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# Stock exchanges indices and abnormal returns in the crisis condition

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**Abstract.** In the event study methodology it is recommended to use buy-and-hold abnormal return approach, based on reference portfolio or a stock exchange index, to estimate abnormal returns in the long-run. There is growing literature on the biased BHAR estimates problem, that can result from the common estimation procedures. However, in the crisis condition, application of appropriate reference portfolio seems to be crucial. The aim of this research is to identify the impact of application of different stock exchange indices, as reference portfolios, on results obtained in the BHAR methodology in the crisis condition.

The common practice is to use indices based on a sector in which the analysed company is operating or indices based on the size classification. The main thesis is that the application of one of these reference indices, especially in the crisis condition leads to rates of return, which can be considerably different in the case of another reference index.

For analysis purposes two representative sectors of the Warsaw Stock Exchange were chosen. The research covers real BHAR calculations and comparative analyses of obtained results from different points of view: states of economy, market sectors and sizes of companies.

**Keywords:** Financial Markets, Portfolio Choice, Investment Decisions, Asset Pricing, - Financial Crises
**JEL:** G1, G01, G11, G12.

## INTRODUCTION

In order to assess the impact of certain events relating to a company on the company's share price, expected ("normal") rates of return on the share can be calculated. The models used in event studies, examining the response of the stock price around the announcement of the event, are based on comparison of normal and abnormal returns. In literature, several ways of estimating abnormal returns can be found. The most often such indicators are being applied as Cumulative Abnormal Returns (CAR), based on arithmetic sum of shares' prices, or Buy-and-Hold-Abnormal Returns (BHAR), based on geometric sums of shares' prices.

Cumulative abnormal return is the sum of abnormal returns in a certain period. Buy and hold abnormal return explains the rate of return on shares which are purchased at the beginning of the analysis period and kept until the end of the abnormal returns measurement period. The real rate of return is adjusted for the expected rate of return during this period. However in the long-run BHAR is claimed to be a standard measure of long-term abnormal returns (Mitchell, Stafford, 2000).

If the expected rates of return are obtained using the market-adjusted model, the index used to adjust the actual rates of return on the shares of companies to achieve abnormal rates of return, is often one of the stock exchange indices. The adjustment was proposed by R. J. Rosen (Rosen, 2006):

$$BHAR_{IT} = \prod_{t=1}^{T}(1+R_t) / \prod_{t=1}^{T}(1+R_{index,t})$$

where:

$R_{it}$ – the return on the share on the day t

$R_{index,t}$ – the return on the stock index on the day t (Rosen, 2006).

In such a case shareholders benefit if the value of BHAR is above 1, and lose when the value of BHAR is between 0 and 1. The other way of presenting results is to subtract 1, and then, the positive BHAR values mean that the share prices are relatively higher than the market average value while negative BHAR values mean relative loss.

On the one hand, BHAR is considered to be the appropriate estimator because of its ability to measure precisely investor experience (Barber and Lyon, 1997). On the other hand common estimation procedures can produce biased BHAR estimates. There is growing literature on the biased BHAR estimates problem. The problem can arise mainly as a result of the new listing bias, which occurs when the long-run return of a benchmark portfolio reflects new listings(Barber and Lyon, 1997). The index portfolio typically includes new firms that began trading after the event date and because of that have lower long-horizon returns.

Moreover, rebalancing bias can occur, which arises because of using equally weighted market indices, rebalanced to equal weights each month. The returns of sample firms are compounded without rebalancing, as a result an inflated long-run benchmark return occurs and that leads to a downward-biased abnormal return. (Barber and Lyon, 1997; Canina et al., 1998). The other bias occurs because of the fact that long-run abnormal returns are positively skewed.

In order to use BHAR and to avoid bias certain improvements can be made, for example: the winsorization of abnormal returns in the case of skewness bias. The procedure of winsorization "sets a limit on how far away from the rest of the sample an extreme observation is allowed to be", by giving the most extreme observations a lower weight.

According to Mitchell and Stafford's (2000) definition of BHAR, it measures "the average multi-year return from a strategy of investing in all firms that complete an event and selling at the end of a pre-specified holding period versus a comparable strategy using otherwise similar non-event firms." As a proxy for non-event firms a stock exchange index can be applied into the BHAR formula, and then it is claimed to remove the impact of changes that are not directly related to the analysed event. The aim of this research is to identify the impact of application of different stock exchange indices, as reference portfolios, on results obtained in the BHAR methodology in the crisis condition. The main thesis is that the application of one of these reference indices, especially in the crisis condition leads to rates of return, which can be considerably different in the case of another reference index.

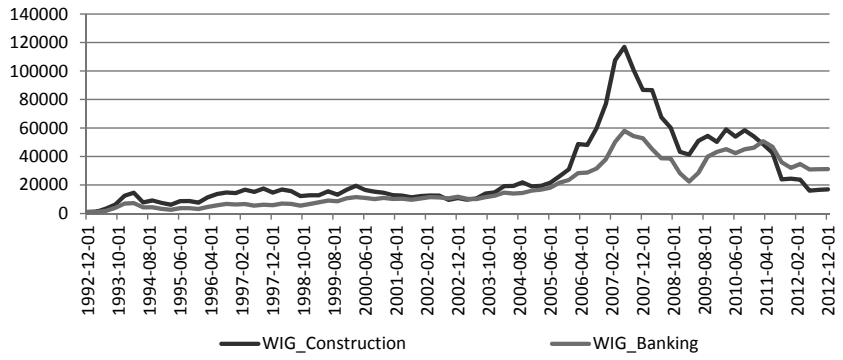
For analysis purposes two representative sectors of the Warsaw Stock Exchange were chosen. The research covers real BHAR calculations and comparative analyses of obtained results from the points of view of: states of economy, market sectors and sizes of companies.

## STOCK EXCHANGE INDICES AND ECONOMIC GROWTH

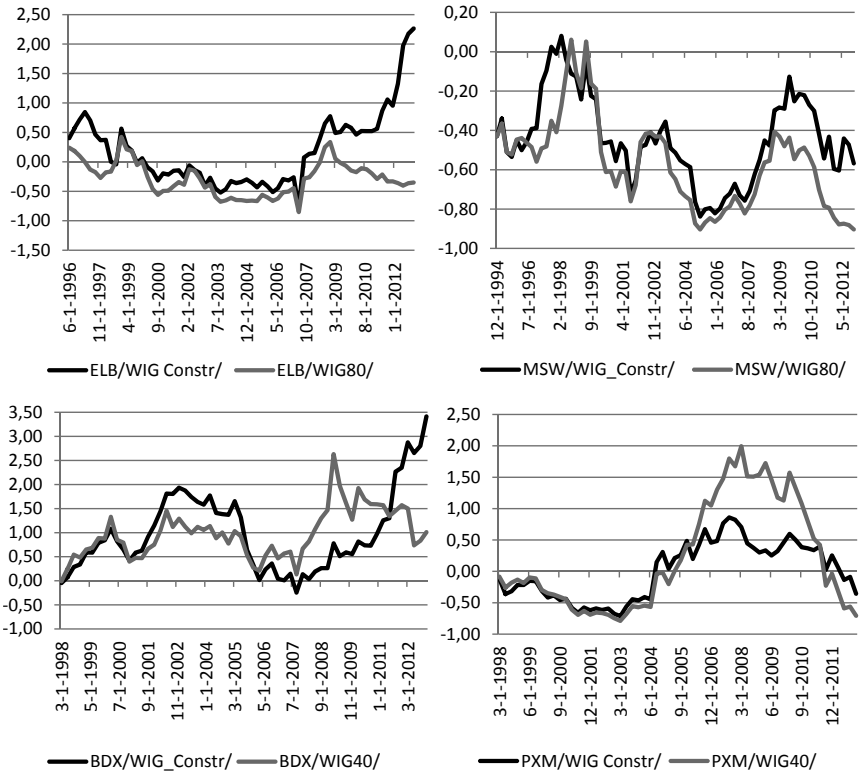
There is a wide array of stock market indices that can be applied into BHAR calculations. For example in the Warsaw stock exchange the widest is the main market index WIG, but there are also other indices diversificated in accordance to the size of a company such as WIG20 that includes shares of 20 major and most liquid companies in the WSE Main List. Similarly, WIG40 comprises of 40 medium sized companies listed on WSE Main List, and WIG80 is based on 80 smaller companies (all these are price indices). There are also various other indices, based on share prices in companies of a given sector and other indices based on dividends, etc.

While analysing stock prices of a certain firm, a researcher has to choose the most appropriate index to be applied into BHAR methodology. To achieve buy-and hold abnormal returns the actual rates of return on shares can be for example adjusted by dividing them by the rate of return on the stock index for a certain industry. The common practise is to use either indices based on a given sector (branch) or on a group of companies of the similar size (WIG20, WIG40 or WIG80).

This research is based on share prices of companies listed in the Warsaw Stock Exchange. In order to identify the impact of application of different stock exchange indices, as reference portfolios, on results obtained in the BHAR methodology, two representative sector were chosen. The first one is the sector, which was strongly influenced by crisis that started in 2007: the Construction Sector. Before the crisis, the construction sector in Poland was bustling. Analysing the Warsaw Stock Exchange index for this sector (WIG_Construction, picture 1) a noticeable increase in the index can be seen. The index was soaring so high, that its value was denominated 10:1 on 30.03.2007. However, for the reasons of this research, in order to achieve comparable results, the values excluding denomination were applied.




**Picture 1. WIG_Construction index vs. WIG_Banking index (excluding denominations)**
Source: own compilation.




**Picture 2. BHARs based on sector index vs. BHARs based on WIG80/WIG40 for representative companies of Construction sector**

Source: own compilation.

Since the beginning of the crisis the Construction sector has still continued to suffer. One of the main reasons was the considerable increase in prices in the housing market. In 2011 the housing market in Poland was the second-worst performer in Europe. House prices went down by 10.55% in 2011 in inflation-adjusted terms (Poland…, 2012).

The values of WIG_Construction in the Warsaw Stock Exchange significantly dropped in the analysed crisis period. At the end of June 2012 it was 7.29 times lower than it was at the end of June 2007 (the maximum of WIG_Construction in the picture 1), and 2.66 times lower than a year before.

The second analysed sector is Banking, which relatively was not as strongly influenced by the crisis. As in the Construction sector (and many other sectors in the Polish economy), a higher increase in the Banking sector was noticed just before the beginning of the crisis. The value of WIG_Banking was also denominated 10:1 on the same day as WIG_Construction (30.03.2007). In this case values without denomination were also applied.

However, the slowdown in the Banking sector following the crisis was not as significant as in the case of the Construction sector. The current crisis started in the financial spheres of economies, so taking into consideration the situations of banking sectors in other countries, the Polish sector has been in surprisingly

good condition. The analyses conducted shows that at the beginning of 2011 WIG_Banking exceeded WIG_Construction, which is still decreasing (picture 1).

In order to find the most appropriate reference index to be applied into buy-and-hold abnormal returns methodology, BHARs for companies in Banking and Construction sectors were calculated. The main criterion for choosing companies for theses analyses was the fact that the chosen company is included as a component of one of the following indices: WIG20, WIG40 or WIG80. Buy-and-hold abnormal returns were calculated as returns on the share price on the day of the oldest available data (in terms of a certain company or stock market index).

In the Construction sector there are a few companies that were also taken into consideration in WIG40 and WIG 80. None of them were listed in the WIG20 index. In cases of smaller companies (included in WIG80), as the crisis started, a wide spread between BHARs based on WIG_Construction and those based on WIG80 occurred (picture 2).

Indicators based on WIG80 were dropping as well as those for WIG_Construction, which means that smaller companies in the Construction sector achieved lower returns than other 'small' companies in other sectors of economy.

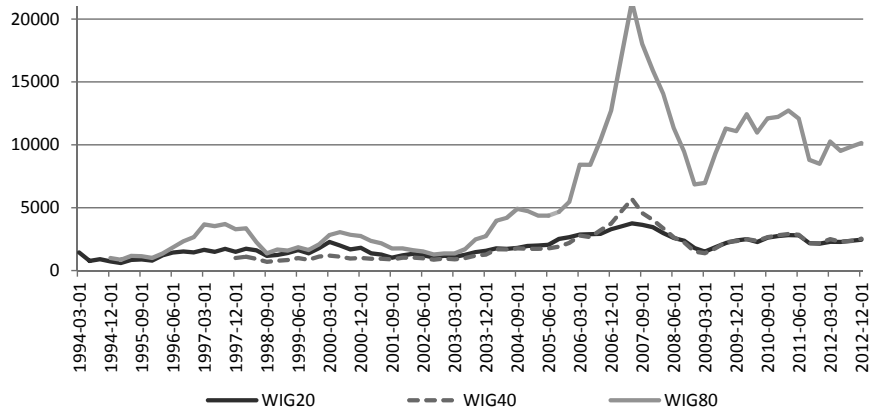
As WIG_Construction was decreasing, any firm, whose share prices was decreasing slower, seemed attractive to investors according to their BHARs based on this index. The situation of ELB shows that in comparison with other companies in the construction sector it was doing really well, but in comparison with other 'small' companies it achieved lower returns.

In the cases of 40 medium size companies listed on the WSE Main List, the situation was different. BHARs based on WIG_Construction illustrate relatively worse abnormal returns of medium companies in comparison with the whole sector (picture 2). The situation became better in the beginning of the crisis condition. Moreover, until 2011 BHARs based on WIG40 were higher than BHARs based on WIG_Construction[1], which means that medium companies in the Construction sector achieved higher returns than other companies in this sector and even much higher abnormal returns than medium companies in other sectors. Even though the Construction sector was doing bad, medium companies of the sector were relatively in a better situation. After 2011 the situation changed. There is one relationship that has held true for all analysed medium companies: BHARs based on WIG40 became lower than those based on WIG_Construction. One of the reasons was that the WIG_Construction was decreasing and WIG40 was increasing.

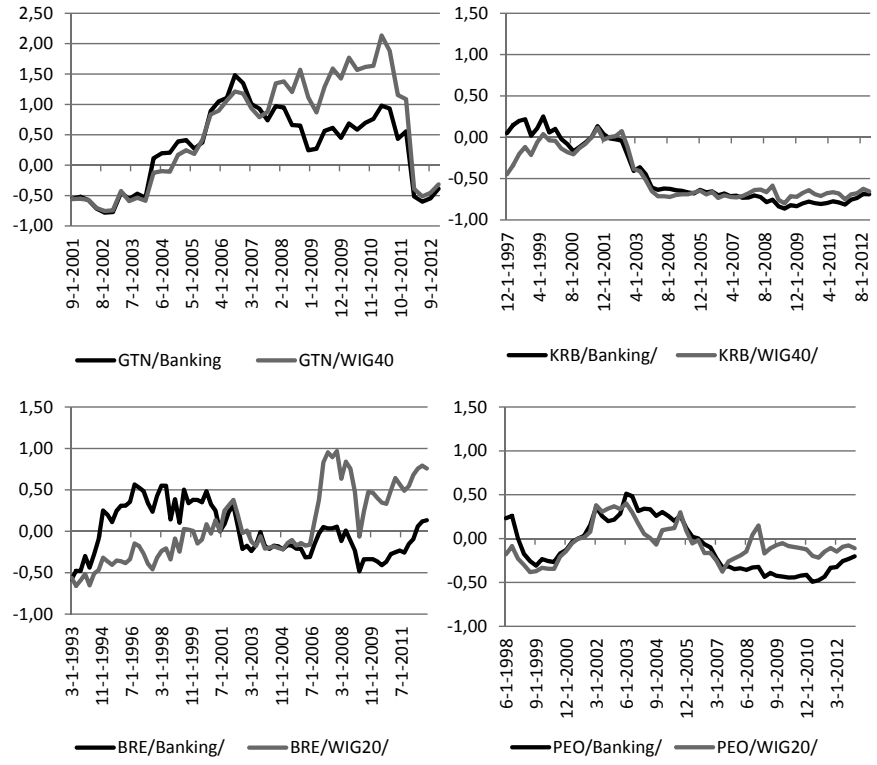
The different situation for companies included in WIG40 than for companies included in WIG80 results mainly for the fact that WIG80 was at a very high level in the analysed period. The result of application of different reference indices is especially explicit in the case of BDX company. BHARs calculated on WIG40 are positive and relatively high in the crisis condition, while BHARs based on WIG_Construction are negative.

Comparison of index of 20 major and most liquid companies in the WSE Main List with index of 40 medium companies (WIG40) and with index of smaller companies (WIG80) indicates that the share prices of smaller companies are much more susceptible to changes in economy such as downturn in rate of economic growth. The bigger companies' shares are analysed, they are less susceptible to these changes (picture 3). This property of stock market indices influences results obtained by using BHAR methodology. As a result in the cases of bigger companies, changes in BHAR are not so considerable, which confirms the thesis of the article.

[1] In the case of the second of analysed companies (PXN) of the Construction sector the split (25:1)on 28.09.2007 was excluded.

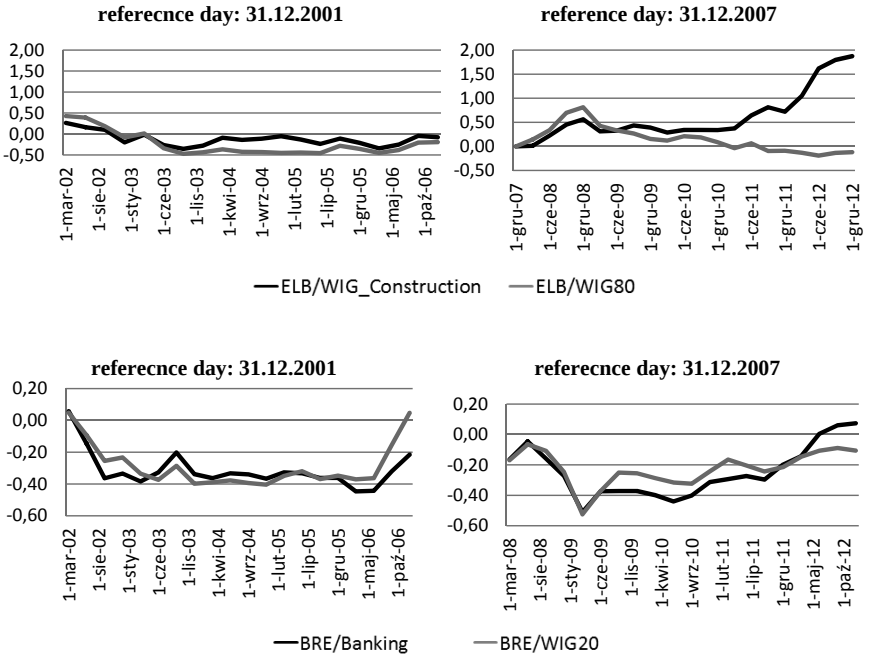



**Picture 3. Warsaw Stock Exchange Indices: WIG20, WIG40 and WIG80 in years 1994-2012**
Source: own compilation.




**Picture 4. BHARs based on sector index vs. BHARs based on WIG40/WIG20 for representative companies of Banking sector**
Source: own compilation.

The next sector analysed was Banking, in which there were companies of that were also included in WIG20 and WIG40. In this case abnormal returns based on size indicators were higher. For some companies with negative BHARs based on WIG_Banking, abnormal returns based on size index were positive. That means that that even if some companies achieved lower abnormal returns than other companies in the banking sector, their returns were higher than returns of other companies in the same size. That confirms that results obtained by the application of different indices can lead to differentiated results. Furthermore, it also confirms that the Banking sector was not as strongly influenced by the crisis as other sectors. Generally, there is not one pattern of BHARs behaviour in the banking sector which results from the individual micro and meso-enviromental factors of development for a given company.




**Picture 5. BHARs based on different indices for representative companies of Construstion sector and Banking sector**
Source: Own calculations.

In order to check if the fact that BHARs above were calculated as returns on the share price on the day of the oldest available data (in terms of certain company or stock market index) influences the results obtained, new BHARs were calculated. The two following periods were indicated:

– the crisis period, from the beginning of 2002 to the end of 2006, where the reference day was 31.12.2001;
– the period before crisis, from the beginning of 2008 to the end of 2012, where the reference day was 31.21.2007.

Share prices in 2007 were excluded, because of their high variability, which can be seen not only in time series of analysed shares, but also in WIG_Construction, WIG_Banking (picture 1), etc., and particularly in the WIG80 time series (picture 3).

The results of this, calculations are similar to the previous BHARs. In the period before crisis BHARs based on the size indices and BHARs based on the sector indices are similar. The distance between them in not so high and variable as in the case of these indicators in the crisis period (picture 5).

Table 1

Standard deviation on differences between BHAR calculated on the basis of sector index and size index

| Sector: | Construction | | | | Banking | | | |
|---|---|---|---|---|---|---|---|---|
| company(ticker) | ELB | BDX | PXM | MSW | GTN | KRB | BRE | PEO |
| crisis | 0.720 | 1.013 | 0.214 | 0.395 | 0.121 | 0.112 | 0.087 | 0.135 |
| before crisis | 0.165 | 0.150 | 0.901 | 0.205 | 0.222 | 0.068 | 0.086 | 0.125 |

Source: own calculations.

The last stage of the research was the analysis of differences between BHARs based on the size indices and BHARs based on the sector indices. It shows that the average deviation from the mean of these differences in the crisis period was more often higher than the average deviation in the period before crisis (table 1). In other words, in cases of most companies deviations in the crisis period were more disperse, which is consistent with the article thesis.

## CONCLUSIONS

The research in stock exchanges indices and abnormal returns in the crisis condition was based on data of the Warsaw Stock Exchange. Two representative market sectors were selected. They were Construction and Banking. Then buy-and-hold abnormal returns were calculated on the basis of size indices and sector indices. Firstly, the reference day was indicated as the day for which the oldest data (of certain company or index) was available. Secondly, the analysed period was divided into the period before crisis and the crisis period. For each of periods the reference day for BHARs calculations was indicated. The reason for this division was to analyse separately BHARs in these two macroeconomic conditions, and to conduct the comparative analyses of obtained results. As a result, BHARs of all companies in each period were based on the same day.

Concluding above-mentioned stages of task realization, comparative analyses of obtained buy-and-hold abnormal returns from different points of view: states of economy, market sectors and sizes of companies, were conducted.

According to the research, buy-and-hold abnormal returns in the long-run, obtained by the applications of different reference indices lead to different results. In cases of most companies, these differences are even more considerable in the crisis period. Results of analyses conducted are consistent with the article thesis. As a result, in economic researches based on abnormal returns, it is crucial to determine properly the aim of calculating BHAR, before choosing the best reference index.

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