the difference between the actual and expected returns:

$$AR_{i,\tau} = R_{i,\tau} - E\left[R_{i,\tau} \mid \Omega_{i,\tau}\right],$$

where: *AR* –abnormal returns, *R* – actual returns, *E* – expected returns, $R|\Omega$ – the average value of the yield under the set of events (CEO change announcements).

So, abnormal returns are returns that are higher than expected returns under the normal condition of market functioning.

With the help of event study methodology, Worrell (1993) explored which effects CEO deaths have on the price of stock in large publicly held corporations during 1966–1982. He wrote that there is a negative reaction on the market when CEO died unexpectedly compared to the cases in which CEO died because of long-lasted illness. The author stated that expected death of top manager provides support for the informational efficiency of market. Under informational efficiency of the market, Worrel (1003) meant a theory that is beyond the definition of the EMH and states that new information about

a company is known with certainty, and is immediately reflected in the company's stock price.

Another event study was done in the 1987 by the Etebari stating that there is a negative relation between the death of CEO and cumulative returns (which stand for the aggregate gained or lost amount of an investment over time). He separated causes of CEO's death into 3 categories: heart attacks, suicides, and accidents. The interesting thing is that CEO deaths by accidents had caused significant positive market reaction. According to Etebari, that was because the nature of accidents is not viewed as forced top management resignation.

As it was mentioned earlier, this paper is going to examine the relationship between announcements of CEO change and stock prices reaction by studying Polish market. Johnson (1985), Worrell (1993), and Etebari (1987) in their works analyzed the market reactions on CEO death announcements. This paper will not concentrate on causes or natures of CEO deaths and thus, it will give the broader understanding of market reactions on CEO changes and offer insights into firms' management of news disclosure, which will help to consolidate previous findings.

According to Jensen and Meckling's (1976) agency theory, very often Boards of directors have no alternatives but to fire or substitute CEOs. Conflicts of interest and bad corporate performance may be reduced if companies used performance–related contracts more often. Performance – related contract is a type of contract with a clear set of the main objectives, progress, evaluation, and consequences, either rewards or sanctions for the contractor, that are based on performance.

In 1987, the first event studies (with the event window -2;0;+2) by Furtado and Rozeff analyzed companies' internal and external resignations and its influence on stock prices. For this study, authors considered companies listed on New York Stock Exchange (in the period 1975–1982). Findings of Furtado and Rozeff (1987) revealed a positive but not statistically significant price increase. Furthermore, another event study (with the event window –1;0) done by Denis and Denis (1995) analyzed the influence of the forced resignations of top management and its influence on stock prices. To perform this study, authors inspected 908 American companies during 1985–1988. Authors discovered that forced CEO changes had significantly positive abnormal returns.

Furtado and Rozeff as well as Denis and Denis explained that the decision of the Board of Directors to change CEO stayed in line with profit-maximization goal of each company. Thus, a lot of attention is paid towards the human capital.

Authors stated that CEO changes can lead to new investment opportunities, possibility of cost minimization or return maximization.

However, the authors interpret the result without considering bad news (such as information about poor performance) in general. Scholars stress that CEO turnover is more likely to be an indicator of other events., such as stress events or internal problems.

As one can possibly assume, if the retirement is the reason for the top management change, then this fact may not lead to negative price reactions of the stock market, as investors may assume that younger successor with well-developed managerial skills and new business ideas is likely to come, which, in reality, is not necessarily true.

On the other hand, if there is an announcement about the nonconflictual and prior to retirement age CEO change, then one can suggest that the market reaction will have a negative connotation. Some of the reasons for this can be that the company loses valuable human capital or that conflict between top managers of the company takes place.

Hubler and Schmidt (1996) as well as Mahajan and Lummer (1993) in their works investigated what effects nonconflictual resignations have on French and US companies. Both studies agree that the announcement about the executives leaving the company on nonconflictual basis has a negative effect on abnormal return. In their study, Mahajan and Lummer come to a very interesting conclusion that stock returns are increasing if executive manager steps down but remains among the members of the Board of Directors or continues to maintain managerial role within the company.

The choice of new CEO depends not only on the type and size of a corporation, but also on the type of industry in which company operates. Usually, there are two choices that companies can make concerning CEO succession: nominate internal or external candidate.

According to Teoh (1998), market reaction can be different depending on whether or not an internal candidate is nominated as CEO. Usually, internal candidates for top management position may have better knowledge about the company and its technological processes; and thus, they have clearer insights in market and competition and they maintain better and closer relationships with clients and suppliers. Moreover, such candidates have already formed social networks via which they acquire specific internal information.

However, authors claim that external candidate may bring bigger change and creativity into the company. Often, external candidates are nominated in times of the need for radical changes in company's strategy.

Such corporate characteristics as corporate performance or degree of diversity of business also may affect the choice of CEO change. Corporate performance is an assessment of how well companies execute on financial and market parameters, while business diversity is a key element to company's long-term prosperity. The mentioned corporate characteristics may have positive or negative effects on price reactions concerning different CEO departures described above.

In the study done by Franks, Mayer and Renneboog (1998) the relationship between the company's performance and CEO dismissal was analyzed. Authors came to conclusion that poor performance of corporation leads to higher CEO dismissal. According to the mentioned study, in case of poor company's performance, the appointment of the external candidate for the top manager position is expected to result in a positive market price reaction. On the other hand, internal promotion of employee following poor performance may proceed to negative market price reaction.

Furtado and Rozeff (1987) in their works investigated the costs of internal and external succession for American companies. According to authors, internal succession is less costly, that is why it is normal practice among well performing companies to hire somebody from the inside in case of resignation. In this case, market reaction to internal succession will be less negative comparing to the reaction to external employment of CEO. Internal succession for big companies implies less costs than for small ones as big firms have more employees and thus, a bigger pool of internal potential candidates. Often, there is no need for big corporations to perform an external succession (which requires costs and time) as they have plenty of candidates.

The same study pointed out that the external succession is more likely to take place in case of an urgent need for new strategy. It is easier in small companies as small enterprises adapt and refocus new objectives and strategies faster and easier than bigger ones. Usually, if the need for new skills is essential, then CEO from the outside is expected to cause positive market reaction.

As it was mentioned earlier, market reaction to a new CEO may also vary depending on the industry the company operates in. According to Parrino (1997), if company is engaged in several unrelated industries, then public is expected to pay less attention to the announcement of CEO change. Thus, external succession in diversified firms may lead to positive price reaction, because new manager can bring higher value added to company. The author discussed the difference between the intra-industry and outside-industry successors. According to him, the main difference lies in the managerial skills that successors have. In his study, Parrino stated that outside-industry employee has skills that may or may not be transferable across industries and companies, while intra-industry

successor has specific skills that can contribute to and be transferable to firms in the same industry. Outside-industry succession refers to a succession in which CEO has an experience within the industry for less than two years, while intra-industry succession stands for CEO who has more than two years background in the industry where company operates.

It is important to consider market efficiency when it comes to analyzing event study data. One of the most well-known researches concerning market efficiency was conducted by Eugene Fama (1970).

The main idea of market efficiency model states that stock prices contain information about news announcements and will reflect new information easier and without delay. According to Fama (1970), there are 3 main factors that can affect information content of any announcement (e.g. CEO change, earnings announcement, merger or acquisition), such as: capital market expectations, credibility of information, and implications of release of information.

One more study about market efficiency is done by Richard R. West (1975). In his work he distinguished market efficiency as externally and internally efficient. In his study, West discovered that external efficiency depended upon the trading directions. Internal efficiency establishes price levels that fully reflect all current available information. So, according to West (1975), it should not be possible to use information to get abnormally high returns if the market is efficient.

This paper is going to investigate which effects CEO change announcements have on stock prices with the help of event study. Michael C. Jensen (1978) in his work discussed market efficiency, price reflections, and event study method. He explained that market participants rationally react to news announcements. According to Jensen, event studies investigate the speed with which markets react to released information and whether the returns after the announcement are normal or abnormal.

The study done by E. Furtado and V. Karan (1990) states that there is a positive relation between CEO departure and stock prices. In their research, Furtado and Karan conducted event studies showing that over 30% of all CEOs turnovers were announced at the same time with other important economic news that influence share prices. According to authors, companies do not want public to pay a lot of attention to CEO changes, that is why corporations try to announce it during news picks, not separately.

In study of Beatty and Zajak (1987), the authors investigated the performance of a company after CEO change. They came to the conclusion, that, in general, CEO change announcements were typically followed by the company's value reduction in the stock market, showing a negative tendency. In 1989, this research was studied in a more precise way and improved by Friedman and

Singh. According to Friedman and Singh (1989), succession initiated by the company has a more positive market reaction than the succession in which executive leaves the company for personal reasons. At the same time, research conducted by Hayes and Schaefer (1999) found negative average abnormal return for those companies where top managers resigned for a position in other organization. This situation imposes that these managers are more likely to be highly qualified and their resignation leads to a loss for the company from which he or she is departing.

The vast majority of all studies concerning the CEO change announcements (Beatty and Zajak (1987), Friedman and Singh (1989), Furtado andKaran (1990), and Jensen (1978) was conducted in the 20th and – the beginning of 21st centuries, and now their results have to be updated as economy constantly changes.

This paper, which includes research conducted for the companies listed on the mWIG40 index on Warsaw Stock Exchange, aims to answer the following question: what are the links between the CEO change announcement and stock price reactions for mWIG40 index companies? This paper is going to analyze strong market reactions on various top management departures on the Polish market.

The hypothesis is formulated in the following way:

Announcement of new CEO has different impacts on stock prices. This happens because investors see CEO changes in different ways. Change of company's top management can be as a signal that the company needs to employ a more qualified manager from the outside world or that company is going to have more efficient management. To test this hypothesis, an event study with 800 days as an estimation window and 2–3 days around the event date as an event window is to be used.

This research is going to contribute to existing event study literature as the Polish market is the area that is needed to be analyzed due to the absence of relevant research concerning announcements of the CEO change and its influence on stock prices.

The first stock exchange was organized in the Netherlands, at the time when East India Company issued shares and traded on Amsterdam Stock Exchange. Stock exchanges are open markets where financial securities are traded. Among such financial securities, we can distinguish shares issued by companies, derivatives, investment products, and bonds. Stock exchange plays the role of intermediary which simplifies transactions associated with buying / selling securities. Companies have to meet certain requirements in order to list and trade their stocks, but requirements vary by stock exchange. For example, in order to be listed on Warsaw Stock Exchange, the capitalization of the company should be

EUR 15,000,000. Capitalization stands for the number of all the issuer's shares multiplied by the (forecasted or actual) market share price.

Investors buy and sell companies and government securities on capital markets. They analyze companies' financial statements, dividends announcements, market expectations, and future interest rates; thus, investors' trading decisions reflect company's performance information. Capital markets perform two main functions. First of all, capital markets are primary markets for new issues of equity and debt; these are the places where companies raise their long-term funds. Second, capital markets help investors to differentiate or to increase portfolios due to the possibility to sell/buy new shares or bonds. In the primary market, investors buy securities directly from the company issuing them, while in the secondary market, investors trade securities among themselves, while the traded company does not participate in these transactions. Secondary markets play an important role as they help primary markets to increase efficiency and allocate new funds because secondary markets are sources of pricing information.

Companies' announcements are important sources of information. These are the statements that are required to be provided by listed companies, namely news which investors can reasonably use for the purpose of their investment decisions since they can affect prices of the financial instruments.

The efficient market hypothesis, which plays an important role in the financial economics literature and was examined by Fama (1970), is concerned with establishing the prices of capital market securities; therefore, it refers to the speed of the prices to adjust to new information. According to Fama (1970), in an ideal situation, prices of securities fully reflect all relevant and available information, such as CEO change, earnings or dividend announcements.

It is important to compute daily market adjusted abnormal return (AR) and daily cumulative abnormal return (CAR) in order to analyze the effect of CEO change announcement on stock return. AR is the relative daily percentage price change compared to change in average market price, while CAR stands for investors' total return measurement over a period after CEO change announcement. Replacement of the CEO is one of the most important decisions and responsibilities of the board of directors that can affect stock prices (Olson and Halloran, 1997).

The reasons why stock prices rise or fall can be complex. Usually, stock prices can be affected by internal and external events, some of which influence stock prices directly and other do so indirectly (Kurihara, 2006). Among internal factors, we can distinguish the announcement of CEO change (as well as dividend policy change, mergers and acquisitions, financial reports, and development of a new product).

Changing top executives may lead to unexpected behaviour of stock prices. Past studies can be categorized into five main parts: 1) impact on ex-ante day, 2) impact on announcement day, 3) impact on ex-post day, 4) signalling, and 5) shareholders' reaction.

Ex-ante (the full term is "ex-antefacto") means before the fact or beforehand, thus, knowing in advance. In order to study CEO change announcements and stock prices reaction, scholars focus on cumulative abnormal returns over the period. Cumulative abnormal return (CAR) is often used to evaluate the impact of news on a stock price and refers to sum of differences between expected and actual returns on stock.

Between 1971 and 1985, 1187 CEO changes were analyzed and examined by Lubatkin, Chung, Rogers and Owers (1989). They discovered that knowing about CEO change in advance makes investors review and re-examine their decisions and expectations concerning investing in companies' stocks. Thus, in most cases company's stock price decreases by an average of 1% during the pre-announcement period.

Usually, companies announce news about departure of top managers or about the appointment of a new one simultaneously; this leads to positive or negative market reactions and price changes surrounding the announcement day. Investors' reactions depend on their expectations; if investors are satisfied with the announced news, then it leads to positive market reactions and vice versa.

As it was mentioned earlier, the study of Warner and Jensen (1988) illustrates that there are two effects that can follow CEO change. The first effect can have a negative influence on stock prices, if the change suggests that company's performance was poor. The second effect corresponds to real effect and implies that positive market reaction will occur if change was initiated by and was in interest of shareholders.

On the other hand, in their study, Bonnier and Bruner (1989) were outstanding and added to previous literature as the authors decided to eliminate information about dividends paid from their sample data. They obtained a significantly positive result that showed that CEO change is associated with higher returns, comparing to returns resulting from the change of other managerial staff.

A very specific reason for CEO change (i.e. sudden executive death) was analyzed by Johnson, Magee, Nagarajan, and Newman (1985). The authors evaluated 53 different companies where sudden death of CEO took place in the period of 1971–1982. The conclusions drawn by the scholars support the idea about the negative relation between share price adjustments and the unexpected deaths of senior corporate executives.

The term ex- post is opposite to ex- ante; the full term is "ex-postfacto", and it means "after the fact". Unlike studies about the impact of an ex-ante day, there are not a lot of investors and authors who pay attention to the post-announcements.

According to the efficient market hypothesis theory, the stock market prices react on changes rationally and promptly. The study of Lubatkin, Chung, Rogers and Owers (1989) analyzed the companies' returns before and after the CEO change announcements. The authors did not find significant positive returns of post-announcement of CEO changes. Thus, investors make their decisions and react to expected news and announcements immediately.

Replacement of CEO of a company sends a signal to public about company's performance and prospects (Johnson, Magee, Nagarajan, and Newman, 1985). The authors analyzed companies in which CEOs had significant share ownership. Thus, according to the scholars, investors see an unexpected top management change (death) as a probability of future takeover of company. Thus, it may lead to a positive rise in share prices. Nevertheless, the evidence shows that in the majority of analyzed companies there is a negative stock price reaction to the CEO's death.

On the other hand, Bonnier and Bruner (1989) employed an event study in order to analyze the relationship between the CEO change and stock price reactions. As a study area, the authors took different distressed companies. According to Bonnier and Bruner (1989), the appointment of a top manager from the outside leads to negative effects on stock market. This can be explained by the fact that investors are signalled about poor company's performance and they assume that the firm needs a more qualified executive from the outside world.

One of the aims of the CEO is to maximize shareholders' wealth. That is why, shareholders pay a lot of attention towards each action fulfilled by the firm. As it was previously mentioned, Hubler and Schmidt (1996) stated that changing CEOs sends a poor signal to the market. However, there are some studies that show contradictory conclusions.

Johnson, Magee, Nagarajan, and Newman (1985) conducted an event study where they examined top management deaths in different companies. According to the authors, unexpected managers' deaths lead to a positive share reaction. As reported by Johnson, Magee, Nagarajan, and Newman's (1985) explanation, this effect took place because in the case of CEO change shareholders could get more wealth.

The view of Johnson, Magee, Magarajan, and Newman (1985) was supported by the study of Mahajan and Lummer (1993). The study proved that the existence of the significantly positive abnormal returns was correlated with the unexpected deaths.

In 1993, 498 different companies were analyzed by Mahajan and Lummer. In their event study, they inspected shareholder wealth effect of CEO change in the period 1972–1983. The authors distinguished internal and external causes of management changes. The main idea was to find out whether there is a correlation between the reaction of stock prices and internal/external sources of CEO changes. As a result, the authors concluded negative abnormal returns when the changes were initiated internally. At the same time, during the voluntary departure there were no abnormal returns observed.

This paper aims to analyze the stock price reaction to CEO change announcement on Warsaw Stock Exchange and is of a great importance for corporate literature. Markets show different reactions on the announcements of CEO change. Some authors (Worrell (1993), Etebari (1987), Hubler and Schmidt (1996), Mahajan and Lummer (1993)), who investigated top management changes around the world, assume negative returns following such changes. Nevertheless, statistical results are various, as some researches (Franks, Parrino (1997), Mayer and Renneboog (1998)) show positive price reactions on stock market. One of the reasons for such different results lies in the fact that the studies focus on different sides of CEO change event. Also, there are different data sets available for different countries around the world and different time zones (for example, different announcement dates). Furthermore, the reason for such diverse conclusions can be due to various governmental policies concerning employment. Even though layoff patterns are similar in developed countries, Polish employees enjoy a higher level of legal employment protection and can affect corporate decisions through cooperation between management and workers in decision making.

The aim of this paper is to indicate that the CEO changes affect prices on the stock market and that such turnovers of executives send messages to the public regarding the company's performance. Despite the fact that the macro views of such researches are similar, in general, each study concentrates on different specific factors. For example, some studies concentrate on poorly performing companies only (Bonnier and Bruner (1989) or on unexpected CEOs' deaths (John *et al.* (1985). This paper is going to concentrate on the companies listed on mWIG40 index on WSE.

This paper is going to analyze how CEO change announcements influence stock prices on example of companies from mWIG40 index. This index has been calculated for almost a decade already (since 1997) and comprises 40 medium-size companies listed at Warsaw Stock Exchange's main list with the market capitalization above € 1 billion.

Next chapter will explain the models and methodology about the correlation between CEO change and stock prices.

Econometric Model

There are two types of studies in corporate literature regarding data analysis: quantitative and qualitative. In their studies, Denis and Denis (1995) analyzed the effect of the forced CEO resignations and their influence on stock prices. To perform this study, the authors used both quantitative and qualitative types of research. According to Aliaga and Gunderson (2002), quantitative research is done by collecting and analyzing numerical data with the help of mathematically based models and statistical methods. On the other hand, Bryman and Bell (2003) defined qualitative research as a research where emphasis is put on theory generation. This paper will leans more towards the quantitative research method than towards the qualitative one. In the study done by Levine, J. (1996) data analysis was defined as an important method that is used in all of the sciences in order to describe facts or test hypothesis. Effective data analysis is possible only when research is based on reliable and right data analysis approach.

According to the main hypothesis of this paper, the change of the CEO significantly affects investors' decisions as to whether to buy shares of this company and the stock returns as a result. This hypothesis is going to be tested on thecompanies from the mWIG40 index traded on the Warsaw Stock Exchange. There are two approaches of event analysis used in this paper: event study methodology and dummy regression approach that are described in more detail below. With the help of the first technique, events – such as CEO change announcements are analyzed separately, while the second techniqueis based on an analysis of similar events for various companies as a repeating event. The model is estimated with Ordinary Least Squares (OLS) method that helps to determine the line of best fit for a model.

Data

The paper objective is to determine whether the announcement of new CEO has a measurable impact on stock performances. In order to fulfil paper's goal, companies from mWIG40 index from Warsaw Stock Exchange were analyzed. Out of forty companies listed on mWIG40 index, five were selected. This is because other companies did not have information about the exact date when a CEO was appointed in their reports. This date cannot be found in company's news and other online sources of information such as online newspapers. The analyzed companies are: Grupa Azoty SA (chemical industry), Bank Millennium SA (banking industry), Ciech SA (chemical industry), PKP Cargo SA (industrial

transportation), and Netia SA (fixed line telecommunications industry). Events in the sample are described in the table below.

Table 1. CEO appointment events in Sample.

Event Date	Event Description
19.02.2016	appointment day of new CEO of *Grupa Azoty SA*
24.10.2013	appointment day of new CEO of *Bank Millennium SA*
22.07.2015	appointment day of new CEO of *CIECH SA*
19.01.2016	appointment day of new CEO of *PKP CARGO SA*
03.12.2015	appointment day of new CEO of *Netia SA*

Source: http://www.biznesradar.pl/, author's own findings.

Model Specification

According to the theory, an efficient market should immediately react to news announced by companies as investors take into account all information available. In their work, Campbell, Lo and MacKinlay (1997), described the abnormal return market model which is used in this paper. In the study done by Zadorozhna and Zaderey (2013), abnormal return market model is explained with the help of the following equation:

$$r_t = \alpha + \beta r_{tM} + \gamma S_{t+} + \delta S_{t-} + \omega r_{tI} + e_t \quad (1)$$

where r_t stands for the daily stock return, r_{tM} is the market return, and abnormal return is represented by e_t. Also, r_{tI} is the return on an industry specific index, S_{t+} is a dummy variable for company-specific positive events, S_{t-} – is a dummy variable for company-specific negative events. If company-specific (positive) negative events are present, then S_{t+} (S_{t-}) captures only investors' reaction to CEO change and take the value of 1 and 0 otherwise.

According to Goh and Ederington (1993), the impact of announcements on stock prices depends on the reasons for the announcement. The authors performed a study analyzing different effects of news in equity and credit markets. They stated that negative announcements should cause equity prices to fall and positive announcements equity prices to rise.

In case of Grupa Azoty SA company, every positive event takes 1, when the company published reports where increases in earnings and EBITDA were present (09.11.2015, 26.08.2015, 13.05.2015). Nevertheless, investors' meeting

held by the company on the 20th November, 2015 was considered as a negative event (and took 0) because it was announced that dividends would not be paid in the 3rd quarter of 2015 due to heavy investments made by the company. On 29th May, Grupa Azoty took part in a "WallStreet" conference. This is one of the biggest European investor meetings. The vice president of the company talked about the chemical industry in Poland and worldwide, stressing the new strategies of Grupa Azoty SA that will help the company to gain an even bigger market share.

There also were regular operational meetings, but no strategically important decisions were made during such meetings. That is why these company-specific events were not included in the analysis.

According to the reports of Bank Millennium SA (25.07.2013, 25.04.2013), the company is doing well. For the analyzed period, it announced huge increases in earnings which were considered positive events. Also, on the 25th July, 2013, Bank Millennium SA announced that there was a 5% increase of bank's shares held by Aviva OFE. This announcement is considered to be neutral, which is why it was not included in the analysis.

A similar situation with earnings increases is with the Polish leader in chemical production, Ciech SA. But despite the fact that the company reported increases in earnings on 23rd March, 2015 (a positive event), it decreased the amount of dividend paid on 15th May, 2015 (a negative event). This is because of the reclassification of assets done by company (one-time earnings). Reclassification of an asset is simply changing the category of an asset, but it has a larger impact on the reporting side.

Reports published by PKP CARGO SA (12.11.2015, 27.08.2015, 01.05.2015) announced negative profits and thus were considered negative events. On 28th October, 2015, the company held a conference where strategies for the next five years were presented and allowed the sale of its shares to its employees (positive events). The day of dividend payment (26.06.2015) is also considered a appositive event for this company. At the same time, on 9th November, 2015, there was a general rolling strike announced by the trade union organizations stating that some companies unlawfully hide internal disputes. The company had to fill in claims to ascertain non-existence of collective disputes within the company which had a negative effect on PKP CARGO's reputation. On 18th December, 2015, PKP KARGO SA signed a significant contract with PKP Polskie Linie Kolejowe S.A. This agreement is a positive event as it gave PKP CARGO SA extra access to rail infrastructure to perform cargo transport operations.

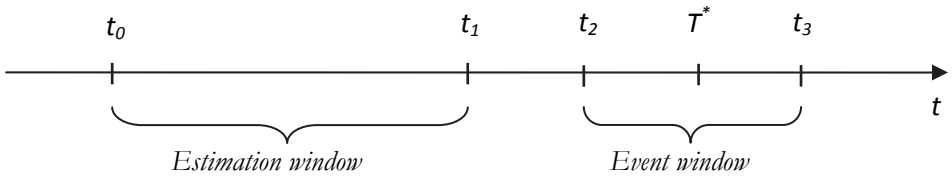
The last company is Netia SA, one of the largest telecommunications operators in Poland. According to the information published on its website, Netia SA

has had an increase in income for last years and in this paper it is recognized as a positive event. Netia SA reported increases in income in reports published on 05.11.2015, 06.08.2015, and 14.05.2015.

After analyzing the impact of news, it is important to identify industry specific indexes for the selected companies. For the analyzed companies, the following industry specific indexes were selected: average oil prices for transport-related company (PKP Cargo SA), average prices for fertilizers for companies in the chemical industry (Grupa Azoty SA and Ciech S.A). Returns on WIG, WiG-BANKI (Bank Millennium SA), or WIG-TI (Netia SA) indices were analyzed and selected because they contain general information about the changes in the corresponding sectors. This helps to detect abnormal returns associated with a particular event.

In order to assess the impact of events in the sample on CEO change in companies, cumulative abnormal returns from equation (1) are used. The estimation window timeline for the event is shown in Graph 1.

Graph 1. Estimation window timeline for the event.



Source: Zadorozhna and Zaderey (2013).

Here: $[t_2; t_3]$ is an event interval, T^* is anevent date over which market is expected to adjust to CEO change events. An interval $[-t_0; +t_1]$ is an estimation window over which the market model is estimated.

Standard optimal length of event window (Zadorozhna and Zaderey (2013)) is used in order to perform this research, these are: [-2;+2], [-2;+1], [-2;+0], [-1;+2], [-1;+1], [-1;+0], [-0;+2], [-0;+1], and [-0;+0]. Event windows that include five days allow testing investor's reaction about the event. The length of estimation window is 200 working days and the interval $[t_1; t_2]$ consists of: $(t - t_1)$ days before the announcement date, the announcement date, and $(t_2 - t)$ days after the announcement date. For example, the appointment day of a new CEO for Grupa Azoty SA is taken from Table 1. The appointment happened on 19th February, 2016. If the boundaries of the event are 17.02.2016 as the start and 21.02.2016 as the end, then we will have two days before and two days after an event. And that gives us the window for the event [-2; +2]. According to the

first approach, the cumulated abnormal returns for the event window period are calculated according to equation (2):

$$CAR_t = \sum_{j=t_0}^{t} e_j \tag{2}$$

Cumulated abnormal returns are used in order to determine which effects CEO change announcements have on stock prices. If CAR_t is positive or negative and statistically significant, it suggests that events in the sample had positive or negative impacts on abnormal returns accordingly. If CAR_t is statistically equal to zero, CEO change will have no effect on stock prices of the companies from mWIG40 index.

At the same time, the statistical significance of CARs (hypotheses) is tested by using t-test according to equation:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

Event study methodology is performed step by step. In the first step, the parameters of the market model ($\hat{\alpha}$,$\hat{\beta}$) were estimated in the estimation window and abnormal returns e_t were predicted in the event window:

$$e_t = r_t - \hat{\alpha} - \hat{\beta} r_{tM} - \hat{\gamma} S_{t+} - \hat{\delta} S_{t-} - \omega r_{tI} \tag{3}$$

In the second step, in event study methodology, cumulative abnormal returns (CAR) were calculated with the help of the equation (2).

Also, the second approach of event analysis, the so-called "dummy regressions", was performed in this paper. All analyzed companies are considered with help of the pool- model. According to Guidolin (2007) and La Ferrara (2010), a "dummy variable" is a numerical variable that takes value one for the dates that are within the event window interval and value zero for other events dates and is used in regression analysis:

$$e_t = \delta + \gamma I_t + \epsilon_t$$

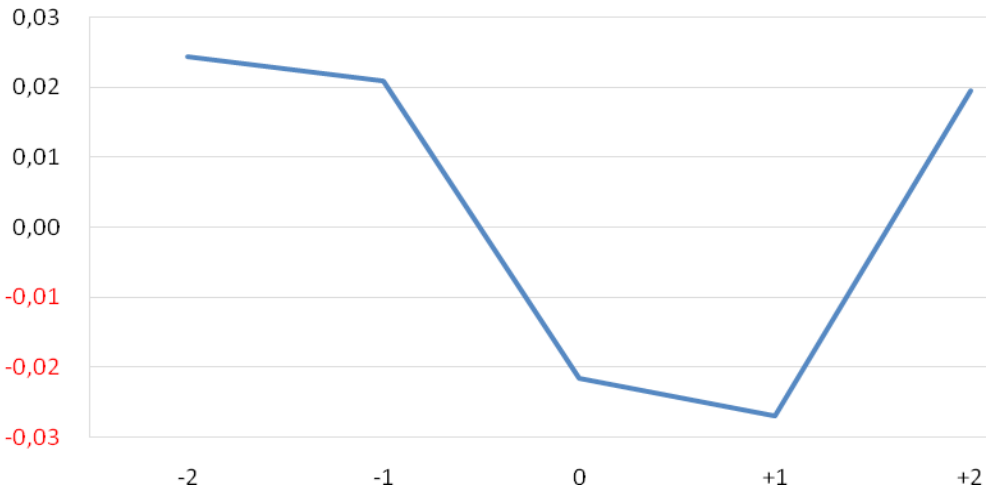
where e_t stands for abnormal returns, It is a dummy variable, γ is a coefficient that measures the effect of CEO change events. In case this coefficient is significant, CEO change.

Results and Analysis

The focus of this research is on the influence of CEO change announcement on stock market. To start, Warsaw Stock Exchange's index mWIG40 was analyzed. Initially, this index consists of 40 companies. By eliminating incomplete information about the CEO date of resignation from the sample list, the final sample consists of CEO change announcements in five companies: Grupa Azoty SA, Bank Millennium SA, Ciech SA, PKP Cargo, and Netia SA. The first step in analyzing the effect of CEO change announcement is to run company specific regressions. The value of CAR shows by how much the value of shares has changed due to the event, while t-statistics plays an important role when it comes to determination of the significance level of CAR value.

In the first step in event study methodology, the parameters of the market model $(\hat{\alpha},\hat{\beta})$ were estimated in the estimation window and abnormal returns e_t were predicted in the event window (equation (3)).

Graph 2. Abnormal returns for the event-window [-2;+2] for Grupa Azoty SA.

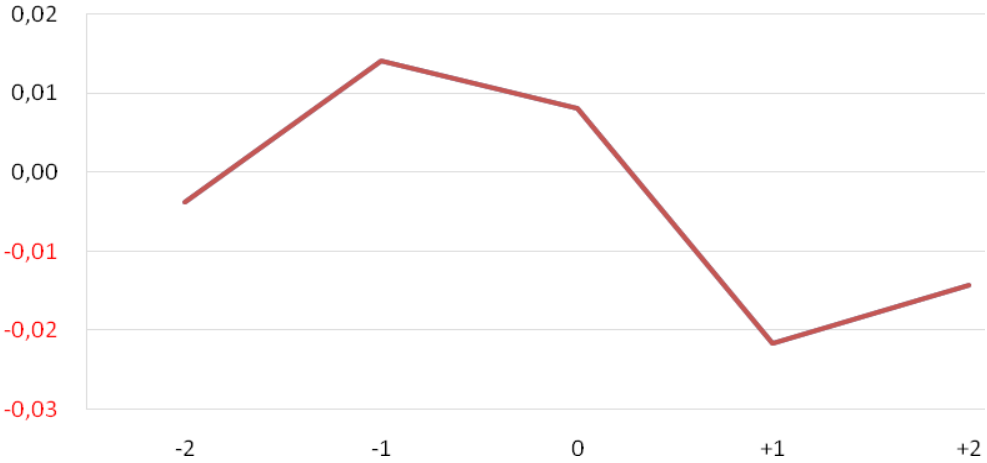


Now, it is important to look in more detail at the abnormal returns for the event window [-2;+2] for all companies from sample. This period of event window makes it easier to have a close look at the stocks' reactions for the companies from the sample. It helps to make a prior analysis of the dynamics of returns behaviour. Graph 2 shows the abnormal returns for the event window [-2;+2] for Grupa Azoty SA.

According to graph 2, Grupa Azoty SA showed a strong fall in its stock returns in the period of two days before and the day after the announcement day of the

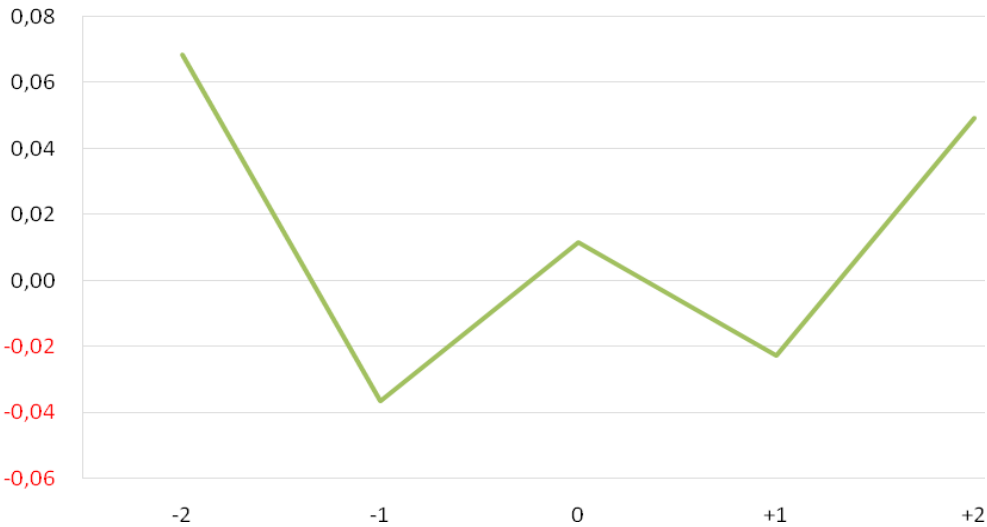
event. The day of CEO change announcement for Grupa Azoty SA was characterized by a decrease in company's stock prices, while during the days that followed stock returns increased considerably. So, the market first reacted negatively to the news about the new CEO; however, it recovered quickly.

Graph 3. Abnormal returns for the event-window [-2;+2] for Bank Millennium SA.

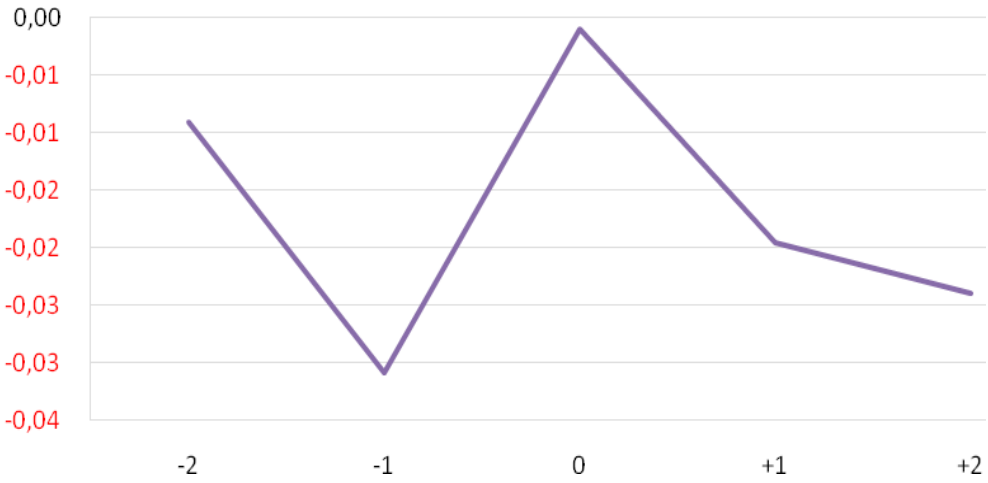


On graph 3, it is clearly seen that the day before CEO change announcement, Bank Millennium SA showed a decrease in its stock returns. AR fell after the event date; however, recovered slightly the next day.

Graph 4. Abnormal returns for the event-window [-2;+2] for Ciech SA.



Graph 5. Abnormal returns for the event-window [-2;+2] for PKP Cargo SA.



Ciech SA showed a decrease in its stock returns in the period of one day before and one day after the announcement day of the event. Ciech SA showed positive abnormal returns on the day of CEO change announcement; however, the next day after the event announcement is characterized by negative stock returns. During the days that followed, stock returns increased considerably. This company showed very acute stock price reactions comparing to other smooth reactions presented by firms from the sample. For the whole analyzed event window period, this company experienced the strongest positive reactions on new Chief Executive Officer.

According to graph 5, PKP Cargo SA did not have a positive return in the event window [-2;+2]. Company's stock returns were close to zero on the day of event announcement. PKP Cargo SA faced almost no increased stock returns (still negative) on the day of event announcement comparing to the returns one day before the CEO change announcement. AR fell after the event date and showed negative trends for the next two days.

Netia SA met the day of CEO change announcement with some positive returns. But on the day after the event the company showed a drop in its stock returns. There was a considerable decrease in AR after the event date; however, they recovered the next day.

So, above graphs clearly indicate that all the analyzed companies show similar behaviour in the event window [0;+1]. One of the most important things is that all the analyzed companies experienced a drop in stock returns the next day after the CEO change announcement and the returns tend to increase in two days after the event. So, the market recovers after the news rather quickly.

Graph 6. Abnormal returns for the event-window [-2;+2] for Netia SA.

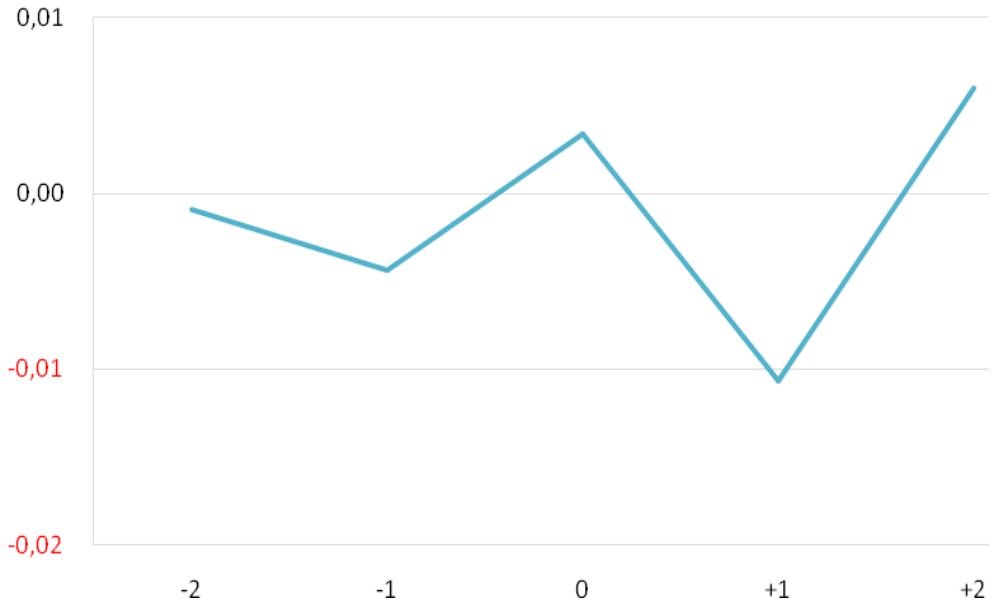


Table 2. CAR estimation results for events for the windows [0;-1], [-1;+1], and [-1;0].

	Event window [0;+1]		Event window [-1;+1]		Event window [-1;0]	
	CAR	**t-statistics**	**CAR**	**t-statistics**	**CAR**	**t-statistics**
azoty	-4.85***	-8.93***	-2.76	-0.61	-0.06	-0.01
mill	-1.35	-0.45	0.00	0.02	2.23***	3.73***
chiech	-1.11	-0.32	-4.77	-1.1	-2.4	-0.51
pkp	-2.05	-1.12	-5.14**	-1.97**	-3.19	-1.07
netia	-0.73	-0.52	-1.17	-0.96	-0.10	-0.13

Notes: t-statistics is in parenthesis. *** –significance at 1% level; ** –significance at 5% level; * –significance at 10% level.

Based on the analysis of graphs 2-6, it is possible to say that there was mutual dynamics for all companies in [0;1], [-1;+1], and [-1;0] event windows. And, furthermore, these analyzed event windows are quite close to the event itself. Firstly, results of the CAR estimation for the analyzed company with event windows [0;+1], [-1;+1], and [-1;0] are presented in table 2. As it was discussed earlier, the event window [0;+1] includes two trading days: the day of an event itself and the day before an event; event window [-1;0] also has two trading days: the

day before an event and the day of an event itself, while event window [-1;+1] consists of three trading days: the day before an event, the day of an event itself, and the day after an event. Appendices A, B, C, D. and E contain results of CAR estimation for the rest of event windows for Grupa Azoty SA, Bank Millennium SA, Ciech SA, PKP Cargo SA, and Netia SA.

As for the companies from the main sample, Grupa Azoty SA experienced a loss of its value due to CEO change announcement in the event windows [0;+1], [-1;0], and [-1;+1]. CAR took the value -4.9, -0.06, and -2.8 percentage points correspondently. It means that the company faced a loss of its value because of the event. CAR of this company for the event is only significant in the [0;+1] estimated event window at 1%-level and the coefficients on CAR change their signs depending on the event window (see Appendix A). These results are consistent with what one can observe on graphs 2-6 – ARs tend to decrease on the date of the event, but then increase during the days that follow.

As for Bank Millennium SA, the company had a negative market reaction on the CEO change announcement in the first estimated event window; Bank Millennium SA lost more than 1.3 percentage points of its value. Probably, investors reacted negatively to this event being afraid of possible consequences of this kind of change for the business. Interestingly, this was the only company from the sample that showed some positive returns of 0.0664 percentage point (in [-1;+1] estimated event window). Nevertheless, there was a 2.23 percentage points increase in the event window [-1;0] with statistical significance of 1% level.

In the [0;+1] and [-1;0] event windows, the abnormal returns of Ciech SA decreased by 1.11 and 2.48 percentage points respectively as a reaction to the event, when it became obvious that the company is going to appoint the new CEO. This means that investors of Ciech SA considered this to be bad news for the company and, as a result, its value went down. Yet, the results for this event were negative but not significant. Also, during the second analyzed event window ([-1;+1]), return results for Chiech SA were also negative, the company lost almost 4.8 percentage points in its value due to the event. It is possible to say that investors saw an increasing risk for their investments with new CEO for Chiech SA.

Investors of PKP Cargo SA reacted negatively for the event. In the event windows [0;+1] and [-1;0], the company showed 2.05 and 3.19 percentage points of decrease in its value. Also, over the course of three days of the event window, PKP Cargo SA experienced a loss in its value due to the CEO change announcement event. Once the information became available to the public, the company faced a drop in its value for more than 5.1 percentage points statistically significant at 5% level. So, abnormal returns of the company decreased as the probability of a new person to become new CEO went up during the event

window. This can be associated with a high risk of having another person ruling the company towards specified firm's goals.

Investors of Netia SA company were pessimistic about the CEO change announcement. In the event windows [0;+1] and [-1;0] company's abnormal returns went down by 0.73 and 0.10 percentage points respectively. The decreasing trend remained the same over the three days event window, as Netia SA faced a decrease in its value for about 1.2 percentage points.

Overall, CAR estimation results suggest that investors of companies from the sample react to CEO change announcement event mostly negatively. The results suggest that some of the analyzed events do matter and investors take them into account when they make investment decisions.

The second step in analyzing the effect of CEO change announcement is to run a dummy regression approach. The dummy regression with residuals is bounded to a company level. With the help of this approach it is possible to estimate the overall market reaction to the events in the sample. Table 3 shows the dummy regression approach results for analyzed event windows.

Table 3. Dummy regression approach results for CEO change for analyzed event windows.

Event window	Coefficient	t-statistics	of observations	R-squared
[-1;+1]	-0.93***	-2.74	1064	0.0855
[0;+1]	-1.02***	-2.73	1064	0.0855

Notes: T-statistics is in parenthesis. *** –significance at 1% level; ** –significance at 5% level; * –significance at 10% level.

There are 1064 observations in the sample. The reaction of investors on CEO change announcement in a particular event window is shown by the coefficient, while t-statistics is important in finding the significance level.

Based on the "dummy" regression approach, it is possible to say that the announcement of CEO changes has a negative impact on the stock prices due to negative coefficients (-0,93 and -1,02) that are highly significant. These coefficients show how much stock prices decrease over the analyzed period. It is possible to expect the decrease of stock prices for CEO change analysis.

To sum up, the sample consisted of five companies. Company specific regressions including CAR analysis and dummy regression approach were performed for these firms. Detailed analysis towards the abnormal returns for the event window [-2;+2] for all companies from sample was done. The code for performing above mentioned analysis with the help of Stata program is in Appendix

F. The results showed that all analyzed companies experienced a drop in stock prices the next day after the CEO change announcement. The results showed that the stock prices of analyzed companies react in a negative way to CEO change announcements. This can be due to the fact that investors of these firms considered the company's performance adequately and were not sure that the new CEO would perform in a better way than the former CEO did. Moreover, any change brings uncertainty and some degree of risk. The value of this risk associated with the CEO change for investors is reflected by the above results.

Conclusion

Over the past decades, CEO has been a key player in the company's environment in terms of economic growth. Chief Executive Officers develop and implement strategic plans of the companies and aid companies to adapt to inevitable changes in the business world. A right CEO with proper skills, knowledge, and experience can increase the value of the firm; that is why, by investing in CEO, companies invest in their future. CEOs play an important role in the process of company's governance all over the world, and Poland is not an exception. The Polish market is growing and very attractive for investors. Before investing in a company, investors pay attention to many aspects, such as financial stability of a company, its reputation, or CEO. The turnover of top management is always an important issue.

However, despite the great significance of the Polish market on international arena, there are no relevant studies concerning the influence of the CEO change announcement on stock prices in Polish market. Previous research about CEO change announcement and its influence on stock market is mostly performed for America or the United Kingdom and the majority of these studies use an event study method on a variety of corporate events, but only few focuses on CEO turnovers.

The main purpose of this paper was to fulfil this missing piece in the corporate literature and to determine whether or not CEO change announcement has an effect on stock prices for the companies listed in mWIG40 index on Warsaw Stock Exchange. In order to make an authentic result, the daily returns on Polish stock market were used (instead of monthly or quarterly returns).

In the first part of the research, where literature about market reactions on different causes of the CEO turnover was reviewed from different perspectives, the market efficiency and current hypothesis were identified. The next part aimed to analyze the theoretical background and the impact of announcement

day, ex-ante, and ex-post days.The shareholders reaction on CEO change was also included in this part. All of this helped to develop a couple of assumptions regarding the possible reaction of CEO change announcement on stock prices, which were further tested with a use of econometric estimations.

According to the formulated hypothesis, the announcement of new CEO has different impacts on stock prices as investors see CEO changes in different ways. In order to test the hypothesis, companies from mWIG40 index were analyzed. Five companies were selected as a sample because of the lack of the available information about the exact date of new CEO appointment for the rest of the companies from index. First of all, the empirical part of the research consisted of company specific approach in line with the CAR analysis and "dummy" regressions approach which helped to estimate the overall market reaction to the events in the sample. Results showed that stock prices of the analyzed companies generally respond to CEO change announcements in a negative way.

A number of recommendations emerge from the findings of the study. The recommendation for WSE is to improve the communication infrastructure, meaning to improve the communication network, which can publicize the real-time transaction information across the country and the globe, and connect WSE with more and more trading terminals. For the analyzed companies, it is highly recommended that the information about CEO change has to be kept secret from the public before the announcement. According to the results of this paper, investors react in a negative way towards CEO changes. Companies do not change CEO without the urgent need for it. In case former CEO appealed to investors in a good way, firms have to provide investors with adequate reasons for CEO change. Awareness of these patterns would help companies prepare better response plans. Recommendation for the investors is not to purchase or sell stocks immediately on the announcement day of CEO resignations as there is no probability of earning a positive capital gain. If they want to get short-term profit, they could trade those stocks within coming days.

Bibliography

Aliaga, M., Gunderson, B. (2002) *Interactive statistics*. "Thousand Oaks: Sage."

Bank Millennium SA. (2016). *Nowości*. [ONLINE] https://www.bankmillennium.pl/. (access: 14.04.2016).

Beatty, R. P., Zajac, E. J.(1987). *CEO change and firm performance in large corporation: Succession effects and manager effects*. "Strategic Management Journal", 8(4), 305–317.

Biznes Radar. (2016). Notowania [ONLINE],http://www.biznesradar.pl/. (access: 02.04.2016).

Bloomberg Markets. (2016). *Bloomberg the Company & Its Products*. [ONLINE] http://www.bloomberg.com/. (access: 24th March 2016).

Bonnier, K. A.,Bruner, R. F.(1989). *An analysis of stock price reaction to management change in distressed firms*. "Journal of Accounting and Economics", 11(1), 95–106.

Bryman, A. Bell, E. (2003) *Business research methods*. "England: Oxford University Press."

CHIECH SA. (2016). *News*. [ONLINE] http://ciechgroup.com/. (access: 15th April 2016).

Dedman, E., (2000). *Shareholder Wealth Effects of CEO Departures: Evidence from the UK*."Department of Economics: University of Bristol."

Denis, D, D. Denis, (1995), *Performance changes following management dismissals*, "Journal of Finance", 50, 1029–1057.

Etebari, A., J. Horrigan, J. Landwehr (1987*), To be or not to be – reaction of stock returns to sudden deaths of corporate chief executive officers, "*Journal of Business, Finance and Accounting", 14, 255–278.

Fama, E. (1970). *Efficient capital markets: A review of theory and empirical work*. "Journal of Finance", 25, 383–417.

Franks, J., C. Mayer and L. Renneboog, (1998), *Who disciplines the management of poorly performing companies?,*"Discussion paper CentER", Tilburg University.

Friedman, S.D., Singh, H. (1989) *CEO succession and stockholder reaction: the influence of organizational context and event conten,.*"Academy of Management Journal", vol. 32, no. 4, 718–744.

Furtado E., M. Rozeff, (1987), *The wealth effects of company initiated management changes*, "Journal of Financial Economics", 18, 147–160.

Furtado, E.P. H., Karan,V. (1990). *Causes, Consequences, and Shareholder Wealth Effects of Management Turnover: A Review of the Empirical Evidence. Financial Management*, 19(2), 60–75.

Giełda Papierów Wartościowych w Warszawie. (2016). *Dane Rynkowe*. [ONLINE] https://www.gpw.pl. (access: 13.04.2016).

Goh J., L. Ederington (1993): *Is a bond rating downgrade bad news, good news, or no news for stockholders?*, "Journal of Finance", Vol. 48, 08, 2001.

GRUPA AZOTY SA. (2016). *Nowości*. [ONLINE] http://grupaazoty.com/(access: 14 April 2016).

Grusky, O. (1963) *Managerial succession and organizational effectiveness.*"The American Journal of Sociology", Vol. 69, no. 1, 21–31.

Guidolin, M., La Ferrara, E., (2010), *The Economic Effects of Violent Conflict: Evidence from Asset Market Reactions.*"Journal of Peace Research". November, Vol 47, No. 6: 671–684.

Guidolin, Massimo Eliana La Ferrara. (2007). *Diamonds are Forever, wars are Not: Is conflict bad for Private Forms?*" The American Economic Review", 97(5): 1978–1993.

Hambrick, D. C., Mason, P. (1984) *Upper echelons: The organization as a reflection of its top managers*. "Academy of Management Review", Vol. 9, no. 2, 193–206.

Hayes, R.M., Schaefer, S. (1999). *How much are differences in managerial ability worth?*"- Journal of Accounting and Economics", Vol. 27 No. 2, 125–148.

Hubler, J., G. Schmidt, (1996*), L effet des annonces de décisions de GRH sur les cours boursiers des entreprises françaises. Application d une méthodologie d études d événements, XIIIes Journées Nationales des I.A.E.*, Tome 1, Toulouse, 16 and 17 April, 448–467.

Jensen, M. C., J. B. Warner (1988). *The Distribution of Power among Corporate Managers, Shareholders, and Directors*. "Journal of Financial Economics"*, 20*, 3–24.

Jensen, M.C. et W.H. Meckling, (1976), *Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure*, "Journal of Financial Economics", Vol. 3, No. 4, October, 305–350.

Jensen, M.C., Meckling, M.H. (1976), *A theory of the firm: Governance, residual claims and organizational forms*, "Journal of Financial Economics", Vol. 3, No. 4.

Johnson, W, R. Magee, N. Nagarajan, H. Newman, (1985), *An analysis of the stock price reaction to sudden executive deaths*, "Journal of Accounting and Economics", *7*, 151–174.

Johnson, W. B., Magee, R. P., Nagarajan, N. J., Newman, H. A.(1985). *An analysis of the stock price reaction to sudden executive deaths: Implications for the managerial labor market*. "Journal of Accounting and Economics"*, 7*, 151–174.

Kurihara, Y., (2006). *The Relationship between Exchange Rate and Stock Prices during the Quantitative Easing Policy in Japan*. Studies in Economics and Finance, Emerald Group Publishing, 23(3), 211–226.

Levine, J. (1996). *Introduction to Data Analysis: The Rules of Evidence*. [ONLINE] http://www.dartmouth.edu/~mss/data%20analysis/Volume%20I%20pdf%20/006%20Intro%20(What%20is%20the%20weal.pdf. (access: 13.04.2016).

Lubatkin, M. H.,Chung, K.H.,Rogers,R.C.,Owers, J.E.(1989). *Stockholder Reactions to CEO Changes in Large Corporations*."The Academy of Management Journal", 32(1), 47–68.

Mahajan A., S. Lummer, (1993), *Shareholder wealth effects of management changes*, "Journal of Business, Finance and Accounting", 20, 393–410.

Netia SA. (2016). *Nowości*. [ONLINE]http://www.netia.pl/ (access: 14 April 2016).

Olson, J. F., Halloran M. J. (1997). *The CEO Succession Challeng*e. "The Corporate Governance Advisor", Vol. 5, No. 3.

Parrino, R. (1997) *CEO turnover and outside succession: a cross-sectional analysis*. "Journal of Financial Economics", Vol. 46, No. 2, 165–197.

Parrino, R., (1997), *Turnover and Outside Succession: A cross-sectional Analysis*, "Journal of Financial Economics", Vol. 46, 165–197.

PKP CARGO SA. (2016). *News*. [ONLINE] https://www.pkpcargo.com. (access: 15 April 2016).

Shen W., Cannella A. (2002) *Revisiting the performance consequences of CEO succession: the impacts of successor type, postsuccession senior executive turnover and departing CEO tenure*. "Academy of Management Journal", Vol. 45, No. 4, 717–733.

Teoh, S., I. Welch, T. Wong, (1998), *Earnings management and the underperformance of seasoned equity offering*, "Journal of Financial Economics", 50(1), 63–99.

The Wall Street Journal. (2016). *Warsaw Stock Exchange IPO Priced at Top of Range*. [ONLINE] http://www.wsj.com/. (access: 01.03.2016).

Warsaw Business Journal. 2016. *News*. [ONLINE] http://wbj.pl/. (access: 24.03.2016].

Warszawa Business Run. 2016. *Wiadomości*. [ONLINE] http://warszawabusinessrun.pl/. (access: 24.03.2016].

West, R., (1975). *On the Difference between Internal and External Market Efficiency*. "Financial Analysts Journal", 31(6), 30–34.

Zadorozhna, O., Zaderey, N., (2013). *Impact of Political Regime Shift on Stock Returns of Oligarch Firms*. Kyiv: EERC.

APPENDIX A. CAR Estimation Results for Grupa Azoty Event

Table 1. CAR estimation results for Grupa Azoty SA events for the window [-2;+2]

date	**car_22**	**ttest_22**
17.02.2016	0.0244067	0.4315102
18.02.2016	0.045399	0.8026521
19.02.2016	0.023823	0.4211892
22.02.2016	-0.0031921	-0.0564354
23.02.2016	0.0163257	0.2886384

Table 2. CAR estimation results for Grupa Azoty SA events for the window [-2;+1]

date	**car**_21	**ttest**_21
17.02.2016	0.0244067	0.4476831
18.02.2016	0.045399	0.8327352
19.02.2016	0.023823	0.4369752
22.02.2016	-0.0031921	-0.0585506

Table 3. CAR estimation results for Grupa Azoty SA events for the window [-2;+0]

date	**car**_20	**ttest**_20
17.02.2016	0.0244067	0.5500219
18.02.2016	0.045399	1.023096
19.02.2016	0 .023823	0.5368663

Table 4. CAR estimation results for Grupa Azoty SA events for the window [-1;+2]

date	**car**_12	**ttest**_12
18.02.2016	0.0209922	0.406449
19.02.2016	-0.0005838	-0.0113028
22.02.2016	-0.0275988	-0.5343645
23.02.2016	-0.008081	-0.1564634

Table 5. CAR estimation results for Grupa Azoty SA events for the window [-1;+1]

date	**car**_11	**ttest**_11
18.02.2016	0.0209922	0.461043
19.02.2016	-0.0005838	-0.012821
22.02.2016	-0.0275988	-0.60614

Table 6. CAR estimation results for Grupa Azoty SA events for the window [-1;+0]

date	**car**_10	**ttest**_10
18.02.2016	0.0209922	0.4931431
19.02.2016	-0.0005838	-0.0137137

Table 7. CAR estimation results for Grupa Azoty SA events for the window [-0;+2]

date	**car**_02	**ttest**_02
19.02.2016	-0.021576	-0.4896316
22.02.2016	-0.048591	-1.102693
23.02.2016	-0.0290732	-0.659769

Table 8. "CAR estimation results for Grupa Azoty SA events for the window [-0;+1]

date	**car**_01	**ttest**_01
19.02.2016	-0.021576	-3.966885
22.02.2016	-0.048591	-8.93377

APPENDIX B. CAR Estimation Results for Bank Millennium SA Events

Table 1. CAR estimation results for Bank Millennium SA events for the window [-2;+2]

date	**car**_22	**ttest**_22
22.10.2013	-0.0036883	-0.1103584
23.10.2013	0.0104557	0.312851
24.10.2013	0.0186243	0.5572674
25.10.2013	-0.0030242	-0.0904895
28.10.2013	-0.0173267	-0.5184412

Table 2. CAR estimation results for Bank Millennium SA events for the window [-2;+1]

Date	**car**_21	**ttest**_21
22.10.2013	-0.0036883	-0.1168863
23.10.2013	0.0104557	0.3313568
24.10.2013	0.0186243	0.5902309
25.10.2013	-0.0030242	-0.0958422

Table 3. CAR estimation results for Bank Millennium SA events for the window [-2;+0]

Date	**car**_20	**ttest**_20
22.10.2013	-0.0036883	-0.2346122
23.10.2013	0.0104557	0.6650937
24.10.2013	0.0186243	1.184701

Table 4. CAR estimation results for Bank Millennium SA events for the window [-1;+2]

Date	**car**_12	**ttest**_12
23.10.2013	0.014144	0.409785
24.10.2013	0.0223126	0.6464484
25.10.2013	0.000664	0.0192386
28.10.2013	-0.0136384	-0.3951382

Table 5. CAR estimation results for Bank Millennium SA events for the window [-1;+1]

Date	**car**_11	**ttest**_11
23.10.2013	0.014144	0.4258893
24.10.2013	0.0223126	0.6718534
25.10.2013	0.000664	0.0199947

Table 6. CAR estimation results for Bank Millennium SA events for the window [-1;+0]

Date	**car**_10	**ttest**_10
23.10.2013	0.014144	2.367035
24.10.2013	0.0223126	3.73407

Table 7. CAR estimation results for Bank Millennium SA events for the window [-0;+2]

Date	**car**_02	**ttest**_02
24.10.2013	0.0081686	0.3035858
25.10.2013	-0.01348	-0.5009831
28.10.2013	-0.0277824	-1.032535

Table 8. CAR estimation results for Bank Millennium SA events for the window [-0;+1]

Date	**car**_01	**ttest**_01
24.10.2013	0.0081686	0.2739561
25.10.2013	-0.01348	-0.4520877

APPENDIX C. CAR Estimation Results for Chiech SA Events

Table 1. CAR estimation results for Ciech SA events for the window [-2;+2]

Date	**car**_22	**ttest**_22
20.07.2015	0.0683931	0.6784703
21.07.2015	0.031836	0.315818
22.07.2015	0.0435461	0.4319841
23.07.2015	0.0207039	0.2053855
24.07.2015	0.0700885	0.6952888

Table 2. CAR estimation results for Ciech SA events for the window [-2;+1]

Date	**car**_21	**ttest**_21
20.07.2015	0.0683931	0.7309709
21.07.2015	0.031836	0.3402563
22.07.2015	0.0435461	0.4654114
23.07.2015	0.0207039	0.2212784

Table 3. CAR estimation results for Ciech SA events for the window [-2;+0]

Date	**car**_20	**ttest**_20
20.07.2015	0.0683931	0.7516807
21.07.2015	0.031836	0.3498964
22.07.2015	0.0435461	0.4785974

Table 4. CAR estimation results for Ciech SA events for the window [-1;+2]

Date	**car**_12	**ttest**_12
21.07.2015	-0.0365571	-0.4754798
22.07.2015	-0.024847	-0.3231725
23.07.2015	-0.0476893	-0.6202699
24.07.2015	0.0016954	0.022051

Table 5. CAR estimation results for Ciech SA events for the window [-1;+1]

Date	**car**_11	**ttest**_11
21.07.2015	-0.0365571	-0.8485966
22.07.2015	-0.024847	-0.5767712
23.07.2015	-0.0476893	-1.107006

Table 6. CAR estimation results for Ciech SA events for the window [-1;+0]

Date	**car**_10	**ttest**_10
21.07.2015	-0.0365571	-0.7573902
22.07.2015	-0.024847	-0.5147803

Table 7. CAR estimation results for Ciech SA events for the window [-0;+2]

Date	**car**_02	**ttest**_02
22.07.2015	0.0117101	0.1871527
23.07.2015	-0.0111321	-0.1779155
24.07.2015	0.0382525	0.6113574

Table 8. CAR estimation results for Ciech SA events for the window [-0;+1]

Date	car_01	ttest_01
22.07.2015	0.0117101	0.3389091
23.07.2015	-0.0111321	-0.3221819

APPENDIX D.– CAR Estimation Results for PKP Cargo SA Events

Table 1. CAR estimation results for PKP Cargo SA events for the window [-2;+2]

Date	car_22	ttest_22
15.01.2016	-0.0090398	-0.3391306
18.01.2016	-0.0399246	-1.497776
19.01.2016	-0.0409054	-1.534567
20.01.2016	-0.0604558	-2.268003
21.01.2016	-0.0844711	-3.168938

Table 2. CAR estimation results for PKP Cargo SA events for the window [-2;+1]

Date	car_21	ttest_21
15.01.2016	-0.0090398	-0.3483588
18.01.2016	-0.0399246	-1.538532
19.01.2016	-0.0409054	-1.576325
20.01.2016	-0.0604558	-2.329719

Table 3. CAR estimation results for PKP Cargo SA events for the window [-2;+0]

Date	car_20	ttest_20
15.01.2016	-0.0090398	-0.3373166
18.01.2016	-0.0399246	-1.489764
19.01.2016	-0.0409054	-1.526359

Table 4. CAR estimation results for PKP Cargo SA events for the window [-1;+2]

Date	**car**_12	**ttest**_12
18.01.2016	-0.0308848	-1.206685
19.01.2016	-0.0318655	-1.245002
20.01.2016	-0.0514159	-2.008848
21.01.2016	-0.0754312	-2.947137

Table 5. CAR estimation results for PKP Cargo SA events for the window [-1;+1]

Date	**car**_11	**ttest**_11
18.01.2016	-0.0308848	-1.181101
19.01.2016	-0.0318655	-1.218606
20.01.2016	-0.0514159	-1.966256

Table 6. CAR estimation results for PKP Cargo SA events for the window [-1;+0]

Date	**car**_10	**ttest**_10
18.01.2016	-0.0308848	-1.032795
19.01.2016	-0.0318655	-1.06559

Table 7. CAR estimation results for PKP Cargo SA events for the window [-0;+2]

Date	**car**_02	**ttest**_02
19.01.2016	-0.0009807	-0.0463508
20.01.2016	-0.0205311	-0.9703518
21.01.2016	-0.0445464	-2.105372

Table 8. CAR estimation results for PKP Cargo SA events for the window [-0;+1]

Date	**car**_01	**ttest**_01
19.01.216	-0.0009807	-0.0528125
20.01.2016	-0.0205311	-1.105625

APPENDIX E. CAR Estimation Results for Netia SA Events

Table 1. CAR estimation results for Netia SA events for the window [-2;+2]

Date	car_22	ttest_22
01.12.2015	-0.0009533	-0.0649422
02.12.2015	-0.0053233	-0.3626385
03.12.2015	-0.0019703	-0.1342206
04.12.2015	-0.012656	-0.8621663
05.12.2015	-0.0066688	-0.4542974

Table 2. CAR estimation results for Netia SA events for the window [-2;+1]

Date	car_21	ttest_21
01.12.2015	-0.0009533	-0.08042
02.12.2015	-0.0053233	-0.4490671
03.12.2015	-0.0019703	-0.1662098
04.12.2015	-0.012656	-1.067649

Table 3. CAR estimation results for Netia SA events for the window [-2;+0]

Date	car_20	ttest_20
01.12.2015	-0.0009533	-0.142219
02.12.2015	-0.0053233	-0.7941542
03.12.2015	-0.0019703	-0.2939342

Table 4. CAR estimation results for Netia SA events for the window [-1;+2]

Date	car_12	ttest_12
02.12.2015	-0.00437	-0.2883946
03.12.2015	-0.001017	-0.0671138
04.12.2015	-0.0117027	-0.7723143
05.12.2015	-0.0057154	-0.3771896

Table 5. CAR estimation results for Netia SA events for the window [-1;+1]

Date	**car_**11	**ttest_**11
02.12.2015	-0.00437	-0.3588342
03.12.2015	-0.001017	-0.0835062
04.12.2015	-0.0117027	-0.9609498

Table 6. CAR estimation results for Netia SA events for the window [-1;+0]

Date	**car_**10	**ttest_**10
02.12.2015	-0.00437	-0.5658397
03.12.2015	-0.001017	-0.1316795

Table 7. CAR estimation results for Netia SA events for the window [-0;+2]

Date	**car_**02	**ttest_**02
03.12.2015	0.003353	0.2159837
04.12.2015	-0.0073327	-0.4723354
07.12.2015	-0.0013455	-0.0866693

Table 8. CAR estimation results for Netia SA events for the window [-0;+1]

Date	**car_01**	**ttest_**01
03.12.2015	0.003353	0.23884
04.12.2015	-0.0073327	-0.5223199

Chapter VI.

The Effect of Dividend Announcements on Stock Returns for Banking Sector: Evidence from the Polish Stock Market

Anastasiia Sorokina, RBS / Lazarski University
0000-0003-2756-7739
Olha Zadorozhna, Lazarski University
0000-0002-2160-6904

The capital market allows to make transactions between sellers and buyers of long-term funds – corporate and government securities – and plays a significant role for both firms and investors. It allows firms to interact with investors so as to get external financing resources and investors to obtain the securities at market prices. The prices respond to new information that is available for investors. Thus, the price of the stock reflects all relevant information in an efficient market.

Informational content of dividends was introduced by Merton Miller and Franco Modigliami (MM) in 1961. They suggested that the dividend distribution provides useful information about manager's perspectives of company's profitability. Although MM stated that dividend payments do not cause the change in stock prices, later dividend-signaling hypotheses supported the dividend effect on market return. Thus, the dividend policy of the company remains one of the channels through which investors receive information. However, there is no commonly defined way of investors' reaction to these signals provided by dividend policy.

A lot of theories have been developed so as to explain the relationship between dividend payouts and firms' market value. They could be divided into two main schools of thought: those that argue in favor of dividend irrelevance and those that argue in favor of relevance of dividend payments in determining the firm's stock price.

According to the dividend irrelevance theory firstly developed by Modigliani and Miller (1961), the dividend policy does not affect the firm's market value. This view was a new wave in the finance theory. On the other hand, taking into account various market imperfections (such as, taxes, agency problem, transactions costs etc.), a lot of theories have been developed. They show the relevance of dividend policy for determining the market return. Some of them

suggest that high dividends increase share value ('bird-in-the-hand' theory), others – that low dividends increase share value (the tax preference theory). The informational content of dividends (signaling), the free cash flow hypothesis, the agency cost theory, and the clientele effects also explain the dividend relevance. Although numerous investigations have been conducted over the decades, there is no general consensus among relevance and irrelevance hypotheses of dividend policy.

A great majority of empirical studies that investigated the dividend announcement effect on the stock return for the last decade also indicate that there is no common market reaction to dividend announcements. Thus, Gurgul and Majdosz (2005), Miletic (2011), and Abdullah Al Masum (2014) found out a positive relation between dividend changes and reaction of stock prices, whereas Kadıoğlu, Telçeken and Öcal (2015) defined a significantly negative relationship. Moreover, the study of Zia and Kochan (2015) showed a negative market reaction to dividend announcement decrease. Some researchers such as Bayezid and Chowdhury (2010), Sharma (2011), Pan, Tang, Tan, and Zhu (2014), and Nezum and Jashim Uddin (2014) did not find statistically significant abnormal market return for dividend announcements.

The banking studies of dividend impact on the stock market are limited. In the majority of dividend investigations, the banking sector has been excluded due to its highly leveraged operations and the highly regulated sector. However, the banking industry, due to its opaque nature, is characterized by a more pronounced reaction to different market signals. Especially, informational signals for investors that dividend payouts contain become more important during the financial crisis when the financial information for the banks became limited. Therefore, the sector's features make the investigation of dividend policy for banking industry interesting.

Poland is a relatively new market that faced a lot of changes over the last decade in terms of size, the number of domestic and foreign participants, and the role in the economy. Moreover, equity as an investment opportunity instrument appeared in Poland only in 1990s. Currently, the Warsaw Stock Exchange is a mid-size European stock exchange and belongs to one of the largest exchanges of the Central and Eastern Europe. Moreover, the lack of empirical studies regarding investor's behavior in response to the dividend announcement for Polish banking sector, especially during the crisis period, make this study relevant and valuable.

Research aim. The aim of the work is to investigate the reaction of the stock market to the announcements of cash dividend payments of the companies belonging to the banking sector and listed on the Warsaw Stock Exchange. The study attempts to investigate whether there is a significant reaction of investors to

changes in dividend policy of the companies and, hence, if it affects significantly stock returns of those companies.

After the review of literature and empirical works, it is believed that the effect of dividend announcements on the stock return will be statistically significant. MM theory that suggests dividend irrelevance is based on the set of assumptions of perfect market and rational investors; therefore, it is supposed that the dividend irrelevance theory is hardly supported under the market imperfection. On the other hand, theories that favor dividend relevance take into account various market imperfections (such as taxes, agency problem, transactions costs etc.) that exist in the real world. Therefore, it seems that banking dividend distribution affects the stock prices of Polish market due to the fact that the market imperfections exist, and dividend payments could signal needful information to investors regarding banks' current and future perspectives and risks.

Thus, in order to shed some light on the debate about the effect of dividend signaling on the stock prices, the main hypothesis that will be tested by the current study is defined as follows:

The cash dividend announcements affect the stock prices.

In order to evaluate the impact of the event, abnormal returns measure is applicable. Abnormal return (AR) is defined as a difference of the actual return and the expected return given the absence of the event. The statistically significant cumulative abnormal return (CAR) that is sum of AR will indicate that the effect of dividend announcements on the marker return exists; as a result, the dividend relevance theories will be proved. If CAR is statistically equal to zero, then dividend payment announcements will have no effect on stock prices of the analyzed companies; therefore, the irrelevance theory developed by Miller and Modigliani (1961) will be proved.

Therefore, the main research questions of this paper are determined as follows:

- Is there a significant effect of dividend announcement on stock returns for WSE listed companies?
- What is the impact of cash dividend announcement on the price of stock in the banking sector?
- Is the reaction of investors to dividend payments before and after the financial crisis different?
- On which day the effect of dividend announcement on stock prices is the strongest?

The ten year period from 2006 till 2015 is chosen for research so as to widely analyze the dividend announcement effect on stock returns. The investigation includes recession period that gives the chance to examine whether there are any

differences between the investors' reactions for different phases of economic cycles: expansion and recession. The impact of the global financial crisis on the Warsaw Stock Exchange occurred between November 2007 and January 2009 that was accompanied by 57.95 per cent drop of WIG Index and by 72.24 per cent of WIGBANK Index. Thus, the time line of the study includes 2006–2007 as a period before the crisis; 2008–2009 – during the crisis; 2010–2015 – post-crisis period.

Bloomberg database is used as a source of collection of the announcement dividend data and daily closing prices for companies' stocks, WIG and MSCI Europe Banks Indices. Moreover, the statistical data connected to the analyzed stock exchange is obtained from WSE website. The stock price reaction to 43 dividend announcements for six banks has been examined with the help of event-study methodology.

Research objectives. Based on the research questions, the research objectives are determined as follows:

- To examine the existing dividend theories and their empirical results.
- To analyze the effect of dividend announcements on share prices for the banking sector of WSE.
- To investigate the impact of the global financial crisis on the banking dividend policy and on investors' reaction to dividend payments.
- To compare the obtained results with the previous studies and financial theories.

The significance of the study. The impact of dividend announcements on stock returns is important knowledge for investors. Based on the information of price movements, shareholders could make decisions about further investments. Also, this knowledge provides financial managers with the information on how their dividend policy decisions influence the company's value.

The study will fill up the lack of empirical researches regarding investor's behavior in response to the dividend announcement for the Polish market during the pre-crisis, crisis, and post-crisis periods. The investigation in this work will help to clarify the effect of cash dividend announcements on stock returns, understand the way investors perceive the news about the dividend announcements, and provide financial managers with the information of how their dividend policy decisions influence the company's value.

The paper is organized in the following way: The first section includes the theoretical background of dividends, shows the effect of dividend policy on the firm value through different theories, and investigates the way of taking the decision by the company to pay dividends and information context for investors about future opportunities. In section II, empirical literature review of the stock prices reaction on the dividend announcements is described; the tendencies in

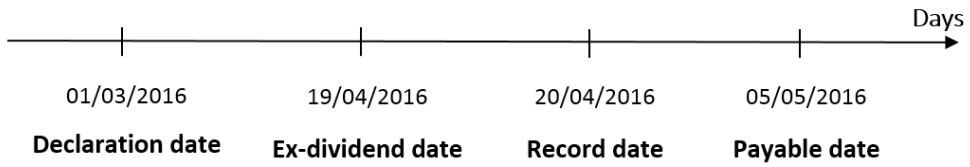
dividend policies are shown with the banking sector and crisis period specifications. SectionIII provides empirical analysis and results of the dividend announcements' effect of 6 companies belonging to banking sector and listed on Warsaw Stock Exchange. In Conclusion, results of theoretical and empirical researches of the work are included.

Dividend Policy and the Mechanism of Paying Dividends

According to the financial theory, the main objective of dividend policy is the maximization of shareholder's return which consists of capital gains and dividend payments. Thus, the dividend policy of the company has a direct effect on these two parts.

Lawrence J. Gitman and Chad J. Zutter (2015, p. 628) define firm's dividend policy as "a plan of action to be followed whenever it makes a dividend decision". Therefore, the dividend policy is a guideline companies use in their decisions regarding the portion of earning that should be distributed in the form of dividend payments and which portion should be retained. The most important issues of dividend policy are payout ratio that could be determined as percentage of dividends in the whole earnings, and retention ratio – 100 per cent minus payout ratio (Brealey & Myers 2003, p. 432).

Figure 1. An example of cash dividend payment of ING Bank Slaski S.A.



Source: Bloomberg, author's own calculations.

The standard mechanism of cash dividend payment begins with the meeting of the Board of Directors of the firm regarding the further dividend payments. This day is known as the *Declaration day*. The Board of Directors takes decision about the dividend amount, the date of record, the ex-dividend (ex-date) date, and the payment date (see Fig.1). The meeting could be organized every year or semiannually, or quarterly, or with a special occasion. Therefore, the declaration date, also known as the announcement date, is the day when the company announces basic information about the next dividend payment.

On the *Record date*, the corporation's books are closed in order to register the names of legal shareholders that will receive dividend payments. Therefore, people from this list will take part in the dividend distribution even if they are not already beneficial owners. The changes in beneficial ownership, for instance, as a result of share selling, will occur after re-registration. Those people that were the shareholders on the date of record are able to receive dividends.

The ex-dividend date (the ex-date) determines the day from which the security begins to be traded without current benefits (dividends). As a rule, the ex-date takes place two (one) business days before the date of record. Therefore, if the equity is sold on or after the ex-dividend day, the seller will receive the dividend payments; meantime the buyer will not retain the benefit. Furthermore, generally, the market will react to this event with share price declines by about the dividend's amount (Loader 2014, p. 49).

The day when the dividends are distributed to shareholders on the record is the *Payable day* that is about two weeks later than the record date (Brealey & Myers 2003, p. 432).

The company's value of stock determines the present value of all dividends in the future that could be received by common stockholders. The dividend distribution in a company follows its payout policy. Corporate payouts show not only the distribution of cash flow to stockholders, but also indicate the useful information regarding company's performance (present and future). Corporate managers develop dividend policies in order to maximize stock price because dividend policies have a great impact on share prices (Gutman & Zutter 2015, p. 636).

A low payout ratio could be accomplished by higher market prices as the earnings growth will be supported. In this case, shareholders' return will be mostly via capital gains. As a rule, dividend yield – the ratio of dividend per share and market price per share – for growth companies will be low. However, it does not mean that a low payout policy will obviously lead to higher prices because investors might find some uncertainty regarding capital gains that will be in distant future. The effect of dividend policy on stock prices is hardly identified as market prices reflect many factors.

On the contrary, a high payout policy could lead to lower market prices per share as it decreases the retained earnings compared to the amount of paid dividends. High payout policy means more current dividends, less retained earnings, and lower capital gains, which could be accepted by investors as lower earnings in the future; hence lower prices per share are observed. Due to the fact that in most countries, tax value on dividends is bigger compared to capital gains, investors prefer capital gains rather than dividend payments. However, investors sometimes go in favor of current payments via dividends rather than future

earnings. Therefore, different investors would prefer different payout policy of company (Pandey 2010, 293–295).

A lot of theories were developed regarding the relationship between dividend policy and firm's value (see Appendix 1). Two main groups of theories could be determined: theories that maintain dividend relevance and those that argue the dividend policy does not influence company's market return (dividend irrelevance). In the meantime, it seems there is no consensus on whether dividend payments matter or not.

Dividend Irrelevance Theory

According to the residual theory of dividends, the company should distribute earnings in the form of paying dividends after all available sufficient opportunities; for example, when its return from investment will not exceed the cost of capital. This means that company's dividends should be treated as a "residual" and not as a way of influence on company value. This approach corresponding to *Dividend irrelevance theory* developed by Merton Miller and Franco Modigliani (MM) (1961).

MM were the pioneers in the investigation of the relation between dividend changes announcements and stock prices which was explained by "the informational content of dividend" (Miller & Modigliani 1961, p. 430). They discovered that stock prices and dividend policy are independent and showed the irrelevance of dividend policy in perfect capital market. Therefore, they demonstrated that dividend decisions do not influence firms' value or costs of capital. MM claimed that firm's earnings and risk of its investments have the impact on the value of the company and not the ratio of earnings distribution between dividends and retained/reinvested earnings (Miller & Modigliani 1961, p. 425). The researchers reported that the value of the firm is not determined by the dividend distribution in the perfect market under such circumstances as certainty, no personal or corporate taxes, no issuance and transaction costs, and fixed investment policy.

However, the real market does not maintain these assumptions. Thus, taxation that is historically higher for dividends compared to capital gains could indicate that a better way for shareholders is retaining profits rather than receiving dividends. Nevertheless, MM argued that not all types of investors pay taxes on dividends and capital gains (for instance, for such institutional investors as pension funds); consequently, the payout policy of certain companies does not affect the amount of taxes should be paid. Therefore, MM argued that the change of dividend policy

leads only to allocation of ownership and not to a change in firm's value: tax-sensitive investors would prefer to invest in companies that pay dividends; meantime, investors that should pay high taxes for dividends would desire to invest in firms that retain more earnings (Gutman & Zutter 2015, p. 626).

Although MM claimed that the investor's required return and, as a result, firm's value and share prices are not affected by dividend policy, they determined that dividends provide information about firm's future earnings and cash flow. MM showed that, via information content, dividends could decrease the level of asymmetric information that appears as a result of unequal information disposed by managers and shareholders regarding future company's performance. Insider knowledge about future firm's cash flow and earnings that is available for managers could be shared with owners through the dividend declaration as a way of communication.

To sum up, dividend irrelevance theory firstly developed by Miller and Modigliani (1961) suggests that, in perfect capital market, the firm's value or the share price will not be affected by the chosen dividend policy.

Dividend Relevance Theories

"Bird-in-the-hand" theory. "Bird-in-the-hand" theory that follows relevance principle of dividend policy was developed by Myron J. Gordon (1962) and John Lintner (1962). This theory indicates a positive relation between firm's dividend policy and market value of share. It is based on risk aversion of investors: they prefer current premium in the form of dividend payments rather than risky future income in the form of future dividend or capital gains. Thus, the name and the context of the theory relate to the phrase: "A bird in the hand is worth two in the bush".

The Walter Model. The Walter model that was developed by professor James E. Walter maintains the idea that dividend policies almost always have an impact on the firm's value. Walter (1963) argued that the relationship between the company's rate of return and its cost of capital is significantly important in developing dividend policy for the firm.

Agency cost theory. One of the theories that supports the concept of dividend impact on firm's share prices is the agency cost theory. Agency costs are the costs that appear due to the divergence of opinions between managers and owners of the company (Frankfurter 2003, p. 100). Thus, managers could want to increase company's assets with the help of retaining earnings so as to have greater compensation. On the other hand, the owners afraid that company's earnings could be distributed to managers' own fund. Therefore, in order to

assure shareholders that managers will not waste owner's money, the company promises to pay dividends regularly, which increases investors' costs.

Free cash flow hypothesis. Free cash flow hypothesis explains the positive relation between dividend announcements and stock prices. Taking into account the agency costs theory and market information asymmetric, Jensen (1986) was first who indicated free cash flow theory. Efficient managers distribute the cash flow to profitable projects in order to improve company's performance and maximize stockholders' wealth. Sometimes, managers of cash-rich companies with unavailable profitable projects for investing could invest free cash flow in projects with negative net present value. Consequently, in order to avoid waste, dividend payments can be used to distribute the cash flow of the company and reduce the agency costs. According to Jensen (1986), such dividend communication by managers with shareholders allows not only to reduce the agency costs but also decrease the probability of investment in wasteful projects with negative net present value.

The tax preference theory. According to the Modigliani and Miller's (1961) assumptions, there is no difference in taxes for dividends and capital gains. However, in the real world, taxes play a significant role in terms of dividend policy and firm's value. Investors always take into account the taxation factor. According to the Tax preference theory (Brennan (1970), Litzenberger and Ramaswamy (1979), John and Williams (1985), Miller and Rock (1985), Ambarish et al. (1987), the tax tension for dividends is higher compared to capital gain. The dividends are taxed directly, whereas capital gains – only after the security sold. Therefore, the theory determines the preference of investors for a low dividend ratio. This theory claims that the low dividend payout ratio supports the cost of capital to be lower; hence, higher stock price (Brigham & Houston 2004: 523–524). However, some empirical results did not support the relevance of the tax preference theory (Omet 2004; Reddy 2006; Anil and Kapoor 2008).

Moreover, the dividend **clientele effect** was developed by Black and Scholes (1974) and Miller and Scholes (1982). This effect differentiates preferences of investors regarding paying dividend or retaining due to such a factor as taxation. Therefore, different rates in taxation of capital gains and dividend yields determine the relation between dividend enclosure and market reaction. Thus, in case of taxation the capital gains at a lower rate, no reaction between dividend and share price could be determined (Miller & Scholes 1982). In such circumstances, shareholders will prefer earnings to be retained by the company. If the company changes its dividend policy and initiates more dividend payments, investors in case of relatively low capital gain taxes will sell their shares so as to avoid paying taxes. However, there will be indifferent investors'

behavior regarding dividend and capital gain policies when the taxes are equal for these types of income.

Informational Content of Dividends

Informational value of dividends gives support to dividends' relevance. So as to form a positive impression on shareholders, a company could proclaim future earnings' growth. However, in order to strengthen the effect on investors, distribution of cash by dividend payments could be done. Therefore, cash payments will ensure shareholders regarding company's profitability and positive expected perspectives. When the dividend policy of a firm changes significantly with the increased dividend payout ratio, investors accept this news as a signal for permanent or long-term growth of expected earnings. As a result, the share prices are affected by changes of dividend announcements payments. Moreover, informational content of dividend changes could also influence investors' perception about the risk of the firm to provide a stable dividend policy.

Literature Review of the Stock Prices Reaction to the Dividend Announcements

This Chapter contains the review of previous empirical investigations regarding the dividend announcement effect on company's market return. It covers the studies of banking sector, Polish market dividend payouts, and the tendencies of dividend payout policies during the financial crisis. Although a large number of studies have been conducted, the empirical results could not unanimously solve the debates regarding the impact of dividend policy on the company's value.

A great number of empirical studies on dividend effects have been conducted over the last decades. The early studies are controversial regarding divided influence on stock prices. Thus, Fama (1969), Griffen (1976), Laub (1976), Pettit (1972), Amihud and Murgia (1997) demonstrated a positive relation between returns and dividend changes. Whereas Ang (1975), Watts (1973), and Gonedes (1978) could not support this hypothesis in their investigations determining little or no effect of dividend disclosure. The former indicated the information content of dividends; announcement of dividend's increase signals about future cash flows of company and has great cumulative abnormal return. In other words, the investors interpret increase/decrease of dividend payments as a signal from the company regarding future earnings that the expected to change in the same

direction. Consequently, the increase in dividend could be treated as a positive signal, investors begin to bid up the share prices; in the meantime, decrease in dividend payments leads to selling investor's shares and, as a result, decrease in stock prices.

D. S. Docking and P. D. Koch (2005) studied the sensitivity of investors' reaction to the recent direction of the underlying market movement. They found out that the impact of dividend announcement change on stock prices is greater when the news of the announcement goes against the previous tendency of market return. Thus, according to their investigation, the declaration of lower dividend payments will lead to stronger decrease in the market prices when previously the company's market prices showed an upward tendency during the six weeks before the announcement. And, in case of dividend decrease, the news would have a greater effect on market return if it has recently been normal or down. Moreover, market volatility was also included into the investigation. The researchers concluded that high market volatility provokes the higher degree of uncertainty that may transfer to higher firm's uncertainty regarding specific news.

The studies of Sharma (2011) and Pan, Tang, Tan, and Zhu (2014) analyzing Indian and Chinese markets, respectively, over the approximately the same period of time did not determine a significant market reaction to cash dividend announcements. Meantime, Miletic's (2011) results were in favor of dividend relevance. Some of them found a negative relationship between cash dividend announcement and the market reaction (Kadıoğlu, Telçeken and Öcal 2015; Viera 2011), others (Vazakidis & Athianos 2010) – a positive reaction over the pre-announcement period.

Current research is different from those discussed above as it aims to analyze the banking sector that is excluded by most scholars. Moreover, the study is based on the analysis of the Polish stock market that is relatively new, and there is lack of dividend announcement studies for this market.

The empirical investigations about dividends of banking sector are limited. A great number of studies that investigate the dividend policy exclude the banking industry from the study due to the strong banking regulations that restrict the bank's financial leverage and influence on income distribution process.

Banks are characterized by paying a larger dividend compared to commercial companies. Therefore, the relation between the dividend policy and bank risk is very important to investigate. Thus, E. Onali (2009) provided research about the relation between banking dividends and two kinds of risk – default and credit risk. The investigation included a sample of 335 banks for the period of 2000–2007. He found a positive relation between dividends and default risk and a negative relation between the former and retained earnings which

is controversial to the literature findings regarding nonfinancial firms. Moreover, the investigation of the banking sector showed that dividend payments are coherent with "inside/outsider agency issues, profitability, and size" that is similar to nonfinancial companies.

Those studies that investigated the dividend announcements effect on the market value for the banking sector showed contradictious results even for the same market. Thus, testing Bangladesh market reaction to banking dividend announcements, Bayezid and Chowdhury (2010) and Nezum and Jashim Uddin (2014) identified no significant effect on the stock price, whereas Abdullah Al Masum (2014) suggested a significantly positive effect of dividend policy on the market return.

Current research will examine the effect of informational contest of dividend announcements on the Polish stock return applying event study methodology. The event study is not a new approach but only some of the above-mentioned studies have been conducted using this method. Moreover, contrary to the previous studies, the current investigation will show the results separately for different phases of economic development which will help to examine the effect of dividend payout policy on stock return for company's expansion and recession periods.

The increasing consolidation, changes in production technics, and regulations are important issues for the banking sector of Poland as well as for all European countries. The period of 1997–2009 for the Polish banking sector was characterized by rapid changes: changes in ownership structure and consolidation processes occurred.

Empirical Analysis of the Dividend Announcements' Effect on the Stock Return

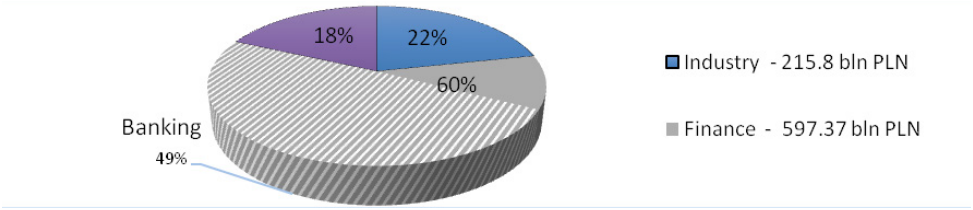
This section includes a short description and analysis of Warsaw Stock Exchange and 6 banks selected for investigation. Moreover, the methodology for empirical analysis is provided. In the end, the results of the dividend announcements' effect of 6 companies belonging to the banking sector and listed on Warsaw Stock Exchange are described.

Data Description

The Warsaw Stock Exchange (in Polish: Giełda Papierów Wartościowych w Warszawie) was founded in April 12, 1991. There are 487 companies listed on the Warsaw Stock exchange, 434 of which are domestic companies. The total market capitalization of the exchange is 994,727.98 million PLN (domestic market capitalization. 527,820.19 million PLN) in 2016 (WSE website).

The companies listed on the WSE are classified into different sectors of the economy depending on their business activities and revenue structure by the members of Index Committee of WSE. The sectors are grouped into three macrosectors, which are: Industry, Finance, and Services. The most valuable macrosector is Finance with 597.37 billion PLN market capitalization in 2016, which is about 60 per cent of the whole WSE. The market capitalization of the banking sector that is included into the Finance macrosector is equal to about 49 per cent of the total WSE market capitalization (WSE website). It makes the banking sector most valuable among the WSE's sectors (Fig. 2).

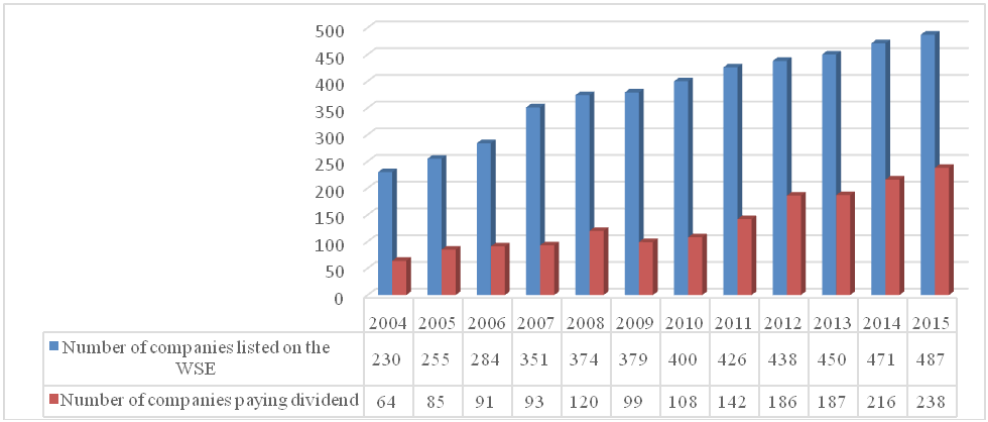
Figure 2. Market capitalization of WSE by sector, 2016.



Notes: The grey lines indicate the part of the Financial macrosector that corresponds to banking sector. *Source*: WSE website (2016).

The dividend payments on the WSE were done for the first time in 1992 by six out of nine listed companies. Over the years, the number of listed companies significantly increased which was accompanied by gradual increase in companies that distribute dividends to their shareholders. Companies are not required to issue dividends and could choose retained earnings instead of dividend initiations. The number of dividend paying companies could be seen in Figure 3.

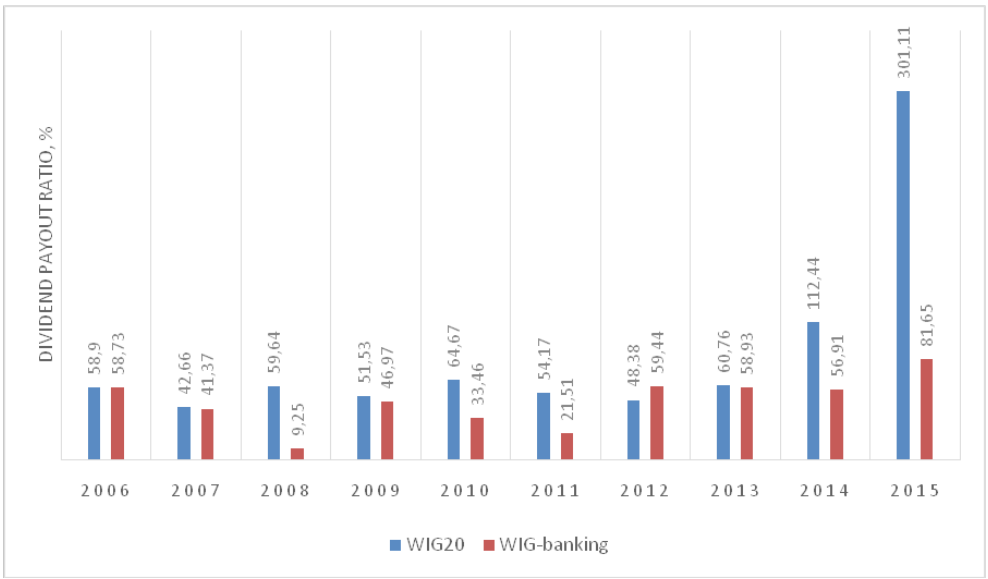
Figure 3. Number of companies paying dividends compared to the total number of companies listed on the WSE for the period 2004–2015.



	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Number of companies listed on the WSE	230	255	284	351	374	379	400	426	438	450	471	487
Number of companies paying dividend	64	85	91	93	120	99	108	142	186	187	216	238

Source: Interia Biznes and WSE websites (2016).

Figure 4. Dividend payout ratio for WIG20 and WIGBANK Indices for 2006–2015 period.



Source: Bloomberg (2016).

In 2008, when the crisis in the financial market occurred, the share of dividend paying companies reached 32.1 per cent, which was higher compared to previous years. The number of companies that distribute dividends declined significantly over 2009 and 2010 which was equal to 26.1% and 27%, respectively. However, from 2011, the number of dividend-yielding stocks started to increase.

Over the 2011–2012, it rose enormously; thus, in 2011 it reached 142, in 2012 – 186 (which accounted for about 42 per cent). The increase tendency of dividend paying companies remained over the last years: the share of dividend paying companies in 2014 and in 2015 was equal to 46 and 49 per cent, respectively.

The dividend payout ratio for 20 largest companies and all banks listed on the WSE could be seen in Figure 3.3. The ratio is calculated as the percentage of total cash common dividends from normalized earnings[1] (Bloomberg). The dividend payout for the banking sector of WSE significantly declined in 2008 to 9.25 per cent; in the meantime, for the 20 largest companies, the ratio was almost 60 per cent this year. However, in 2009, the dividend payout ratio for both indices was equal to more than 46 per cent. Over the last years, the tendency of increased dividend payouts is observed.

Among 487 companies listed on the WSE, 15 companies belong to the banking sector. For the research purposes, only the companies that are listed for the whole analyzed period, namely 2006–2015, were selected so as to widely examine the changes in the dividend policy of the companies through the determined period of time. Thus, after excluding the banks with the first list date after 2005, 10 companies in the banking sector remained, among which 6 companies paid comparatively regular dividends for the last five years. Therefore, for further investigation of the impact of dividend announcements on stock return, six banks listed on WSE have been taken (Table 1). The selected banks are highly market capitalized and account for 86.6 per cent of the total WIG-banking portfolio.

Table 1. List of the companies selected for the current investigation.

Full name	Ticker	Date of first listing	Market value (mln PLN)
BANK POLSKA KASA OPIEKI SA	PEO PW Equity	Jun 1998	39777.3
POWSZECHNA KASA OSZCZĘDNOŚCI BANK POLSKI SA	PKO PW Equity	Nov 2004	31625.0
BANK ZACHODNI WBK SA	BZW PW Equity	Jun 2001	28078.4
ING BANK ŚLĄSKI SA	ING PW Equity	Jun 1994	15403.8
BANK HANDLOWY W WARSZAWIE SA	BHW PW Equity	Jun 1997	10523.3
BANK MILLENNIUM SA	MIL PW Equity	Aug 1992	7278.7

Sourse: WSE website and Bloomberg (2016).

[1] Normalized earnings – earnings that are adjusted for cyclical variations in the economy (Scott 2003).

The short characteristics of the banks taken for investigation are provided below.

BANK HANDLOWY W WARSZAWIE SPÓŁKA AKCYJNA (BHW) is a Polish bank that is based in Warsaw and was established in 1870. It is the eighth largest bank in Poland with 2.4 billion market value. In 2001, the bank was merged by Citigroup and, currently, operates by the brand name Citi. Since June 1997, BHW has been listed on the WSE and included to the WIG20 Index (BHW website).

BANK ZACHODNI WBK SPÓŁKA AKCYJNA is the third largest Polish bank that is based in Warsaw, Wroclaw, and Poznan. It was founded in 2001 by the merger of Bank Zachodni S.A. and Wielkopolski Bank Kredytowy SA and has been listed on the WSE since June 2001. Since 2011, the Bank has been owned by the Santander Group (Spanish bank). In 2013, it merged with Kredyt Bank (WBK website).

ING BANK ŚLĄSKI SPÓŁKA AKCYJNA (ING BSK) is a Polish commercial bank based in Katowice. It was founded in 1988 as a result of dividing from the National Bank of Poland.ING BSK has been listed on the WSE since January 1994. Since 2011, it has operated with the current name as a result of merger with ING Bank N.V. Branch. Currently, it is the fifth largest bank listed on the WSE with 3.9 billion PLN market capitalization (ING Bank Slaski SA web-site and WSE website).

BANK MILLENNIUM SPÓŁKA AKCYJNA is a Polish commercial bank that was founded as Bank Inicjatyw Gospodarczych S.A. in 1989. It was the first financial institution that started to be listed on the WSE in 1992. The bank merged with Lodzki Bank Rozwoju S.A in 1992, with Bank Gdanski S.A. in 1997 and has been cooperated with the Portuguese bank Millennium BCP since 1998. Since 2003, it has been named as Bank Millennium (Bank Millenium website).

BANK POLSKA KASA OPIEKI SPÓŁKA AKCYJNA is a Polish bank founded in 1929 as a national bank with headquarters in Warsaw. Currently, 59 per cent of the company belongs to Italian bank UniCredit. From 1998, the bank has been listed on the WSE. It has around 1000 offices in Poland (PEO website).

POWSZECHNA KASA OSZCZĘDNOŚCI BANK POLSKI SPÓŁKA AKCYJNA is the largest Polish bank with 20.6 billion market capitalization (about 31 per cent of the whole Polish banking sector). The bank was founded in 1919 and has been listed on the WSE since 2004. In 2000, the Bank became wholly-owned subsidiary of the State Treasury (PKO website).

The data for the empirical research have been obtained from the Bloomberg database. Thus, the historical daily closing stock prices for selected 6 banks, for indexes WIG, WIG20, WIG-banking, and MSCI Europe Banksfor the time period from January 2005 till the end of December 2015 have been collected.The data

for such a corporate action as dividend announcement events have been taken from Bloomberg for the period January 2006 – December 2015 so as to analyze the dividend announcement events over 10-year period starting from 2006. The announcement dates were obtained only for cash dividend payments as, usually, in the studies, they are examined separately from the stock dividend distribution due to a different effect on stock returns. Thus, the dates of cash dividend announcements were checked with stock splits and stock dividend events in order to exclude concurs. Over the analyzed period, only ING Bank had stock split (1:10); however, in November 2011, the company did not provide the dividend announcement. The stock return for those split has been adjusted via dividing the first price after the split by 10. Therefore, the split would not distort the results of the investigation. The announcements of omitted and canceled dividend payments also were not included into the investigation. Therefore, for 6 selected banks listed on WSE, 43 cash dividend announcements from the 2006 till the end of 2015 were found (Table 2).

All defined dividend announcements were classified in three categories depending on the change direction. Based on the Nur-Adiana, Rosemaliza, and Yusnidah's (2002) method of classification, the dividend reduction by 10 percent and more was defined as a negative dividend change; dividend increase by 10 percent and more was separated to the positive dividend changes category; the other dividend changes that were not included into the mentioned categories belonged to neutral dividend changes. After the categorization, 27 positive, 13 negative, and 3 neutral dividend changes have been defined.

The tendency of omitted dividends occurred during the crises period: in 2008, half of analyzed companies initiated dividend payments; whereas, in 2009, only PKO (Powszechna Kasa Oszczędności Bank Polski Spółka Akcyjna) paid dividends among the 6 banks.

The impact of the global financial crisis (the burst of the "credit bubble") on the Warsaw Stock Exchange occurred between November 2007 and January 2009 that was accompanied by 57.95 per cent drop of WIG Index. The market return diminished by 72.24 per cent over the same period for WIGBANK Index (Fig. 5). The highest price drop was in October 2008 (-31.13% of WIGBANK Index) and over the first two months of 2009 (about -26% of WIGBANK Index).

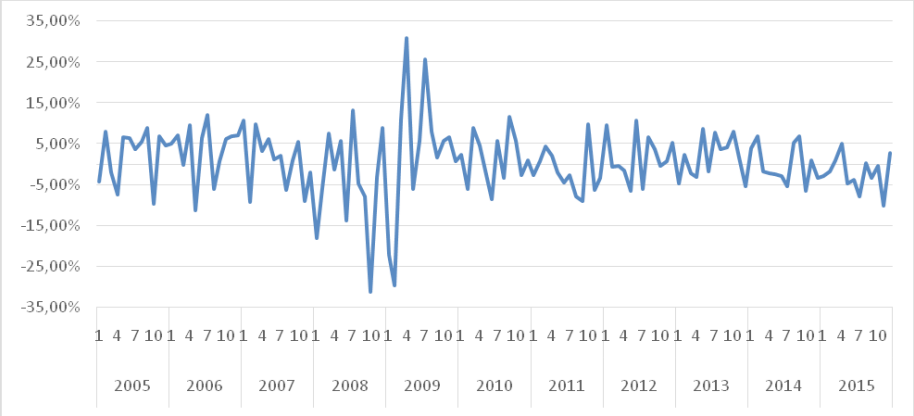
The price movements of the 6 analyzed banks are shown in Figure 6. The stocks of MIL PW Equity, PKO PW Equity, and ING PW Equity are highly volatile. Thus, the stock price for these companies declined drastically over the financial crisis period compared to other three analyzed companies. The strong drop of market prices for ING Bank in the last quarter of 2011 was associated with the stock split (1:10).

Table 2. The dividend announcement events for selected 6 companies over 2006–2015.

Stock	BHW	BZW	ING	MIL	PEO	PKO	
Frequency of dividend payments	**A**	**A**	**A**	**A**	**A**	**A**	**Total number of events by year**
2006	*28.03.2006*	*22.02.2006*	*31.03.2006*	*19.01.2006*	*23.03.2006*	**18.04.2006**	6
2007	*14.03.2007*	22.02.2007	*23.04.2007*	**26.03.2007**	*16.03.2007*	*23.03.2007*	6
2008	-	-	**10.04.2008**	*10.03.2008*	-	*09.04.2008*	3
2009	-	-	-	-	-	**08.06.2009**	1
2010	**13.04.2010**	*02.03.2010*	-	-	**15.03.2010**	*13.04.2010*	4
2011	*08.03.2011*	*02.03.2011*	*16.02.2011*	**31.03.2011**	*09.03.2011*	*05.05.2011*	6
2012	**13.03.2012**	01.03.2012	-	-	**26.04.2012**	**09.05.2012**	4
2013	*12.03.2013*	**08.03.2013**	-	-	*15.03.2013*	*18.04.2013*	4
2014	*06.03.2014*	*04.03.2014*	*04.03.2014*	*04.02.2014*	*11.03.2014*	**29.04.2014**	6
2015	*10.03.2015*	-	**24.02.2015**	-	11.02.2015	-	3
Number of events per company	8	7	6	5	8	9	43

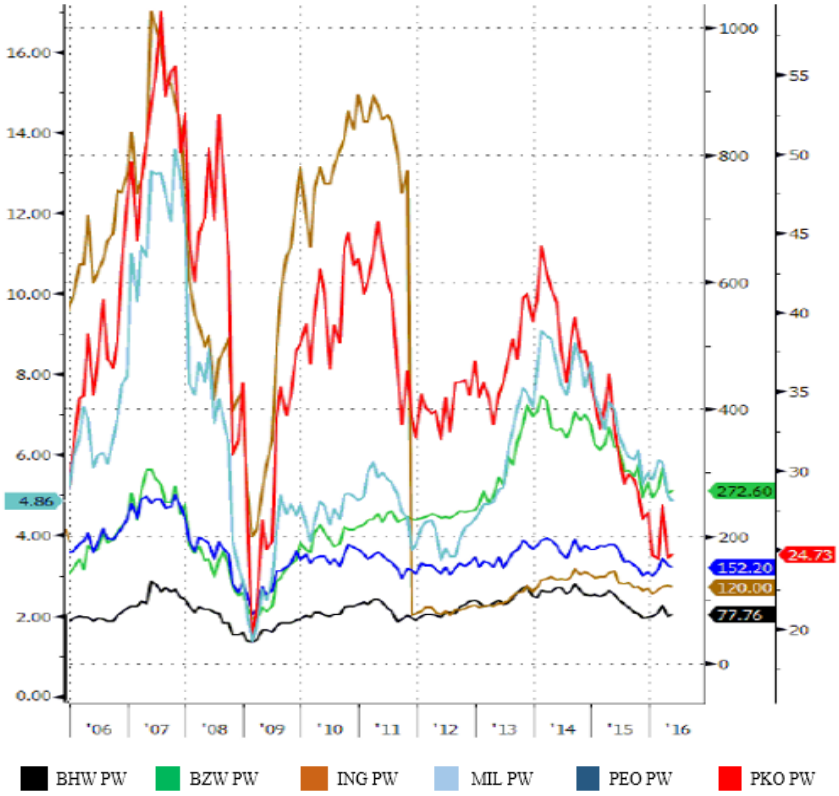
Notes: All dividend events were divided into three groups depending on the dividend change: italic color stands for positive dividend changes (>10% increase); bold – for negative (>10% decrease); and the regular font – for neutral dividand change. The frequency of dividend payment A means annually dividend distribution.
Source: Bloomberg (2016).

Figure 5. WIGBANK Index market return over 01.2005–12.2015 period.



Source: Google Finance (2016).

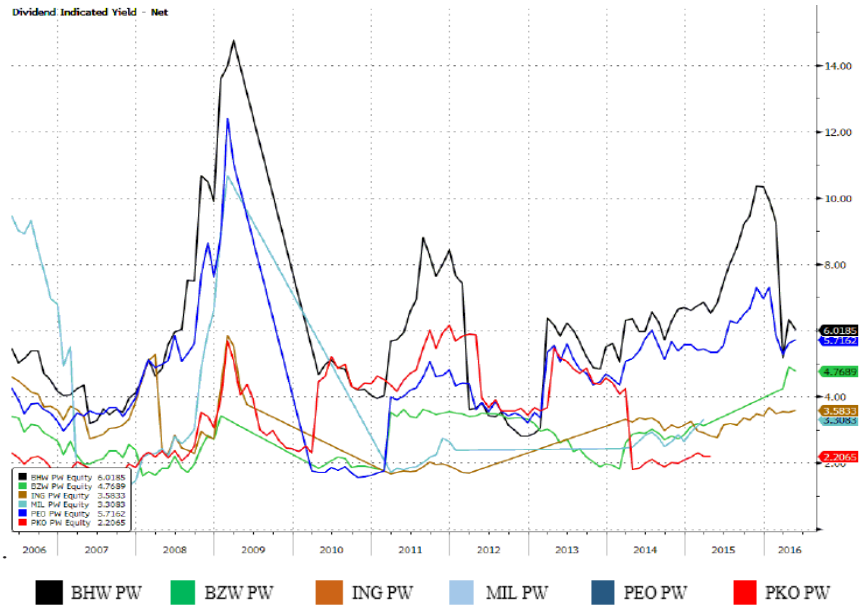
Figure 6. Historical last prices for six banks listed on WSE for the period of 2006–2016.



Source: Bloomberg (2016).

The average dividend yield for the banking sector of WSE for the last 7 years equals to 2.8. Figure 7 demonstrates the significant increase of dividend indicated yield[2] of analyzed banks over 2008–2009 years which occurred mainly due to the drastically drop in stock prices. The dividend yield increase over 2011 was also supported by price decline. However, from 2012, the increase of the indicator was accomplished by increase in dividend payments. The above determined dependences could be observed through the tendencies of stock prices (see Figure 6) and dividend payout ratio (see Figure 4) which determine the dividend yield.

Figure 7. Dividend Indicated Yield for 6 banks listed on the WSE, 2006–2016 period



Source: Bloomberg (2016).

In order to estimate market return for the current empirical research, WIG Index has been chosen. WIG Index is a price index that has been calculated since April 16th, 1991. The calculation of this Index is based on the value of portfolio that includes shares of all companies listed on the WSE.

[2] Dividend indicated yield could be found by dividing the most recent dividend multiplied by the number of dividend payments per year by the current stock price (measured as percentage) (Bloomberg).

The industry return has been measured with the help of MSCI Europe Banks Index. This a free-float weighted equity index was developed with a base value of 100 in December 31st, 1998. MSCI Europe Banks Index includes large and mid capitalized banks across 15 Developed Markets countries in Europe (Bloomberg).

Additionally, in the work, such indices as WIG20 and WIG-banking are mentioned. However, these indices were not included into the regression as they contain the same data and the model could regress share prices in the indices that already consist of them. Three analyzed banks account for more than 30 per cent of the WIG20 index. And, these two indices are based almost on the same stock prices. Therefore, in order to avoid such problems of econometric estimation, WIG Index and of MSCI Europe Banks Index have been used.

WIG20 Index is a price index that has been calculated since April 16th, 1994. The calculation of this index is based on the value of portfolio that includes shares of 20 major and the most liquid companies in the WSE. Moreover, the number of companies from the same exchange sector could not exceed 5 companies. Thus, PKO, PEO, and BZW stocks are included to WIG20 Index with the share in the portfolio of 13.4%, 12.2%, and 5%, respectively.

WIG-banking is a sectorial sub-index that has been calculated by the WSE since December 31st, 1998. It allows to estimate the efficiency of investments into the banking sector. The index is based on the same as WIG Index methodology and also includes the income from dividend and subscription rights. Currently, WIGBANK Index includes 15 banks. The analyzed 6 banks amount to 86.6 per cent from the total WIG-banking portfolio.

The WIG Indices are calculated as below:

$$\text{Index} = \frac{\text{Current capitalization}}{\text{Underlying capitalization} * \text{Adjustment factor}} * \text{Index underlying value}$$

Where Index underlying value is 1 279.56 points for WIG-banking and 1 000.00 points for WIG and WIG20 Indices (WSE website).

The research methodology

The applied event study methodology is widely used and is not unique. It was described in the paper of Campbell, Lo and MacKinlay (1997). An efficient market reacts to all types of news and announcements and incorporates this information into stock prices. Dividend announcements as a type of events directly

affecting equity market prices could be measured by unexplained residual-abnormal return – of the model below:

$$r_t = \alpha + \beta r_t^M + \gamma r_t^I + e_t \quad (1)$$

where r_t – daily stock return,
r_t^M – market portfolio return,
r_t^I – industry-specific return,
e_t – abnormal return.

All returns have been calculated with the help of the bellow formula:

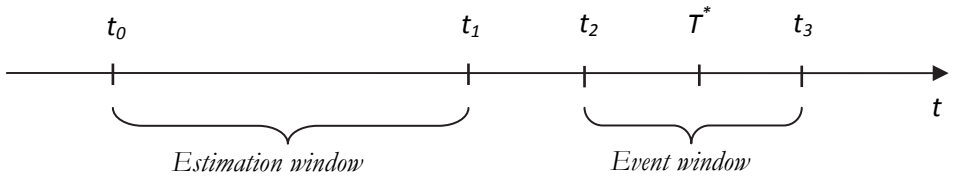
$$r_t = \frac{\left(P_t - P_{t-1}\right)}{P_{t-1}} \quad (2)$$

where P_t stands for the particular daily close price.

Market return, r_t^M, is the return on WIG Index that represents "market". It is value-weighted return on the all shares traded on the Warsaw Stock Exchange. Industry-specific return, r_t^I, is return on another market index – MSCI Europe Banks Index. General market trends are well-captured by the representative Indices.

The impact of the dividend announcements on the stock prices are estimated by measuring cumulative abnormal returns (CAR) during the event windows. An event window $[t_2;t_3]$ is defined as an interval of time around the specific event (T^*) during which the market reacts to the news and appropriately adsorbs obtained information by adjusting prices. In terms of the present research, the dividend announcement stands for the event that is expected to influence the share prices. The estimation window $[t_0;t_1]$, on the contrary, is a period of time before the event during which the market model is estimated (see Figure 8).

Figure 8. Event Study Periodization.



Estimation window used for our computational analysis is fixed at [-180; -12] days before the actual event. It results in 168 business days' length $[t_0;t_1]$ which is relevant to the annual frequency of the dividend announcements in our data sample. The estimation window covers eight months for estimation of the normal

returns and do not concur with the event window, which makes the selected interval appropriate.

For testing purposes, nine event windows for each event are constructed. All possible combinations of [-2; +2] business days are as follows: [-2; 0], [-2; +1], [-2; +2], [-1; 0], [-1; +1], [-1; +2], [0; 0], [0; +1], [0; +2]. Day 0 is the actual event date. Before the dividend announcements, market participants form certain expectations regarding the future event. After the actual announcement took place, the stock prices move appropriately adsorbing the coming data. Suggested length of the event windows is more or less standard for such event studies. It is believed to be long enough to estimate the impact without bringing additional "noise" and distorting significance of the results. The database is discrete and does not include weekends and holidays when the stock exchange is closed.

The event study methodology includes a sequence of steps described below.

Firstly, the parameters (α, β) of the equation (1) are estimated during the estimation windows for each event of each company during the examined 10-year period.

Secondly, e_t – error term – is calculated for each event for all combinations of event windows:

$$e_t = r_t - \alpha - \beta r_t^M - \gamma r_t^I \tag{3}$$

Thirdly, cumulative abnormal returns (CAR) are obtained as a sum of error term element of the equation for all time shifts:

$$CAR_t = \sum_{j=t_0}^{t} e_j \tag{4}$$

The final step is to determine whether CAR is statistically significant or not. In case of its significance, this means that the effect of dividend announcements on the marker return exists. On the other hand, if CAR is not statistically significant, dividend announcements do not influence any abnormal returns and it is impossible to get extra return by applying event arbitrage investment strategy. In this case, firm dividend policy is irrelevant and does not bring any relevant information to the stock market.

CAR could also be positive or negative. Statistically significant and positive CAR could be explained as dividend announcements having a positive impact on abnormal returns. A negative sign of CAR means that suggested event respectively has a negative impact on the estimated abnormal return.

To examine the response of the event on the return and determine whether the abnormal return is statistically significant, the t-test was employed. It is the leading test statistics used in the event studies (Ahern 2009). The t-statistic is

estimated by dividing the average event-period abnormal return by its estimated standard deviation:

$$T\text{-}test = \frac{\frac{\sum AR}{N}}{\frac{AR\_SD}{sqrt(N)}} \tag{5}$$

where *AR* is the abnormal returns (i.e. CAR), *AR_SD* – the abnormal return standard deviation, and *N* – a number of days in the event window (Princeton University Library 2008).

If the absolute value of test is lower than 1.64, then the average abnormal return for the stock is not statistically significant. The ranges below determine the significant difference from zero at the 10, 5, and 1 per cent levels:

$1.96 < \text{t-test} \leq 1.64$- significant at 10 per cent level;

$1.96 < \text{t-test} \leq 2.32$- significant at 5 per cent level;

$2.32 \leq$ t-test- significant at 1 per cent level.

Thus, the research hypothesis is tested over the constructed data sample by applying described above methodology. It enables to make further generalization regarding the dividend relevance under specific circumstances for the banking sector of the Polish stock market.

Empirical Results

The analyzed data sample consists of the daily data for six companies representing the banking sector that are listed on the Warsaw Stock Exchange.Each company investigated in the current research pays out dividends annually with the exceptions for years when all earnings were retained. A banking dividend announcement served as a central event in the event study. The purpose of the present research was to check whether a dividend announcement as type of event influences the stock prices. The event study methodology was applied for the investigation and is described in the respective section of this paper. Cumulative abnormal returns (CAR) and their significance are tested for 9 possible event windows.

The main finding of the performed analysis is the significant impact of the dividend announcements on the cumulative abnormal returns just after the actual announcement occurs. Thus, the statistically significant effect on the market return mostly occurs in two event windows, mainly: [-1;0] and [0; +1].

The summary of the results for mentioned event windows for all companies analyzed is presented in tables 3.3. and 3.4. In the efficient highly liquid

Table 3. The summary of the results for [-1;0] event window for the whole data sample.

Stock		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BHW_PW	**CAR**	-0.0049***	-0.041			-0.0237	0.0146	-0.0143	0.0184	0.0148	0.0326***
	t-stat	(-6.8491)	(-1.2388)			(-0.7591)	(0.6402)	(-1.4318)	(0.8693)	(1.4128)	(3.9731)
BZW_PW	**CAR**	-0.048	-0.0608*			-0.0241	0.0049	-0.0014*	-0.0214***	-0.0287	
	t-stat	(-1.5726)	(-1.7552)			(-1.4727)	(0.6181)	(-1.7296)	(-4.3603)	(-1.2545)	
ING_PW	**CAR**	-0.005	0.0097***	-0.0087			-0.0062***			-0.0047	-0.008
	t-stat	(-0.8823)	(2.7436)	(-0.9107)			(-4.3572)			(-0.4606)	(-0.6361)
MIL_PW	**CAR**	-0.0123	-0.0181***	0.0316			0.0068			0.0605	
	t-stat	(-0.5257)	(-13.1963)	(0.6097)			(0.703)			(0.7691)	
PEO_PW	**CAR**	-0.0083	0.0167			-0.0078	0.0161	0.018	0.0255	0.0189***	-0.024
	t-stat	(-0.5259)	(1.1615)			(-1)	(0.5219)	(0.4215)	(1.038)	(6.2277)	(-1.4142)
PKO_PW	**CAR**	-0.0077	-0.0247***	0.0043	-0.0265	0.0001	0.0133***	0.0243	0.0165	0.0031	
	t-stat	(-0.2966)	(-2.4324)	(0.2346)	(-0.8645)	(0.079)	(12.3681)	(0.8903)	(0.5855)	(0.2644)	

Notes: T-statistics is in the parenthesis. The stars marked next to CAR indicate statistical significance: *** – at 1% level; ** – at 5% level; * – at 10% level.

Table 4. The summary of the results for [0;+1] event window for the whole data sample.

Stock		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BHW_PW	**CAR**	-0.0057***	-0.0353			0.0075***	-0.0082	-0.0022	-0.0028	0.0126	0.0366***
	t-stat	(-22.6098)	(-0.8887)			(16.1523)	(-0.4217)	(-0.098)	(-0.4626)	(1.2795)	(2.9957)
BZW_PW	**CAR**	-0.0393	-0.0708***			-0.0039	-0.0107**	-0.0011	-0.0165***	-0.0029	
	t-stat	(-1.082)	(-2.8602)			(-0.5877)	(-2.2823)	(-0.1997)	(-4.0458)	(-0.1196)	
ING_PW	**CAR**	-0.0053	0.0066	0.0283			-0.0296**			-0.0074	0.0046
	t-stat	(-0.189)	(0.8407)	(1.064)			(-2.0537)			(-0.8539)	(0.6709)
MIL_PW	**CAR**	0.0422**	-0.0259**	0.0672***			-0.0029			-0.0182	
	t-stat	(2.1053)	(-1.9757)	(4.1325)			(-0.2226)			(-0.2964)	
PEO_PW	**CAR**	0.0074	0.0205*			-0.0084	-0.0148	0.0436***	0.025	0.0079	-0.0205
	t-stat	(0.5347)	(1.9391)			(-1)	(-0.679)	(2.5378)	(0.6696)	(0.6285)	(-0.7569)
PKO_PW	**CAR**	0.0321**	-0.0239**	0.0114	-0.0811***	0.0008	0.0123	0.0258	-0.0117	0.0075	
	t-stat	(2.3188)	(-2.1813)	(0.503)	(-3.3887)	(0.0591)	(0.9404)	(0.6647)	(-0.4588)	(0.7473)	

Notes: T-statistics is in the parenthesis. The stars marked next to CAR indicate statistical significance: *** – at 1% level; ** – at 5% level; * – at 10% level.

financial market, all the incoming public information is immediately adsorbed and incorporated in the stock prices. Market participants form their expectations in advance, and after the actual announcement takes place, they adjust their beliefs. Due to the fact that the current research covers daily price data (not the intraday data), it seems to be most appropriate to focus on the short period of time just before and shortly after the event. The estimation results for other event windows are provided in Appendices 3-8.

The summary of the results presented in table 3 and table 4 confirms the main hypothesis that the dividend announcements have a significant impact on the cumulative abnormal returns of the sample companies from the banking sector listed on the WSE.

Table 5. Statistical significance of CAR over tested event windows for each company analyzed during 2006–2015 period.

Stock	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	% of significant CAR for each company
BHW_PW	+	-			+	-	-	+	+	+	63%
BZW_PW	-	+			+	+	+	+	+		86%
ING_PW	+	+	+			+			-	-	50%
MIL_PW	+	+	+				-			-	60%
PEO_PW	-	+			+	-	+	-	+	-	50%
PKO_PW	+	+	-	+	+	+	-	-	-		56%
% of significant CAR for each year	67%	83%	67%	100%	100%	60%	40%	50%	60%	25%	

Notes: In case of the statistically significant CAR on dividend announcements, the event is marked as "+"; otherwise "-". If the cash dividend announce was omitted, the sell is blank.

On average, 65 per cent of the dividend announcements have been followed by statistically significant CAR. Table 5 demonstrates which events had a statistically significant impact (marked by "+") and which did not have (defined as "-") in different event windows over the 10-year period. Moreover, it could be seen that during the financial crisis the percentage of significant dividend announcements in the whole number of events increased. Thus, almost all dividend

announcements influenced stock market return significantly over 2008–2010 period. This means that the informational content of dividend announcement for investors was pronounced during the crisis. Additionally, over the last four years, only about half of dividend announcements are supported by significant investor's reaction.

Nevertheless, the direction of the relationship between the dividend announcements and the cumulative abnormal return is not obvious as some of dividend events show a direct relationship with the stock returns, some of them – inversed. The direction of dividend change and market reaction on it are visualized in table 6.

The positive and negative dividend changes are accompanied by the respective sign of CAR in case of 56 per cent of dividend announcements. Thus, almost 60 per cent of increased (decreased) dividend announcements lead to increase (decrease) in stock prices, whereas all neutral dividend announcements showed a negative market reaction. Therefore, it seems that increased dividend payments signals positive future perspectives of the company to investors and lead to stock returns' improvement. However, about 37 per cent of analyzed dividend events show the inverse relationship between dividend direction and market returns.

The tendency of omitting dividend announcements occurred in 2008 when the WSE faced the financial crisis[3]. Thus, half of the analyzed companies canceled dividend announcements. However, for those three companies that initiated the dividend payments in 2008, the results of CAR were mixed. The ING stock faced negative market return of dividend announcement at [-2;0] window with significance at 10 per cent level. The second bank initiated dividend payments in 2008 (MIL) obtained a positive investor's reaction at the [0;+1] and [0;+2] event windows with statistical significance at 1 per cent level. Meantime, there was not significant impact on the return of PKO stock for this year.

In 2009, only one of six banks initiated the dividend announcement that was accomplished by the negative CAR on the first day after announcement with the statistically significance at 1 percent level. Already in the next year, the companies recovered the dividend announcements. Thus, in 2010, four of six companies and, in 2011, all companies decelerated dividend payments. Over these two years (2010–2011), almost all dividend declaration events were associated with the statistically significant abnormal return across the different tested

[3] The impact of the global financial crisis on the Warsaw Stock Exchange occurred between November 2007 and January 2009 by 57.95% drop of WIG Index and by 72.24 % for WIGBANK Index (author's calculations).

Table 6. The summary of the results for [-1;0] and [0;+1] event windows for the whole data sample with mentioned dividend change direction.

		[-1;0]									
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
BHW_PW	*CAR*	**-0.0049*** **	-0.041			-0.0237	0.0146	-0.0143	0.0184	0.0148	**0.0326*** **
	t-stat	(-6.8491)	(-1.2388)			(-0.7591)	(0.6402)	(-1.4318)	(0.8693)	(1.4128)	(3.9731)
BZW_PW	*CAR*	-0.048	**-0.0608***			-0.0241	0.0049	**-0.0014***	**-0.0214*** **	-0.0287	
	t-stat	(-1.5726)	(-1.7552)			(-1.4727)	(0.6181)	(-1.7296)	(-4.3603)	(-1.2545)	
ING_PW	*CAR*	-0.005	**0.0097*** **	-0.0087			**-0.0062*** **			-0.0047	-0.008
	t-stat	(-0.8823)	(2.7436)	(-0.9107)			(-4.3572)			(-0.4606)	(-0.6361)
MIL_PW	*CAR*	-0.0123	**-0.0181*** **	0.0316			0.0068			0.0605	
	t-stat	(-0.5257)	(-13.1963)	(0.6097)			(0.703)			(0.7691)	
PEO_PW	*CAR*	-0.0083	0.0167			-0.0078	0.0161	0.018	0.0255	**0.0189*** **	-0.024
	t-stat	(-0.5259)	(1.1615)			(-1)	(0.5219)	(0.4215)	(1.038)	(6.2277)	(-1.4142)
PKO_PW	*CAR*	-0.0077	**-0.0247*** **	0.0043	-0.0265	0.0001	**0.0133*** **	0.0243	0.0165	0.0031	
	t-stat	(-0.2966)	(-2.4324)	(0.2346)	(-0.8645)	(0.079)	(12.3681)	(0.8903)	(0.5855)	(0.2644)	

		[0;+1]									

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BHW_PW	*CAR*	**-0.0057*** **	-0.0353			0.0075***	-0.0082	-0.0022	-0.0028	0.0126	**0.0366*** **
	t-stat	(-22.6098)	(-0.8887)			(16.1523)	(-0.4217)	(-0.098)	(-0.4626)	(1.2795)	(2.9957)
BZW_PW	*CAR*	-0.0393	**-0.0708*** **			-0.0039	-0.0107**	**-0.0011**	**-0.0165*** **	-0.0029	
	t-stat	(-1.082)	(-2.8602)			(-0.5877)	(-2.2823)	(-0.1997)	(-4.0458)	(-0.1196)	
ING_PW	*CAR*	-0.0053	**0.0066**	0.0283			**-0.0296** **			-0.0074	0.0046
	t-stat	(-0.189)	(0.8407)	(1.064)			(-2.0537)			(-0.8539)	(0.6709)
MIL_PW	*CAR*	0.0422**	**-0.0259** **	0.0672***			-0.0029			-0.0182	
	t-stat	(2.1053)	(-1.9757)	(4.1325)			(-0.2226)			(-0.2964)	
PEO_PW	*CAR*	0.0074	0.0205*			-0.0084	-0.0148	0.0436***	0.025	**0.0079**	-0.0205
	t-stat	(0.5347)	(1.9391)			(-1)	(-0.679)	(2.5378)	(0.6696)	(0.6285)	(-0.7569)
PKO_PW	*CAR*	0.0321**	**-0.0239** **	0.0114	-0.0811***	0.0008	**0.0123**	0.0258	-0.0117	0.0075	
	t-stat	(2.3188)	(-2.1813)	(0.503)	(-3.3887)	(0.0591)	(0.9404)	(0.6647)	(-0.4588)	(0.7473)	

Notes: All dividend events were divided into three groups[1] depending on the dividend change: green color stands for positive dividend changes (>10% increase); red – for negative (>10% decrease); and grey – for neutral dividend change. The frequency of dividend payment A means annually dividend distribution. T-statistics is in the parenthesis. The stars marked next to CAR indicate statistical significance: ***- at 1% level; **- at 5% level; *- at 10% level.

[1] The classification is based on the Nur-Adiana, Rosemaliza, and Yusnidah's (2002) method and described in data description part.

event windows; whereas about 45 percent of the dividend announcements over 2012–2015 period were statistically significant (Tables3 and 5).

To sum up, the presented above results confirm the banking dividend announcement relevance for the Polish market return over 2006–2015 period. Thus, about 65 percent of announced events affected the market return for the whole period. Moreover, during the financial crisis, almost all of the dividend initiations were accompanied by significant stock market response. Moreover, the tendency of the forward relationship between dividend change direction and stock market return is observed in 56 per cent cases of dividend initiations. Thus, more that in half cases, the tendency of investors' reaction to dividend changes is observed as follows: positive dividend changes lead to positive market return and the announcement of negative dividend change negatively affect the stock prices.

Conclusion

A great majority of theoretical and empirical studies have been produced to define the relationship between dividend payouts and firms market value, especially, after the publication of the dividend irrelevance theory by MM (1961). However, after several decades of investigating the issue, there is no consensus about dividend payment influence on stock returns.

The literature on dividend policy could be divided into two main schools of thought: those that argue in favor of dividend irrelevance and those that argue in favor of relevance of dividend payments in determining the firm's stock price.

MM argued that investors are indifferent between dividends and capital gains; therefore, the dividend distribution does not affect shareholders' wealth. However, it is hard to support the theory under the market imperfection due to the fact that it is based on the set of assumptions of perfect market and rational investors.

Taking into account various market imperfections (such as taxes, agency problem, transactions costs etc.), a lot of theories that show the relevance of dividend policy on market return have been developed. Some of them suggest that high dividends increase share value ('bird-in-the-hand' theory), others – that low dividends increase share value (the tax preference theory). Informational content of dividends (signaling), the agency cost theory, and the clientele effects also argue in favor of dividend relevance.

However, it was presumed that the tax preference theory that indicates that different taxation of dividends and capital gains influences investors' preferences

and hence stock prices, is not applicable for the Polish stock exchange. The suggestion has been made based on the information that there is no difference between Polish integrated long-term capital gains tax and integrated dividend tax rate. Therefore, taking into account taxes, the investors' behavior in response to dividend announcements of the companies listed on the WSE could be indifferent.

The literature review indicates that the current research is different from the recent studies conducted. There is no similar research that investigates the dividend announcement impact on the WSE market return separately for banking sector – the most valuable sector on the Polish market (49 per cent of the whole market capitalization). Moreover, the current investigation included the sample of the latest period including the financial crisis.

Current paper investigated the reaction of the stock market to the announcements of cash dividend payments of the companies belonging to the banking sector and listed on the Warsaw Stock Exchange. The effect of informational contest of dividend announcements on the Polish stock return has been examined with the help of event study methodology using abnormal return (AR) and cumulative abnormal return (CAR). In order to estimate the market and industry returns for the current empirical research, WIG and MSCI Europe Banks Indices, respectively, have been chosen. The data sample included 43 dividend announcements for six banks listed on the Warsaw Stock Exchange over ten years starting from 2006.

The analysis of the Polish market showed that the impact of the global financial crisis on the Warsaw Stock Exchange occurred between November 2007 and January 2009 and was accompanied by 57.95 per cent drop of WIG Index and by 72.24 per cent for WIGBANK Index. Moreover, the dividend payout ratio for the banking sector of WSE significantly declined in 2008; it was more than six times lower compared to the ratio for 20 largest companies of WSE (WIG20 Index). However, already in 2009, the dividend payout ratio for both Indices was approximately the same and equal to more than 46 per cent. Over the last years, the tendency of increased dividend payouts is observed for both sectors.

The empirical results showed statistically significant CAR after the dividend announcement for about 65 percent of announced events over the years analyzed. Consequently, the study confirms that investors recognize the informational content of dividend announcements; and, as a result, the impact on the Polish market returns for the banking sector occurs.

Moreover, it was indicated that during the financial crisis almost all of the dividend initiations were accompanied by significant stock market returns, the sign of which directly depended on the direction of the dividend change (positive/

negative dividend changes led to positive/negative market returns). On the other hand, the last four years analyzed show the decrease of investors' response to dividend declarations as only 45 per cent of all announcements during this period had statistically significant CAR. This conclusion highlighted the dividend policy importance for investors during the crisis period when the shareholders treated dividend payments as additional source of information regarding future companies' perspective.

In addition, the tendency to direct relationship between dividend change direction and stock market return is observed in slightly more than half of dividend initiations: positive dividend changes lead to positive market returns, and the announcement of negative dividend change negatively affects the stock prices. This indicates that dividend increase is treated by the investor as a good news about company's future performance which is complained with positive movement of stock prices; and vice versa, the decrease of dividend payments through the shareholder's expectation lead to negative market returns.

The impact of dividend announcements on the stock returns is important knowledge for financial managers as it shows that their dividend policy decisions influence the company's value. Especially, the dividend relevance is strong during the crisis. The policy makers could provide the information to their shareholders about future perspectives with the help of dividend announcements which will affect the stock prices.

The study fills up the lack of empirical studies regarding the investor's behavior in the response to the dividend announcement for Polish market during the last ten years. The main hypothesis of the current investigation has been confirmed which means a significant reaction of investors to changes in the dividend policy of the companies. The dividend relevance has been proved based on the sample of banking dividend announcements of the WSE for the 2006–2015 period.

Further research could also cover the investor's reaction to omitted dividend payment that was expected to be paid but was not declared by the board of directors, and compare the effect of banking dividend announcements with other Polish market sectors.

Bibliography

Abdulkadir R. I., Abdullah N. A., Woei-Chyuan W., (2015). *Dividend policy changes in the pre-, mid-, and post-financial crisis: evidence from the nigerian stock market.*"Asian academy of management journal of accounting and finance", 11, 2: 103–126.

Acharya V. V., Gujral, I., Kulkarni, N., Shin, H.S., (2011). *Dividends and Bank Capital in the Financial Crisis of 2007–2009*. "NBER Working Paper No. 16896", http://www.nber.org/papers/w16896 (access: 14.04.2016).

Ahern K.R., (2009). *Sample selection and event study estimation*. "Journal of Empirical Finance", 16: 466–482.

Ang J.S., Ciccone S.J., (2009). *Dividend irrelevance theory* in Baker, H.K. (Ed.), *Dividend and Dividend Policy*, "Oxford University Press", New York, 97–113.

Baker H., Powell E., (1999). *How Corporate managers View Dividend Policy*. Quarterly Journal of Business and Economics, 38: 17–35.

Bayezid A., Chowdhury A., (2010). *Effect of Dividend on Stock Price in Emerging Stock Market: A Study on the Listed Private Commercial Banks in DSE*. "International Journal of Economics and Finance", 2, 4: 52–64.

Bernstein P.L., (1996). *Dividends: The Puzzle*. "Journal of Applied Corporate Finance", 9: 16–22.

Bessler W., Nohel T., (2000). *Asymmetric information, dividend reductions, and contagion effects in bank stock returns*. "Journal of Banking & Finance", 24: 1831–1848.

Bistrova J., Lace N., (2012). *Dividend Stability and Sustainability in CEE Region*. Proceedings of the 2nd World Sustainability Forum, Switzerland, Basel, 1, 30: 1–8.

Black F., Scholes M., (1974). *The effects of dividend yield and dividend policy on common stock prices and returns*."Journal of Financial Economics", 1, 1: 1–22.

Bloomberg L.P., (2016). Bloomberg Professional. Electronic database, (access: 20.04.2016).

Brav A., Graham J., Harvey C., Michaely R., 2005. *Payout Policy in the 21th Century: The Data*. "Johnson School Research Paper", 29, 6.

Brealey R.A. & Myers S.C. (2003). *Principles of Corporate Finance*, 7th ed. The McGraw–Hill Companies.

Brigham, E. F., Houston, J. F., (2004). *Fundamentals of Financial Management,* 10th ed. US: Thomson South-Western.

Brzeszczyński J. Gajdka J., (2007). *Dividend-Driven Trading Strategies: Evidence from the Warsaw Stock Exchange*. "International Atlantic Economic Society", 13: 285–300.

Campbell J. Y., Lo A. W. MacKinlay A. C., (1997). *The Econometrics of Financial Markets*. Princeton: Princeton University Press.

Caseya, K. M., Dickensb, R. N., (2000). *The effects of tax and regulatory changes on commercial bank dividend policy*. "The Quarterly Review of Economics and Finance", 40: 279–293.

DeAngelo, H., DeAngelo, L. E., (2005). *The Irrelevance of the MM Dividend Irrelevance Theory*. *SSRN*,http://papers.ssrn.com/sol3/papers.cfm?abstract_id=680855 (access: 04.06.2016)

DeAngelo H., DeAngelo L. E., Skinner D. J., (2000). *Special Dividends and the Evolution of Dividend Signaling*. "Journal of Financial Economics", 57: 309–354.

Deloitte, (2015). *Taxation and Investment in United Kingdom*, https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-unitedkingdomguide-2015.pdf (access: 11.05.2016).

Docking, D.S., Koch, P.D., (2005). *Sensitivity of investor reaction to market direction and volatility: dividend change announcements*. "The Journal of Financial Research", 28,1: 21–40.

Easterbrook, F. H., (1984). *Two Agency-Cost Explanations of Dividends*. "American Economic Review", 74, 4: 650–59.

Ernst&Young, (2015). *Corporate dividend and capital gains taxation: A comparison of the United States to other developed nations*. "Alliance for Savings and Investment", http://theasi.org/assets/EY-ASI-2014-International-Comparison-of-Top-Dividend-and-Capital-Gains-Tax-Rates.pdf (access: 11.05.2016)

Fama, E. F. French, K. R., (2001). *Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?* "Journal of Financial Economics", 60: 3–43.

Floyd E., Li N., Skinner D. J., (2015). *Payout policy through the financial crisis: The growth of repurchases and the resilience of dividends*. The University of Chicago Booth School of Business. Working Paper, 12, 1.

Forti, C., Schiozer, R. F., (2015). *Bank dividends and signaling to information-sensitive depositors*. "Journal of Banking & Finance", 56: 1–11.

Frankfurter G. M., Wood B. G., Wansley J., (2003). *Dividend Policy: Theory and Practice*. Academic press.

Google Finance: Index, Historical Prices, WIG & more. (n.d.). Google, http://www.google.com/finance, (access: 18.05.2016).

Gordon M. J., (1962). *Optimal Investment and Financing Policy*. "Journal of Finance", 264–272.

Gurgul H. Majdosz P., (2005). *Effect of Dividend and repurchase announcements on the polish stock market*. "Badania Operacyjne Decyzje", 1: 25-41.

Gutman L. J., Zutter, C. J., (2015). *Principles of Managerial Finance*, 14th ed., Pearson Education.

Hess P.J., (1981). *The Dividend Debate: 20 Years of Discussion*. In: Stern, J.M. (1986) The Revolution in Corporate Finance. Blackwell, Oxford.

Jablonski B. Kuczowic J., (2015). *Strategies of dividend policy of the companies listed on the Warsaw Stock Exchange*. "Folia Oeconomica Stetinensia", 20: 69–82.

Jagannathan M., Stephens C. P., Weisbach, M. S., (2000). *Financial flexibility and the choice between dividends and stock repurchases*. "Journal of Financial Economics", 57: 355–84.

Jensen M., (1986). *Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers*. "American Economic Review", 76, 2: 323–329.

Kadıoğlu E., Telçeken N., Öcal N., (2015). *Market Reaction to Dividend Announcement: Evidence from Turkish Stock Market*. "Internatonal Business Research", 8, 9: 83–94.

Khotari S.P., Warner J.B., (2006). *Econometrics of Event Studies*. "Handbook of Corporate Finance. Empirical Corporate Finance."

Kjellman A., Hansen S., (1993). *Financing Decisions and Dividend Policy Under Asymmetric Information: The Importance of Long-term Planning*. "Finnish Journal of Business", 3: 195–201.

Kowelewski O., (2012). *Does Corporate Governance Determine Corporate Performance and Dividends During Financial Crisis: Evidence from Poland*. "Polish National Science Center."

Kuo J. M., Philip D., Zhang Q. J., (2013). *What drives the disappearing dividends phenomenon?*, "Journal of Banking & Finance", 37: 3499–3514.

Lintner J., (1962). *Dividends, earning, leverage, stock price, and the supply of capital to corporations*. "Review of Economics and Statistics", 44: 243–269.

Loader D., (2014). *Clearing, Settlement and Custody*, 2nd ed., Elsevier.

Masum A., (2014). *Dividend Policy and Its Impact on Stock Price – A Study on Commercial Banks Listed in Dhaka Stock Exchange*. "Global Disclosure of Economics and Business", 3, 1: 9–17.

Miletic M., (2011). *Stock Price Reaction to Dividend Announcement in Croatia*. "Ekonomska Istrazivanja/Economic Research", 24, 3: 147–156.

Miller, M., Modigliani, F., (1961). *Dividend policy, growth, and the valuation of shares*. "Journal of Business", 34: 411–433.

Miller M. H., Scholes M. S., (1982). *Dividends and taxes: some empirical evidence*. "Journal of Political Economy", 90: 1118–1441.

Nur-Adiana H. A., Rosemaliza A. R., Yusnidah I., (2002). *The effect of dividend announcements on stock returns for companies listed on the main board of the Kuala Lumpur Stock Exchange*. "Malaysian Management Journal", 6(1,2): 81–98.

OECD, *OECD Tax Database*, http://www.oecd.org/tax/tax-policy/tax-database.htm, (access: 4.06.2016).

Onali E., (2009). *Dividend and risk in European banks*. "UKEPAN conference. Leicester."

Pan R., Tang X., Tan Y., Zhu Q., (2014). *The Chinese Stock Dividend Puzzle*. "Emerging Markets Finance & Trade", 50, 3: 178–195.

Pandey I. M., (2010). *Financial Management*, 10th ed., Paperback.

Pawlowska M., (2012). *Competition, concentration and foreign capital in the Polish banking sector (prior and during the financial crisis)*. National bank of Poland. Working paper 130.

Polish Information and Foreign Investment Agency. *Corporate Income Tax,* http://www.paiz.gov.pl/polish_law/taxation/cit. (access: 10.05.2016)

Public Law No: 112-240., 2013. *American Taxpayer Relief Act of 2012*, <www.congress.gov/bill/112th-congress/house-bill/8>. (access: 12.05.2016).

Research and Instructional Services in Firestone Library at Princeton University, (2016). *Event studies with Stata*, http://dss.princeton.edu/online_help/stats_packages/stata/eventstudy.html. (access: 18.05.2016).

Scott L.D., (2003). *Wall Street Words: An A to Z Guide to Investment Terms for Today's Investor*. "Houghton Mifflin Company", http://financial-dictionary.thefreedictionary.com/normalized+earnings. (access: 10.04.2016).

Sharma R., (2011). *Stock Price Behaviour around Dividend Announcements: An Event Study Methodology*. "The Vilakshan: XIMB Journal of Management", 8, 2: 23–32.

Solomon E., (1963). *The Theory of Financial Management*. "Colombia University Press."

Stephen R. A., Randolph W. Jeffrey J., (2005). *Corporate Finance*, 7th ed., USA: McGraw-Hill Irwin.

Supermedia Interactive, (2016). *GPW.pl – Analysis and Statistics*, https://www.gpw.pl/analizy_i_statystyki_en., (access: 18.05.2016).

Szomko N., (2015). *Investor Reaction to Information on Final Dividend Payouts on the Warsaw Stock exchange – an Event Study Analysis*. "International Journal of Management and Economics", 45: 127–146.

Uddin N. Md., Uddin M. J., (2014). *Dividend Announcement of the Commercial Banks in DSE: Scenrio and Effect on Stock Price*. "International Journal of Ethics in Social Sciences", 2, 1: 143–155.

Vazakidis A., Athianos S., (2010). *Do Dividend Announcements Affect The Stock Prices in The Greek Stock Market?*"International Journal of Economic Sciences and Applied Research", 3, 2: 57–77.

Viera E. S., (2011). *Firm-specific factors and the market reaction to dividend change announcements: evidence from Europe*. "Marmara Journal of European studies", 19, 1.

Walter J. E., (1963). *Dividend Policy: Its Influence on the Value of the Enterprise*. "Journal of Finance", 280–291.

Worniewska G., (2008). *Methodds of measuring the efficiency of commercial banks: an example of polish banks*. "Economica: Poland", 84–91.

WSE, (2016). *Warsaw Stock Exchange Indices*, https://www.gpw.pl/pub/files/PDF/foldery/IndeksyGPW_0513_en.pdf (access: 20.05.2016)

Zameer H., Rasool S., Iqbal S., Arshad U., (2013). *Determinants of Dividend Policy: A Case of Banking Sector in Pakistan*. "Middle-East Journal of Scientific Research", 18, 3: 410–424.

Zia M., Kochan M., (2015). *The signaling content of dividend cuts and stock market reaction in the banking industry during the financial crisis of 2007 and 2008*. "The 2015 Conference of the Southwestern Finance Association", http://swfa2015.uno.edu/D_Signaling_&_Market_Response/paper_133.pdf. (access: 11.05.2016).

APPENDIX 1. Implication of Corporate finance theories in prediction of the dividend announcement effect on stock prices.

Theory	Dividend announcement	Expected effect on stock prices
Dividend irrelevance theory (Miller and Modigliani)	Increase / Decrease	No effect
"Bird-in-the-hand" theory	Increase	Positive effect (investor's uncertainty decrease)
	Decrease	Negative effect (investor's uncertainty increased)
The Walter Model	Increase	Negative effect for growth company (internal rate is bigger than the opportunity cost of capital); No effect for company with equal investment rate of return and the cost of capital; Positive effect for declining company (internal rate less than opportunity cost of capital)
	Decrease	Positive effect for growth company; No effect for company with equal investment rate of return and the cost of capital; Negative effect for declining company
Agency cost theory	Decrease	Negative effect (threat of fund's misuse by manager's)
Free cash flow hypothesis	Increase	Positive effect (behavior of managers is in line with the owners' interest)
	Decrease	Negative effect (threat of free cash flow investment in projects with negative net present value)
The tax preference theory	Increase	Negative effect
	Decrease	Positive effect (the low dividend payout ratio supports the cost of capital to be lower due to higher taxes for dividends)
The dividend-signaling hypothesis / Information content hypothesis	Increase	Positive effect (signals increase if present or future cash flow; signal for permanent or long-term growth of expected earnings)
	Decrease	Negative effect

APPENDIX 2. Summary of studies on dividend announcement effect.

Author	Country of investigation	Number of firms	Number of events	Period of investigation	Results
Docking and Koch (2005)			4336	1962–1997	Lower dividends lead to stronger market price decrease when previously market prices showed upward tendency
Gurgul and Majdosz (2005)	Poland	45		Jan 2000–Jun 2004	Statistically significant positive abnormal return on day +1.
Vazakidis and Athianos (2010)	Greece	60		2004-2008	Positive reaction over the pre-announcement period and negative reaction over the post- announcement period
Bayezid and Chowdhury (2010)	Bangladesh	25		Jan-Sep 2008	No effect of dividend announcement on stock prices
Sharma (2011)	India	133	1188	1997–2007	No significant abnormal market returns surrounding the dividend declaration day
Viera (2011)	UK, France, Portugal		4442	2004–2010	Negative market response on the announcement of dividend increase for companies with higher growth opportunities and historically lower dividend changes
Miletic (2011)	Croatia	41	56	2007–2009	Statistically significant effect of dividend announcement on stock prices
Pan, Tang, Tan, and Zhu (2014)	China	1475	12538	1993–2006	No significant market reaction for cash dividend announcements
Nezum and Jashim Uddin (2014)	Bangladesh	28		2000–2013	No effect of dividend announcement on stock prices
Abdullah Al Masum (2014)	Bangladesh	30		2007–2011	Significantly positive effect of dividend policy on market return

Author	Country of investigation	Number of firms	Number of events	Period of investigation	Results
Kadıoğlu, Telçeken and Öcal (2015)	Turkey	118	902	2003–2015	Significantly negative relationship between cash dividends announcement and the market reaction
Szomko (2015)	Poland		816	1997–2010	Significant positive reaction to the irregular payouts, initiation and the increase in payouts. Negative reaction for the resumption and decrease in dividend payouts
Zia and Kochan (2015)	US	98		2003–2013	Negative market reaction on dividend cuts

APPENDIX 3. CAR Estimation Results for Bank Handlowy w Warszawie (BHW).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
24mar2006	0.0036	0.3441	0.0036	0.3922	0.0036	0.4019											
27mar2006	-0.0014	-0.1312	-0.0014	-0.1496	-0.0014	-0.1533	-0.0049	-0.6336	**-0.0049*****	-5.6535	**-0.0049*****	-6.8491					
28mar2006	-0.007	-0.676	-0.007	-0.7705	-0.007	-0.7895	-0.0106	-1.3598	**-0.0106*****	-12.1324	**-0.0106*****	-14.6981	-0.0057	-0.7043	**-0.0057*****	-22.6098	-0.0057
29mar2006	-0.013	-1.2449	-0.013	-1.4189			**-0.0165****	-2.1181	**-0.0165*****	-18.8979			-0.0116	-1.4398	**-0.0116*****	-46.2196	
30mar2006	-0.0107	-1.0285					**-0.0143***	-1.8297					-0.0093	-1.1601			
12mar2007	0.001	0.0275	0.001	0.0269	0.001	0.0293											
13mar2007	-0.0057	-0.1622	-0.0057	-0.1585	-0.0057	-0.1727	-0.0067	-0.1943	-0.0067	-0.1885	-0.0057	-0.1727					
14mar2007	-0.041	-1.1636	-0.041	-1.1368	-0.041	-1.2388	-0.042	-1.2196	-0.042	-1.183	-0.041	-1.2388	-0.0353	-0.9774	-0.0353	-0.8887	-0.0353
15mar2007	-0.0366	-1.0382	-0.0366	-1.0144			-0.0375	-1.0913	-0.0375	-1.0585			-0.0309	-0.855	-0.0309	-0.7775	
16mar2007	-0.041	-1.1639					-0.042	-1.22					0	-0.9778			
09apr2010	0.0102	0.3238	0.0102	0.315	0.0102	0.3122											
12apr2010	-0.0135	-0.4295	-0.0135	-0.4177	-0.0135	-0.414	-0.0237	-0.7991	-0.0237	-0.7534	-0.0237	-0.7591					
13apr2010	-0.006	-0.1904	-0.006	-0.1852	-0.006	-0.1836	-0.0162	-0.5455	-0.0162	-0.5144	-0.0162	-0.5182	0.0075	0.7361	**0.0075*****	16.1523	0.0075
14apr2010	0.002	0.0634	0.002	0.0617			-0.0082	-0.2763	-0.0082	-0.2605			0.0155	1.5179	**0.0155*****	33.3045	
15apr2010	-0.0005	-0.0146					-0.0106	-0.359					0.013	1.2776			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
04mar2011	-0.0144	-0.5201	-0.0144	-0.5041	-0.0144	-0.5443											
07mar2011	0.0002	0.0073	0.0002	0.0071	0.0002	0.0077	0.0146	0.7129	0.0146	0.6845	0.0146	0.6402					
08mar2011	-0.008	-0.2891	-0.008	-0.2802	-0.008	-0.3026	0.0064	0.3122	0.0064	0.2998	0.0064	0.2804	-0.0082	-0.4867	-0.0082	-0.4217	-0.0082
09mar2011	0.0032	0.1175	0.0032	0.1139			0.0176	0.8618	0.0176	0.8274			0.003	0.1809	0.003	0.1567	
10mar2011	0.0053	0.19					0.0196	0.9598					0.005	0.3			
09mar2012	0.0042	0.1562	0.0042	0.1567	0.0042	0.2945											
12mar2012	-0.0079	-0.295	-0.0079	-0.2959	-0.0079	-0.5563	-0.0121	-0.4369	-0.0121	-0.4284	-0.0121	-1.2159					
13mar2012	-0.0101	-0.3751	-0.0101	-0.3763	-0.0101	-0.7073	-0.0143	-0.5145	-0.0143	-0.5045	-0.0143	-1.4318	-0.0022	-0.1131	-0.0022	-0.098	-0.0022
14mar2012	0.0097	0.3622	0.0097	0.3633			0.0055	0.1994	0.0055	0.1956			0.0176	0.9278	0.0176	0.804	
15mar2012	0.0192	0.7143					0.015	0.5405					0.0271	1.425			
08mar2013	0.0067	0.3851	0.0067	0.3747	0.0067	0.3636											
11mar2013	0.0251	1.446	0.0251	1.4071	0.0251	1.3655	0.0184	1.0283	0.0184	0.9736	0.0184	0.8693					
12mar2013	0.0224	1.2865	0.0224	1.2519	0.0224	1.2149	0.0157	0.8738	0.0157	0.8272	0.0157	0.7386	-0.0028	-0.4059	-0.0028	-0.4626	-0.0028
13mar2013	0.0256	1.4718	0.0256	1.4322			0.0189	1.0534	0.0189	0.9973			0.0004	0.0657	0.0004	0.0749	
14mar2013	**0.0302***	1.7401					0.0235	1.3135					0.0051	0.7486			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
04mar2014	-0.0129	-0.6216	-0.0129	-0.6123	-0.0129	-0.5803											
05mar2014	-0.0107	-0.5175	-0.0107	-0.5097	-0.0107	-0.483	0.0022	0.2242	0.0022	0.2122	0.0022	0.2064					
06mar2014	0.0019	0.0913	0.0019	0.09	0.0019	0.0853	0.0148	1.5342	0.0148	1.4525	0.0148	1.4128	0.0126	1.4079	0.0126	1.2795	0.0126
07mar2014	0.0047	0.2243	0.0047	0.221			**0.0176***	1.8205	**0.0176***	1.7235			**0.0154***	1.7155	0.0154	1.5591	
10mar2014	0.0096	0.4641					**0.0225*****	2.3364					**0.0204****	2.27			
06mar2015	-0.005	-0.1458	-0.005	-0.1933	-0.005	-0.2244											
09mar2015	0.0154	0.4433	0.0154	0.5878	0.0154	0.6824	0.0204	0.6504	**0.0204***	1.8907	**0.0204*****	2.4866					
10mar2015	0.0275	0.7956	0.0275	1.0548	0.0275	1.2245	0.0326	1.0393	**0.0326*****	3.021	**0.0326*****	3.9731	0.0122	0.3954	0.0122	0.9978	0.0122
12mar2015	0.0413	1.1928	**0.052****	1.9898			**0.057***	1.8178	**0.057*****	5.2841			0.0366	1.1871	**0.0366*****	2.9957	
11mar2015	0.052	1.5007					0.0463	1.4778					0.0259	0.8413			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event. The stars marked next to CAR indicate statistical significance: *** – at 1% level; ** – at 5% level; * – at 10% level.

APPENDIX 4. CAR Estimation Results for Bank Zachodni w Warszawie (BZW).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
20feb2006	0.0091	0.1924	0.0091	0.2211	0.0091	0.2149											
21feb2006	0.0004	0.0077	0.0004	0.0089	0.0004	0.0086	-0.0087	-0.1935	-0.0087	-0.2587	-0.0087	-0.2863					
22feb2006	-0.0389	-0.822	-0.0389	-0.9447	-0.0389	-0.9181	-0.048	-1.0629	-0.048	-1.4212	-0.048	-1.5726	-0.0393	-0.8197	-0.0393	-1.082	-0.0393
23feb2006	-0.0419	-0.8849	-0.0419	-1.017			-0.051	-1.1288	-0.051	-1.5093			-0.0423	-0.8819	-0.0423	-1.164	
24feb2006	-0.0269	-0.5673					-0.036	-0.7961					-0.0272	-0.5681			
20feb2007	-0.0125	-0.2549	-0.0125	-0.3806	-0.0125	-0.3592											
21feb2007	-0.0256	-0.5208	-0.0256	-0.7776	-0.0256	-0.7338	-0.0131	-0.2588	-0.0131	-0.4233	-0.0131	-0.3776					
22feb2007	-0.0734	-1.4909	**-0.0734****	-2.2259	**-0.0734****	-2.1006	-0.0608	-1.2031	**-0.0608****	-1.9677	**-0.0608***	-1.7552	-0.0478	-0.8967	**-0.0478***	-1.9301	-0.0478
23feb2007	**-0.0964***	-1.9584	**-0.0964*****	-2.9238			**-0.0838***	-1.6582	**-0.0838*****	-2.7119			-0.0708	-1.3289	**-0.0708*****	-2.8602	
26feb2007	**-0.083***	-1.6868					-0.0705	-1.3938					-0.0574	-1.0778			
26feb2010	-0.001	-0.0425	-0.001	-0.0469	-0.0212	-1.1767											
01mar2010	-0.0212	-0.9486	-0.0212	-1.0455	-0.025	-1.3916	-0.0202	-0.9479	-0.0202	-0.9886	-0.0202	-1.2363					
02mar2010	-0.025	-1.1218	-0.025	-1.2365	-0.001	-0.0528	-0.0241	-1.1291	-0.0241	-1.1776	-0.0241	-1.4727	-0.0039	-0.2319	-0.0039	-0.5877	-0.0039
03mar2010	-0.0223	-1.0003	-0.0223	-1.1025			-0.0214	-1.002	-0.0214	-1.045			-0.0012	-0.0692	-0.0012	-0.1754	
04mar2010	**-0.0386***	-1.7282					**-0.0376***	-1.7636					-0.0174	-1.0436			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
28feb2011	-0.0072	-0.6432	-0.0072	-0.6229	-0.0072	-0.681											
01mar2011	-0.0024	-0.2117	-0.0024	-0.205	-0.0024	-0.2242	0.0049	0.4669	0.0049	0.4426	0.0049	0.6181					
02mar2011	-0.0054	-0.4783	-0.0054	-0.4632	-0.0054	-0.5064	0.0019	0.1784	0.0019	0.1691	0.0019	0.2362	-0.003	-0.6432	-0.003	-0.6412	-0.003
03mar2011	-0.0131	-1.1606	-0.0131	-1.124			-0.0058	-0.5599	-0.0058	-0.5308			**-0.0107****	-2.2896	**-0.0107****	-2.2823	
04mar2011	-0.0161	-1.4298					-0.0089	-0.8513					**-0.0137*****	-2.9393			
28feb2012	0.0033	0.2515	0.0033	0.4073	0.0033	0.8158											
29feb2012	0.003	0.2294	0.003	0.3716	0.003	0.7442	-0.0003	-0.0219	-0.0003	-0.0494	-0.0003	-0.3648					
01mar2012	0.0019	0.1469	0.0019	0.2379	0.0019	0.4765	-0.0014	-0.1039	-0.0014	-0.2342	**-0.0014***	-1.7296	-0.0011	-0.0775	-0.0011	-0.1997	-0.0011
02mar2012	-0.0046	-0.3489	-0.0046	-0.5651			-0.0079	-0.5964	-0.0079	-1.3445			-0.0076	-0.5428	-0.0076	-1.3995	
05mar2012	0.0048	0.3654					0.0015	0.1131					0.0018	0.1276			
06mar2013	-0.0014	-0.0303	-0.0014	-0.0844	-0.0014	-0.0797											
07mar2013	-0.0228	-0.4824	-0.0228	-1.343	-0.0228	-1.2673	-0.0214	-0.4388	**-0.0214*****	-2.7465	**-0.0214*****	-4.3603					
08mar2013	-0.0393	-0.8309	**-0.0393****	-2.313	**-0.0393****	-2.1825	-0.0378	-0.777	**-0.0378*****	-4.8631	**-0.0378*****	-7.7206	-0.0165	-0.3583	**-0.0165*****	-4.0458	-0.0165
11mar2013	-0.0517	-1.0932	**-0.0517*****	-3.0432			-0.0502	-1.0316	**-0.0502*****	-6.4566			-0.0289	-0.628	**-0.0289*****	-7.0915	
12mar2013	-0.0203	-0.4289					-0.0188	-0.3868					0.0025	0.0551			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
28feb2014	0.0193	0.3584	0.0193	0.4388	0.0193	0.4945											
03mar2014	-0.0065	-0.1201	-0.0065	-0.147	-0.0065	-0.1657	-0.0258	-0.5375	-0.0258	-1.091	-0.0258	-1.1273					
04mar2014	-0.0094	-0.1741	-0.0094	-0.2131	-0.0094	-0.2402	-0.0287	-0.5982	-0.0287	-1.2141	-0.0287	-1.2545	-0.0029	-0.0658	-0.0029	-0.1196	-0.0029
05mar2014	-0.0366	-0.6795	-0.0366	-0.832			-0.056	-1.166	**-0.056*****	-2.3666			-0.0302	-0.6814	-0.0302	-1.2393	
06mar2014	-0.0128	-0.2372					-0.0321	-0.6692					-0.0063	-0.1427			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event. The stars marked next to CAR indicate statistical significance: ***– at 1% level; **– at 5% level; *– at 10% level.

APPENDIX 5. CAR Estimation Results for Bank Handlowy w Warszawie Slaski SA (ING).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
29mar2006	-0.0074	-0.269	-0.0074	-0.2692	-0.0074	-1.0704											
30mar2006	-0.0071	-0.257	-0.0071	-0.2573	-0.0071	-1.0228	0.0003	0.0135	0.0003	0.0129	0.0003	0.0589					
31mar2006	-0.0124	-0.4483	-0.0124	-0.4488	**-0.0124***	-1.7842	-0.005	-0.2027	-0.005	-0.1933	-0.005	-0.8823	-0.0053	-0.2181	-0.0053	-0.189	-0.0053
03apr2006	0.0103	0.3727	0.0103	0.3731			0.0177	0.7254	0.0177	0.6918			0.0174	0.7178	0.0174	0.6221	
04apr2006	0.0199	0.7196					0.0273	1.1175					0.027	1.1131			
19apr2007	0.0003	0.0129	0.0003	0.0406	0.0003	0.0511											
20apr2007	0.0034	0.1543	0.0034	0.4861	0.0034	0.6115	0.0031	0.146	0.0031	0.4514	0.0031	0.8718					
23apr2007	0.01	0.4578	0.01	1.4426	**0.01***	1.8147	0.0097	0.4593	0.0097	1.4205	**0.0097*****	2.7436	0.0066	0.3098	0.0066	0.8407	0.0066
24apr2007	0.0087	0.4003	0.0087	1.2613			0.0085	0.4	0.0085	1.2369			0.0054	0.2511	0.0054	0.6814	
25apr2007	0.0317	1.452					0.0314	1.4857					0.0284	1.3244			
08apr2008	-0.0057	-0.1791	-0.0057	-0.174	-0.0057	-0.6779											
09apr2008	-0.0144	-0.4505	-0.0144	-0.4375	**-0.0144***	-1.7049	-0.0087	-0.2839	-0.0087	-0.2678	-0.0087	-0.9107					
10apr2008	-0.0136	-0.4239	-0.0136	-0.4117	-0.0136	-1.6042	-0.0078	-0.2561	-0.0078	-0.2415	-0.0078	-0.8214	0.0009	0.0348	0.0009	0.032	0.0009
11apr2008	0.0139	0.4339	0.0139	0.4214			0.0196	0.6414	0.0196	0.6048			0.0283	1.1576	0.0283	1.064	
14apr2008	0.0198	0.62					0.0256	0.8361					0.0342	1.4012			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
14feb2011	0.0044	0.1943	0.0044	0.2024	0.0044	0.3872											
15feb2011	-0.0018	-0.0789	-0.0018	-0.0822	-0.0018	-0.1572	-0.0062	-0.3261	-0.0062	-0.4071	**-0.0062*****	-4.3572					
16feb2011	-0.0094	-0.4148	-0.0094	-0.4321	-0.0094	-0.8266	-0.0138	-0.7269	-0.0138	-0.9076	**-0.0138*****	-9.7144	-0.0076	-0.3847	-0.0076	-0.5269	-0.0076
17feb2011	-0.0314	-1.3884	-0.0314	-1.4463			-0.0358*	-1.8887	**-0.0358*****	-2.3582			-0.0296	-1.4995	**-0.0296****	-2.0537	
18feb2011	-0.0309	-1.3666					-0.0353*	-1.8627					-0.0291	-1.4745			
28feb2014	-0.0186	-0.8407	-0.0186	-0.9475	-0.0186	-1.006											
03mar2014	-0.0159	-0.7168	-0.0159	-0.8079	-0.0159	-0.8578	0.0027	0.2415	0.0027	0.2881	0.0027	0.2697					
04mar2014	-0.0233	-1.0523	-0.0233	-1.1859	-0.0233	-1.2592	-0.0047	-0.4124	-0.0047	-0.4921	-0.0047	-0.4606	-0.0074	-0.6369	-0.0074	-0.8539	-0.0074
05mar2014	-0.022	-0.9949	-0.022	-1.1212			-0.0034	-0.3005	-0.0034	-0.3586			-0.0062	-0.528	-0.0062	-0.7078	
06mar2014	-0.0162	-0.7319					0.0024	0.2121					-0.0003	-0.0286			
20feb2015	-0.012	-0.8411	-0.012	-0.8333	-0.012	-0.802											
23feb2015	-0.0199	-1.4	-0.0199	-1.387	-0.0199	-1.335	-0.008	-0.7772	-0.008	-0.7336	-0.008	-0.6361					
24feb2015	-0.0154	-1.0802	-0.0154	-1.0702	-0.0154	-1.0301	-0.0034	-0.3325	-0.0034	-0.3139	-0.0034	-0.2722	0.0046	0.7108	0.0046	0.6709	0.0046
25feb2015	-0.0176	-1.2371	-0.0176	-1.2256			-0.0056	-0.5506	-0.0056	-0.5197			0.0023	0.3622	0.0023	0.3418	
26feb2015	-0.019	-1.3345					-0.007	-0.6861					0.0009	0.1456			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event. The stars marked next to CAR indicate statistical significance: ***– at 1% level; **– at 5% level; *– at 10% level.

APPENDIX 6. CAR Estimation Results for Bank Millenium SA (MIL).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
17jan2006	-0.0239	-0.3885	-0.0239	-0.4877	-0.0239	-0.7751											
18jan2006	-0.0362	-0.5878	-0.0362	-0.738	-0.0362	-1.1727	-0.0123	-0.2066	-0.0123	-0.3264	-0.0123	-0.5257					
19jan2006	-0.0252	-0.408	-0.0252	-0.5122	-0.0252	-0.814	-0.0012	-0.0202	-0.0012	-0.032	-0.0012	-0.0515	0.0111	0.1806	0.0111	0.5527	0.0111
20jan2006	0.006	0.0972	0.006	0.122			0.0299	0.5034	0.0299	0.7952			0.0422	0.6881	**0.0422****	2.1053	
23jan2006	-0.0318	-0.5151					-0.0078	-0.1313					0.0045	0.073			
22mar2007	0.0457	0.7044	0.0457	0.7433	0.0457	0.7086											
23mar2007	0.0276	0.4255	0.0276	0.4489	0.0276	0.428	-0.0181	-0.4256	-0.0181	-1.4529	**-0.0181*****	-13.1963					
26mar2007	0.0081	0.1254	0.0081	0.1323	0.0081	0.1261	-0.0376	-0.8834	**-0.0376*****	-3.0158	**-0.0376*****	-27.3926	-0.0195	-0.4777	-0.0195	-1.4878	-0.0195
27mar2007	0.0018	0.027	0.0018	0.0285			-0.044	-1.0335	**-0.044*****	-3.5283			-0.0259	-0.6343	**-0.0259****	-1.9757	
28mar2007	0.028	0.4312					-0.0177	-0.4169					0.0004	0.009			
06mar2008	-0.0634	-0.6567	-0.0634	-0.6811	-0.0634	-0.6965											
07mar2008	-0.0736	-0.7615	-0.0736	-0.7897	-0.0736	-0.8076	-0.0101	-0.2223	-0.0101	-0.2203	-0.0101	-0.1952					
10mar2008	-0.0318	-0.3295	-0.0318	-0.3417	-0.0318	-0.3495	0.0316	0.6946	0.0316	0.6882	0.0316	0.6097	**0.0417*****	2.9608	**0.0417*****	2.5663	0.0417
11mar2008	-0.0064	-0.0659	-0.0064	-0.0683			0.0571	1.2542	0.0571	1.2428			**0.0672*****	4.7679	**0.0672*****	4.1325	
12mar2008	0.0267	0.276					**0.0901****	1.9799					**0.1002*****	7.1113			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
29mar2011	-0.004	-0.1911	-0.004	-0.2196	-0.004	-0.3936											
30mar2011	0.0027	0.1288	0.0027	0.1481	0.0027	0.2654	0.0068	0.3128	0.0068	0.3466	0.0068	0.703					
31mar2011	-0.0001	-0.0063	-0.0001	-0.0072	-0.0001	-0.013	0.0039	0.1807	0.0039	0.2002	0.0039	0.406	-0.0029	-0.1424	-0.0029	-0.2226	-0.0029
01apr2011	-0.0159	-0.7485	-0.0159	-0.8602			-0.0118	-0.5451	-0.0118	-0.604			-0.0186	-0.9245	-0.0186	-1.4453	
04apr2011	-0.0084	-0.3971					-0.0044	-0.2014					-0.0111	-0.5541			
31jan2014	0.0065	0.091	0.0065	0.0921	0.0065	0.0938											
03feb2014	0.0671	0.9335	0.0671	0.9447	0.0671	0.9621	0.0605	0.835	0.0605	0.8453	0.0605	0.7691					
04feb2014	0.0489	0.6806	0.0489	0.6888	0.0489	0.7014	0.0424	0.5843	0.0424	0.5916	0.0424	0.5382	-0.0182	-0.3358	-0.0182	-0.2964	-0.0182
05feb2014	0.0921	1.281	0.0921	1.2964			0.0855	1.1795	0.0855	1.194			0.025	0.4615	0.025	0.4073	
06feb2014	0.0942	1.3102					0.0876	1.2084					0.0271	0.5003			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event. The stars marked next to CAR indicate statistical significance: ***– at 1% level; **– at 5% level; *– at 10% level.

APPENDIX 7. CAR Estimation Results for Bank Polska Kasa Opieki SA (PEO).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
21mar2006	-0.0023	-0.0779	-0.0023	-0.1613	-0.0023	-0.165											
22mar2006	-0.0105	-0.362	-0.0105	-0.7493	-0.0105	-0.7666	-0.0083	-0.2817	-0.0083	-0.5544	-0.0083	-0.5259					
23mar2006	-0.0031	-0.1059	-0.0031	-0.2191	-0.0031	-0.2242	-0.0008	-0.0277	-0.0008	-0.0545	-0.0008	-0.0517	0.0074	0.2885	0.0074	0.5347	0.0074
24mar2006	-0.0096	-0.3288	-0.0096	-0.6805			-0.0073	-0.2488	-0.0073	-0.4896			0.001	0.0374	0.001	0.0694	
27mar2006	0.0137	0.4728					0.016	0.5461					0.0243	0.9403			
14mar2007	-0.0386	-0.7909	-0.0386	-0.8145	-0.0386	-0.795											
15mar2007	-0.0374	-0.7672	-0.0374	-0.7901	-0.0374	-0.7712	0.0012	0.0878	0.0012	0.09	0.0012	0.0807					
16mar2007	-0.0219	-0.4494	-0.0219	-0.4628	-0.0219	-0.4517	0.0167	1.2629	0.0167	1.2942	0.0167	1.1615	**0.0155***	1.6519	0.0155	1.4696	0.0155
19mar2007	-0.017	-0.3479	-0.017	-0.3582			0.0216	1.6384	**0.0216***	1.679			**0.0205****	2.1797	**0.0205***	1.9391	
20mar2007	-0.0046	-0.0942					**0.034*****	2.5764					**0.0328*****	3.4983			
11mar2010	0.0088	0.5376	0.0088	0.546	0.0088	0.613											
12mar2010	0.001	0.0632	0.001	0.0642	0.001	0.0721	-0.0078	-0.9997	-0.0078	-0.9582	-0.0078	-1					
15mar2010	0.001	0.0632	0.001	0.0642	0.001	0.0721	-0.0078	-0.9997	-0.0078	-0.9582	-0.0078	-1	0	0	0	0	0
16mar2010	-0.0074	-0.4502	-0.0074	-0.4573			**-0.0161****	-2.0817	**-0.0161****	-1.9953			-0.0084	-1.088	-0.0084	-1	
17mar2010	-0.0141	-0.865					**-0.0229*****	-2.9558					**-0.0152****	-1.967			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
07mar2011	-0.0071	-0.2652	-0.0071	-0.2568	-0.0071	-0.2557											
08mar2011	0.009	0.335	0.009	0.3244	0.009	0.3229	0.0161	0.6199	0.0161	0.5866	0.0161	0.5219					
09mar2011	-0.0058	-0.2148	-0.0058	-0.208	-0.0058	-0.207	0.0014	0.0521	0.0014	0.0493	0.0014	0.0438	-0.0148	-0.7632	-0.0148	-0.679	-0.0148
10mar2011	0.0012	0.0451	0.0012	0.0437			0.0083	0.3205	0.0083	0.3033			-0.0078	-0.4024	-0.0078	-0.358	
11mar2011	0.0018	0.0651					0.0089	0.3411					-0.0073	-0.3747			
24apr2012	0.0104	0.2303	0.0104	0.2959	0.0104	0.2806											
25apr2012	-0.002	-0.0436	-0.002	-0.0561	-0.002	-0.0532	-0.0124	-0.2689	-0.0124	-0.3319	-0.0124	-0.2893					
26apr2012	0.0284	0.6296	0.0284	0.8089	0.0284	0.767	0.018	0.3919	0.018	0.4836	0.018	0.4215	0.0304	0.6958	**0.0304***	1.7689	0.0304
27apr2012	0.0416	0.9222	0.0416	1.1849			0.0312	0.6791	0.0312	0.8381			0.0436	0.9982	**0.0436*****	2.5378	
30apr2012	0.0223	0.4954					0.012	0.2602					0.0243	0.5572			
13mar2013	0.0052	0.1718	0.0052	0.1684	0.0052	0.2316											
14mar2013	0.0057	0.1871	0.0057	0.1835	0.0057	0.2523	0.0005	0.0149	0.0005	0.0142	0.0005	0.019					
15mar2013	0.0307	1.0097	0.0307	0.9901	0.0307	1.3616	0.0255	0.8131	0.0255	0.7749	0.0255	1.038	0.025	0.7578	0.025	0.6696	0.025
18mar2013	0.0183	0.6038	0.0183	0.5921			0.0131	0.4192	0.0131	0.3996			0.0127	0.3839	0.0127	0.3392	
19mar2013	0.0181	0.597					0.0129	0.4126					0.0125	0.3776			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
07mar2014	0.0014	0.0857	0.0014	0.0997	0.0014	0.1643											
10mar2014	0.0124	0.7608	0.0124	0.885	0.0124	1.4584	0.011	0.6546	0.011	0.7626	**0.011*****	3.6139					
11mar2014	0.0203	1.249	0.0203	1.4531	**0.0203*****	2.3944	0.0189	1.1281	0.0189	1.3142	**0.0189*****	6.2277	0.0079	0.618	0.0079	0.6285	0.0079
12mar2014	0.0156	0.9604	0.0156	1.1173			0.0142	0.8482	0.0142	0.9881			0.0032	0.2527	0.0032	0.2569	
13mar2014	0.0105	0.6462					0.0091	0.5435					-0.0019	-0.1451			
09feb2015	0.0064	0.2562	0.0064	0.2496	0.0064	0.27											
10feb2015	0.0028	0.1143	0.0028	0.1114	0.0028	0.1205	-0.0035	-0.1523	-0.0035	-0.1484	-0.0035	-0.2071					
11feb2015	-0.0177	-0.7125	-0.0177	-0.6942	-0.0177	-0.7509	-0.024	-1.0399	-0.024	-1.0131	-0.024	-1.4142	-0.0205	-0.8378	-0.0205	-0.7569	-0.0205
12feb2015	-0.0111	-0.4469	-0.0111	-0.4354			-0.0174	-0.7547	-0.0174	-0.7353			-0.0139	-0.5687	-0.0139	-0.5137	
13feb2015	-0.0111	-0.4466					-0.0174	-0.7545					-0.0139	-0.5684			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event. The stars marked next to CAR indicate statistical significance: ***– at 1% level; **– at 5% level; *– at 10% level.

APPENDIX 8. CAR Estimation Results for Powszechna Kasa Oszczednosci Bank Polski SA (PKO).

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
12apr2006	0.0001	0.0022	0.0001	0.0026	0.0001	0.0039											
13apr2006	-0.0168	-0.4099	-0.0168	-0.5016	-0.0168	-0.7335	-0.0169	-0.4141	-0.0169	-0.4809	-0.0169	-0.6483					
18apr2006	-0.0076	-0.1864	-0.0076	-0.2281	-0.0076	-0.3335	-0.0077	-0.1895	-0.0077	-0.22	-0.0077	-0.2966	0.0091	0.5213	0.0091	0.6594	0.0091
19apr2006	0.0154	0.3761	0.0154	0.4603			0.0153	0.3758	0.0153	0.4364			**0.0321***	1.8332	**0.0321****	2.3188	
20apr2006	0.0442	1.0817					0.0441	1.0848					**0.061*****	3.4786			
21mar2007	0.0343	0.7736	0.0343	0.7496	0.0343	0.7231											
22mar2007	0.0271	0.61	0.0271	0.591	0.0271	0.5701	-0.0073	-0.4475	-0.0073	-0.6875	-0.0073	-0.7162					
23mar2007	0.0097	0.2179	0.0097	0.2112	0.0097	0.2037	-0.0247	-1.5197	**-0.0247*****	-2.335	**-0.0247*****	-2.4324	-0.0174	-1.0109	-0.0174	-1.5906	-0.0174
26mar2007	0.0032	0.0723	0.0032	0.0701			**-0.0311***	-1.9178	**-0.0311*****	-2.9468			-0.0239	-1.3863	**-0.0239****	-2.1813	
27mar2007	0.0057	0.1273					**-0.0287***	-1.7675					-0.0214	-1.2446			
07apr2008	0.0109	0.4219	0.0109	0.4599	0.0109	0.5985											
08apr2008	0.0038	0.1485	0.0038	0.1619	0.0038	0.2107	-0.0071	-0.2843	-0.0071	-0.3384	-0.0071	-0.3827					
09apr2008	0.0153	0.5895	0.0153	0.6426	0.0153	0.8361	0.0043	0.1742	0.0043	0.2074	0.0043	0.2346	0.0114	0.4865	0.0114	0.503	0.0114
10apr2008	0.004	0.1537	0.004	0.1675			-0.0069	-0.2789	-0.0069	-0.332			0.0001	0.0057	0.0001	0.0059	
11apr2008	0.0169	0.6515					0.0059	0.2387					0.013	0.5548			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
04jun2009	0.0035	0.055	0.0035	0.0654	0.0035	0.1119											
05jun2009	0.0056	0.0875	0.0056	0.104	0.0056	0.178	0.0021	0.0329	0.0021	0.0438	0.0021	0.0678					
08jun2009	-0.023	-0.3597	-0.023	-0.4278	-0.023	-0.7322	-0.0265	-0.4199	-0.0265	-0.5592	-0.0265	-0.8645	-0.0286	-0.4586	-0.0286	-1.1944	-0.0286
09jun2009	-0.0755	-1.1814	-0.0755	-1.405			-0.079	-1.252	**-0.079***	-1.6672			-0.0811	-1.3011	**-0.0811*****	-3.3887	
10jun2009	-0.0573	-0.8961					-0.0608	-0.9631					-0.0629	-1.0086			
09apr2010	-0.0124	-0.5606	-0.0124	-0.5836	-0.0124	-0.9908											
12apr2010	-0.013	-0.5898	-0.013	-0.614	-0.013	-1.0425	-0.0006	-0.0483	-0.0006	-0.0476	-0.0006	-0.4605					
13apr2010	-0.0123	-0.5556	-0.0123	-0.5784	-0.0123	-0.982	0.0001	0.0083	0.0001	0.0082	0.0001	0.079	0.0008	0.0678	0.0008	0.0591	0.0008
14apr2010	0.0013	0.0581	0.0013	0.0605			0.0137	1.0232	0.0137	1.0082			0.0143	1.2826	0.0143	1.1182	
15apr2010	0.0097	0.4401					**0.0221***	1.655					**0.0227****	2.0389			
02may2011	-0.0072	-0.2984	-0.0072	-0.3579	-0.0072	-0.3594											
04may2011	0.0061	0.255	0.0061	0.3059	0.0061	0.3071	0.0133	0.6014	0.0133	0.9801	**0.0133*****	12.3681					
05may2011	0.0184	0.7637	0.0184	0.916	0.0184	0.9197	0.0256	1.1542	**0.0256***	1.881	**0.0256*****	23.7362	0.0123	0.6378	0.0123	0.9404	0.0123
06may2011	0.0176	0.7314	0.0176	0.8773			0.0248	1.1191	**0.0248***	1.8239			0.0115	0.5973	0.0115	0.8807	
09may2011	0.0078	0.3241					0.015	0.6765					0.0017	0.0867			

	[-2;+2]		[-2;+1]		[-2;+0]		[-1;+2]		[-1;+1]		[-1;+0]		[-0;+2]		[-0;+1]		[-0;+0]
date	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**	**ttest**	**CAR**
07may2012	-0.0091	-0.2674	-0.0091	-0.2589	-0.0091	-0.2852											
08may2012	-0.0106	-0.3116	-0.0106	-0.3018	-0.0106	-0.3324	-0.0015	-0.0458	-0.0015	-0.0434	-0.0015	-0.0549					
09may2012	0.0153	0.4499	0.0153	0.4357	0.0153	0.4799	0.0243	0.7435	0.0243	0.7039	0.0243	0.8903	0.0258	0.7572	0.0258	0.6647	0.0258
10may2012	0.0022	0.0658	0.0022	0.0637			0.0113	0.3454	0.0113	0.3269			0.0128	0.3753	0.0128	0.3294	
11may2012	0.0031	0.0899					0.0121	0.3703					0.0136	0.3992			
15apr2013	0.0101	0.2998	0.0101	0.3953	0.0101	0.3966											
17apr2013	0.0266	0.7869	0.0266	1.0375	0.0266	1.041	0.0165	0.4912	0.0165	0.6128	0.0165	0.5855					
18apr2013	0.0149	0.442	0.0149	0.5828	0.0149	0.5847	0.0048	0.1434	0.0048	0.1789	0.0048	0.1709	-0.0117	-0.4209	-0.0117	-0.4588	-0.0117
19apr2013	0.0287	0.8489	0.0287	1.1192			0.0186	0.5537	0.0186	0.6908			0.0021	0.0756	0.0021	0.0824	
22apr2013	0.0129	0.3824					0.0028	0.0833					-0.0137	-0.4937			
25apr2014	-0.0124	-0.7718	-0.0124	-0.7569	-0.0124	-0.714											
28apr2014	-0.0168	-1.0445	-0.0168	-1.0242	-0.0168	-0.9662	-0.0044	-0.3675	-0.0044	-0.3944	-0.0044	-0.3678					
29apr2014	-0.0092	-0.5759	-0.0092	-0.5647	-0.0092	-0.5327	0.0031	0.2642	0.0031	0.2835	0.0031	0.2644	0.0075	0.6366	0.0075	0.7473	0.0075
30apr2014	-0.0118	-0.7343	-0.0118	-0.7201			0.0006	0.0506	0.0006	0.0543			-0.0005	-0.043	0.005	0.4946	
02may2014	-0.0173	-1.0762					-0.0049	-0.4102					0.005	0.4213			

Notes: The event window length is shown as [-a;+b], where *a* stands for the number of days before the event, and *b* – for the number of days after the event.The stars marked next to CAR indicate statistical significance: ***– at 1% level; **– at 5% level; *– at 10% level.

Summary

In this book we have collected six papers that try to understand what drives stock market investors in their decision making process. We have used a general-to-specific approach starting with the analysis of whether stock market outcomes affect economic growth and economic lives of people, continuing with the topic of the effect that oil price shocks bring to the stock market, and finishing with the analysis of the reaction of investors to specific events. We have learnt that financial markets contribute to economic growth and developed countries may enjoy the benefits of more matured stock exchanges to a greater extent than developing economies. This brings us to revisit the vicious cycle dilemma of the current world where the rich become richer and the poor remain poor. However, in this book we have also seen the results that suggest that a modern day investor is no longer motivated only by profits, but it also cares about bringing value into this world by empathizing with the rest of the world at times of terrorist attacks and nuclear disasters. Yes, investors are still rational agents wanting to maximize their profits and hedge their risks, but they may do so also by investing into less developed countries where their investment is needed much more and can also make more profound changes.

We have seen different econometric techniques being used throughout this book to answer research questions starting from OLS and ARCH, moving on to SVAR and finishing with the event study methodology. It shows how important it is to select an appropriate methodology for the specific model and data in order to obtain robust results.

The most important feature, however, of this book is interdisciplinarity of the topics and methods described. Papers collected here make use of financial, political, psychological and statistical tools to answer economic questions which makes this research stand out among similar ones. It makes one understand the complexity of the world we live in and that modern research questions can be answered only within a combination of different disciplines, looking at the problem from different perspectives and angles.

The results presented in this book are important for not only researchers who want to understand the drivers behind investors' decisions, but also investors themselves, financial management of the publicly traded companies, financial institutions and governments. It is important for investors to understand the consequences if their decisions at a global scale and how their perceptions may affect people's lives. The financial management of the companies should also be aware of how their actions may affect investors' sentiments towards the company and the stock prices as a result. Financial regulators and governments should incorporate understanding of investors' perceptions into their decision-making processes if they want to fill in potential gaps in their countries' growth patterns and create new opportunities for the growth to speed up.

Finally, we want to acknowledge the great work that authors of these papers who are also our former students have undertaken. They selected very difficult, yet important issues to analyze and did a great job. The papers contribute to economic and financial literature and are great reference points for someone looking for an answer to the question of interrelatedness of the stock market and the world around us. Their research fills in the gaps in understanding the way decisions are being made by investors and how their perception of different events may result in a particular stock market outcome. It shows who the modern investor is and that he or she may not always be guided by the rationality principles suggested by the traditional models, but that there is something else pushing him or her to make certain decisions.

Olha Zadorozhna, Ph.D.
Martin Dahl, Ph.D.

About the Authors

Olha Zadorozhna, Ph.D. – Assistant Professor, Chair of Economics at the Lazarski University, Director of English language programmes in Economics at the Lazarski University, Warsaw, Poland (ORCID: 0000-0002-2160-6904)

Dahl Martin, PhD – Assistant Professor, Chair of International Political Relations at the Lazarski University, Dean of the Faculty of Economics and Management at the Lazarski University, Warsaw, Poland (ORCID: 0000-0003-1978-7045)

Danylenko Viktoriia, MSc – Cyber Risk Consultant at Deloitte Canada, Lazarski University alumni (ORCID: 0000-0002-7130-5229)

Bastin Jacek, MSc – Business Strategy Associate at bitFlyer Europe, Lazarski University alumni (ORCID: 0000-0002-6626-3183)

Savchenko Mariia, MSc – Project Analyst at CBRE Corporate Outsourcing sp. z o.o., Lazarski University alumni (ORCID: 0000-0003-0758-0506)

Li Svetlana, MSc – Standard Chartered Global Business Services, Lazarski University alumni (ORCID: 0000-0002-4008-1162)

Chernyshova Iuliia, MSc – Internal Audit Department at Royal Philips B.V, Lazarski University alumni (ORCID: 0000-0002-3333-4037)

Sorokina Anastasiia, MSc – Financial Analyst at RBS, Lazarski University alumni (ORCID: 0000-0003-2756-7739)