Stock Prices and the Rate of Return Analysis: The Case of Warsaw Stock Exchange

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Abstract: *The main aims of this article are to verify whether rates of return might be determined by stock prices and to evaluate low price anomaly on the example of Warsaw Stock Exchange. The author states that cheap assets characterized by nominally lower prices are more attractive to buy and bring higher profits in comparison to assets described as expensive. In order to verify the hypothesis, database of 13789 quotations from 1.07.1999 to 30.12.2013 was created. The sample was divided into three groups – cheap, average, and expensive stocks. Finally, the statistical analysis was conducted using 2924 records including only cheap and expensive units. Statistical analysis confirms that low–priced assets generate higher profits and lower losses.*

Keywords: face nominal effect, low price anomaly, behavioral finance, capital market anomalies, investment risk

JEL codes: G02, G11

Introduction

The final effect of investment process is determined not only by strictly economic factors but also psychological aspects. Emotions and risk tolerance affect human behavior and determine the investment decisions. Economic psychology mainly focuses on consumer behavior and explains the processes that are related with purchasing goods and services. These analyses are mostly used in marketing strategies. However, the aspects of behaviorism are also observed on stock exchange market.

In the process of investment, the rational behavior means that investor analyses all possible choices, assigns importance to possible options and chooses the best one. In predicting a future event people are impartial and objective. This procedure maximizes the subjective expected utility. However, due to certain limitations of time and limited access to information, investors avoid rational methods and use faster and simpler procedures. Additionally, they are influenced by behavioral biases which sometimes cause irrational and contradictory decisions.

There are many studies describing behavioral biases and capital market anomalies, however, they mainly focus on developing markets. Polish Stock Exchange Market was established in 1991 thus it is relatively young and much smaller than other

significant markets; still, it is developing fast. Till 2017 it was classified as an emerging market, since then, FTSE Russel has classified the Polish Market as developed.

Among many anomalies studied on capital markets, low price anomaly is not widely explored, especially in the case of Poland. To the best author's knowledge, there was only one study conducted by Zaremba et al. (2014, 2016) focusing on this phenomenon.

Low price anomaly describes the phenomenon when the value of low priced stocks increases faster in comparison to stocks with relatively high prices. This is in contrast to the theory of market efficiency. Stock prices should not affect investors decisions.

This paper analyzes whether the face nominal effect observed at consumer market also occurs at the stock exchange market. The main aim of this article is to verify whether investors are influenced by face nominal effects on stock market exchange. The author states that cheap assets characterized by nominally lower prices are more attractive to buy and bring higher profits (as a consequence of increased demand) in comparison to assets described as expensive. The paper presents the results of a preliminary study focused on the relation between nominal values of stock prices, investors' willingness to purchase, and profits achieved in one-month and one-year periods. It is assumed that investors are more willing to buy stocks at lower prices. The increase in demand is one of the determinants that influence the stock price increase and finally the rates of return. As a consequence, it is expected that low priced stocks generate higher profits than high priced stocks.

1 Behavioral Biases on Stock Exchange Market

According to H. Simon (1979), people's decisions are not optimal but rather satisfying and they include psychological context. H. Shefrin and M. Statman (1985) stated that investors are motivated by willingness to achieve profits but this aim is balanced between the fear of loss and hope of spectacular profit.

Literature describes many investors' behaviors that are driven by non–rational factors. The most popular is the theory of perspective described by Kahnemann and Tversky (1979). This theory is an alternative to theory of expected utility and explains that the perception of risk differs depending on previously experienced profits or losses. According to this theory, an experienced loss drives investors to riskier behavior. In contrast, Thaler and Johnson (1990) explained the risk tolerance by previous experience in the following way: previously experienced loss increases the fear of risk and prior earning increases risk appetite. It was also confirmed by Nofsinger (2006).

Samuelson and Zeckhauster (1988) observed that investors are more willing to maintain stocks they previously bought, being convinced that they it will ensure profits and focusing only on the market information that confirms this assumption.

Many studies also proved that investors are influenced by stock prices and their nominals. The results of Neiderhofer (1965, 1966), Neiderhoffer and Osborne (1966), Harris (1991) and other studies show that investors are more convenient with stocks whose price ends with a whole or a half or less than quarters or eighths. Goodhart and Currio (1990) observed the decimal price clustering phenomenon. The price clustering quoted by Harris (1991) and Grossman et al. (1997) reflects implicit agreements in price negotiations. Rounding up prices speeds up and simplifies negotiations. The theory of Christie and Schultz (1994), developed by other authors (for example: Godek (1996), Kandel and Marx (1997)) refers to the use of price clustering as a way of maintaining a larger spread than would be the case in full competition. According to Kahn et al. (1999), sellers exploit the advantage of *memory-economizing* with investors who tend to cut the observed prices rather than memorize their full value or round off the price and only then remember it. Such behavior is also observed in other markets.

Numerous studies have highlighted another anomaly related with stock prices – low price anomaly. Low price anomaly is an anomaly which means that stocks with low prices bring higher return rates that stocks with high prices. The first excessive research in this area was conducted by L. Fritzemeier (1936) on the example of New York Stock Exchange. Fritzemeier concluded that stocks below $10 grow faster than stocks over $100. According to the scope of growth or decline probability of achieving above-average profits (as well as above-average losses) - shares with a value of up to 10 $ are characterized by the highest amplitude of fluctuations as opposed to companies whose shares reached prices above $ 100.

Next, the phenomenon was also observed by Goodman and Pevy (1986) and Branch and Chang (1990). Bhardwaj and Brooks (1992) also positively verified low price anomaly but additionally also proved that the effect of January is in fact the effect of low-price shares.

Waelkens and Ward (1997) studied low price anomaly on the example of Johannesburg Capital Market. They found that the highest investment risk is associated with the cheapest and the most expensive stocks but the anomaly is diverted and only most expensive shares generate excessive returns.

According to T. Odean (1999), investors are more willing to sell assets with higher prices than those with lower prices. However, this phenomenon was strongly related with the disposition effect and the effect of such behavior appeared to be negative. The high stocks could bring higher benefits than the low ones.

Hwang and Lu (2008) also stated that the strategy of buying low-price shares can bring above-average rates of return and explained it by nominal price illusion. If there are two securities with the same characteristics and a significantly different nominal price, the same rate of return causes that the increase in the share price is higher in the case of shares with a higher nominal price. Investors naively interpret this phenomenon that high-price shares are too expensive to grow further and expect stock prices at a low nominal price to increase faster.

Low price anomaly also refers to catering theory and stock splits (Baker et al. 2009). When investors prefer stocks at a low nominal value, managers do stock split and deliver assets at expected prices. This is based on the assumption that nominal value of stocks matters for the investors and as a result, the expected rate of return is related with stock price.

Studies conducted on Polish Stock Exchange by Zaremba and Żmudziński (2014) stay in contrast. In that case the low price effect was diverted. It was observed that stocks with high prices generate higher profits than low priced stocks. Studies conducted by Biegańska et al. (2016) on the example of M&A transactions proved that in the case of stocks at lower prices the probability of profits is higher than in the case of high valued stocks. The question is whether this phenomenon might be observed to a wider extent.

2 Nominal Value of Assets and the Rates of Return – Research Results

Research was conducted on data collected from Polish Stock Exchange Market. In order to verify the hypothesis, a database of 13,789 quotations from July 1, 1999 to December 30, 2013 was created. Only those companies were included that were recommended by brokerage analysts.

Brokerage recommendations are important in the process of investing and support the investment decisions made by individual investors. These reports contain extensive analyses made by financial analysts, including an assessment of the company's financial situation based on all available information and containing a message indicating its further development prospects (Keller, Pastusiak, 2015). The author made an assumption that in the case of positive recommendations, the share prices of a given company are expected to increase. In the case of negative recommendations, share prices are expected to decline.

Shares of companies that received neutral recommendations were excluded from the study.

At first, the database was divided into two groups – those with positive brokerage recommendation *(*buy or accumulate) at moment *t* (date of recommendation issue) and those with negative recommendations (sell or reduce) at moment *t*. Next, the sample was divided into three groups – cheap, average and expensive stocks – according to group structure.

It has been assumed that investors perceive cheap shares as those worth up to 10 PLN. The value is understood here as the opening price at time *t* set as at the date of publication of the recommendation*.* The anchor here is the value of the money banknote and a two-digit value. Within this group, shares were divided up to 0.50 PLN, from 0.50 to 1 PLN, from 1 PLN to 5 PLN, and from 5 PLN to 10 PLN, assuming that the anchor determines here the values of coins*.* The next group are shares from 10 PLN to 100 PLN and are considered as a neutral group. It has been assumed that expensive shares will be those with three-digit prices. The following division

was made in this subgroup - shares with a value from 100 PLN to 250 PLN, from 250 PLN to 500 PLN, and over 500 PLN. Such a division is a proposition of the author and is based on round pricing.

Finally, shares price structure in the group of positive and negative recommendations is as follows:

Table 1 Shares price structure in the group of positive and negative recommendations

Share price	Recommendations	
	positive	negative
up to 1 PLN	80	21
from 1 to 10 PLN	1,746	369
from 10 to 100 PLN	5,732	1,279
from 100 to 1000 PLN	2,000	440
above 1000 PLN	86	14
	9,644	2,123

Source: Own elaboration

The number of shares in groups of positive and negative recommendations and its structure according to shares differ. Additionally, the number of negative recommendations issued is much lower than the positive ones, which may influence final conclusions. On the other hand, both samples represent the market and are sufficient for the following study.

In the case of positive recommendations, the analysis is conducted between the group of shares priced below 1 PLN and above 1000 PLN. In the case of negative recommendations low- and high–priced stocks are defined as those with price below 10 PLN and above 100 PLN. The reason why these groups are extended is that there are not enough units in the sample of shares priced up to 1 PLN and above 1000 PLN. Neutral stocks were excluded from the analysis in both groups.

The author verified the rate of return after one year measured by 250 trading sessions and one month measured by 21 trading sessions in order to verify whether the phenomenon occurs in short and long period. The periods proposed are typical for analyses conducted within the capital market. The analysis was conducted separately in the group of positive and negative brokerage recommendations and the results were compared.

The results of analysis conducted among the group of positive recommendation are presented below.

Table 2 Rate of return (%) of low and high prices – positive recommendations in one-year period

Characteristic	Low prices	High prices
Mean	0.721046	0.350316
Standard error	0.218695	0.067061
Median	0.230882	0.201948
Standard deviation	1.956066	0.632657
Variance	3.826192	0.400255
Range	13.2	2.616643
Minimum	-1	-0.91028
Maximum	12.2	1.706362
Sum	57.68366	31.17815
Number of units	80	89

Source: Own elaboration

The descriptive statistics indicate that the average rate of return in the case of low priced stocks is higher than in the case of high priced stocks (0.72 and 0.35, respectively). In the case of low priced stocks, the rate of return is characterized by higher variance and the range of minimum and maximum rates is definitely higher. The highest return rates amounted to 12.2% in the case of low priced stocks and only 1.7% in the case of high priced ones.

The statistical significance of means was verified by using t statistics for means and variances. The zero hypothesis assumed that the difference between the average return rates of low- and high-priced stocks is equal to 0.

Zero hypothesis: the difference between both means = 0

Sample 1:
N=80, mean = 0.721046, std. error = 0.218695
Residual std. error = 0.0244508
95% confidence interval for the mean from 0.672378 to 0.769714

Sample 2:
N=89, mean = 0.350316, std. error = 0.0670615
Residual std. error = 0.0071085
95% confidence interval for the mean from 0.33619 to 0.364443

The test statistic: $t(167) = = (0.721046 - 0.350316)/0.0243572 = 15.2205$
Double−sided critical area p = 2.25e-033
One−sided critical area = 1.125e-033

The test confirms that the means are different. Additional test of variances was also conducted.

Zero hypothesis: the difference between both variations = 0

Sample 1:
n = 79, variation = 0.568327

Sample 2:
n = 86, variation = 0.317299

T statistic: $F_{(78, 85)} = 1.79114$
Double–sided critical area p = 0.008892
(One–sided critical area = 0.004446)

Variation in the group of low- and high–priced stocks differs. In the next step the author verified the coefficient of variation indicator as a standard measure of risk.

CV is evaluated as a standard deviation (δ) divided by mean (μ).

$$CV = \frac{\delta}{\mu} \qquad (1)$$

$CV_{\text{low-priced stocks}} = 2.712817$
$CV_{\text{high-priced stocks}} = 1.805961$

According to the results, in one-year period, capital investments in low–priced stocks are more efficient judged by profits but also characterized by higher risk in comparison to high–priced stocks. In that sense, low price anomaly occurs. In the short time period, some different tendencies are observed.

Table 3 Rate of return (%) of low and high prices – positive recommendations one-month period

Characteristic	Low prices	High prices
Mean	0.06637	0.03664
Standard error	0.01848	0.01231
Median	0.04919	0.03708
Standard deviation	0.16528	0.11419
Variance	0.02732	0.01304
Range	0.92087	0.66368
Minimum	-0.3423	-0.3305
Maximum	0.57858	0.33319
Sum	5.30978	3.15084
Number of units	80	86

Source: Own elaboration

Nominally, the rate of return in the case of low–priced stocks is higher than in high–priced stocks (0.07 and 0.04, respectively). Also in the case of low–priced stocks it is possible to achieve higher rates of return – the maximum amounts to 0.58. In comparison, in the case of high–priced stocks, the maximum rate of return possible to achieve in period analyzed amounts to 0.33.

However, as the following test presents – statistically both means are equal but the variances are not. It means that although the average rate of return in both groups of shares is equal, the variability is higher in the case of low–priced stocks, which also influences the risk of transactions.

Zero hypothesis: the difference between both means = 0

Sample 1:
 n = 80, mean = 0.0663722, std. error = 0.165277
 Residual std. error = 0.0184785
 95% confidence interval for the mean from 0.0295917 to 0.103153

Sample 2:
 n = 86, mean = 0.0366377, std. error = 0.114186
 Residual std. error = 0.012313
 95% confidence interval for the mean from 0.0121561 to 0.0611192

The test statistic: $t(164) = (0.0663722 - 0.0366377)/0.0219212 = 1.35643$
Double–sided critical area $p = 0.1768$
(one–sided critical area = 0.08841)

Zero hypothesis: the difference between both variances = 0

Sample 1:
n = 80, variance = 0.0273164

Sample 2:
n = 86, variance = 0.0130385

Test statistic: $F(79, 85) = 2.09506$
Double–sided critical area $p = 0.0009112$
(one–sided critical area = 0.0004556)

In this case, as means are statistically equal, risk measured by coefficient of variation depends on standard deviation, which is higher in the case of low–priced stocks. According to this, capital investment in low-priced stocks in one-month period are less efficient thus the average rate of return is the same as in the case of high–priced stocks but the variability is higher.

The results of analysis conducted among negative recommendations is presented below. In this situation, the analysis concentrates on losses. Stocks that are expected to lose value received negative recommendations.

Table 4 Rate of return (%) of low and high prices – negative recommendations – in one-year period

Characteristic	Low prices	High prices
Mean	-0.05847	-0.12629
Standard error	0.031235	0.030257
Median	-0.00437	0.016502
Standard deviation	0.615262	0.643273
Variance	0.378548	0.4138
Range	5.164841	4.963525
Minimum	-3.94481	-3.85496
Maximum	1.220028	1.108567
Sum	-22.6874	-57.0816
Number of units	388	452

Source: Own elaboration

As descriptive statistics show, in both cases, the rate of return is negative. However, in the case of low-priced stocks the loss is lower than in the case of high-priced stocks (-0.05% and -0.13%, respectively). The variance of both samples is similar. Despite visible differences, this relation is not statistically significant.

Zero hypothesis: the difference between both means = 0

Sample 1:
N=358, mean = -0.0623703, std. error = 0.610748
Residual std. error = 0.032279
95% confidence interval for the mean from -0.125851 to 0.00111063

Sample 2:
N=452, mean = -0.126287, std. error = 0.643273
Residual std. error = 0.030257
95% confidence interval for the mean from -0.185749 to -0.0668244

The test statistic: $t(808) = (-0.0623703 - -0.126287)/0.0445101 = 1.436$
Double–sided critical area $p = 0.1514$
One–sided critical area = 0.0757

The zero hypothesis is positively verified. It means that statistically both means are equal. The same conclusions appear in the case of variance analysis.

Zero hypothesis: the difference between both variances = 0

Sample 1:
n = 388, variance = 0.378548

Sample 2:
n = 452, variance = 0.4138

Test statistic: $F_{(451, 387)} = 1.09313$
Double–sided critical area p = 0.3658
(One–sided critical area = 0.1829)

In the long time period – one year, capital investments in low- and high-priced stocks are equal according to the average rate of return and variability. Risk measured by coefficient of variation is also the same. The efficiency of investing in both groups of stocks is similar.

In the short time period, the tendencies differ.

Table 5 Rate of return (%) of low and high prices – negative recommendations
– in one-month period

Characteristic	Low prices	High prices
Mean	-0.04213	-0.12629
Standard error	0.009962	0.009962
Median	-0.03311	0.016502
Standard deviation	0.19674	0.643273
Variance	0.038707	0.4138
Range	2.264028	4.963525
Minimum	-1.51413	-3.85496
Maximum	0.7499	1.108567
Sum	-16.4313	-57.0816
Number of units	390	452

Source: Own elaboration

In one-month period, losses generated by low-priced stocks are much lower than in the case of those high-priced. However, the sample of high-priced stocks is more diversified in terms of rate of return. Despite the assumption that stocks in this sample are expected to generate losses, in the case of high-priced stocks, profits at 1.11 are available – versus 0.75 in the case of low-priced stocks. Verification of the hypotheses about means and variations is presented below.

Zero hypothesis: the difference between both means = 0

Sample 1:
n = 390, mean = -0.0421314, std. error = 0.19674
Residual std. error = 0.00996233
95% confidence interval for the mean from -0.0617182 to -0.0225447

Sample 2:
n = 452, mean = -0.126287, std. error. = 0.643273
Residual std. error = 0.030257
95% confidence interval for the mean from -0.185749 to -0.0668244

The test statistic: $t(840) = (-0.0421314 - -0.126287)/0.0338647 = 2.48504$
Double−sided critical area p = 0.01315
(one−sided critical area = 0.006574)

The statistic test confirms that the means are different. Similar conclusions might be formulated for the variances.

Zero hypothesis: the difference between both variances = 0

Sample 1:
n = 390, variance = 0.0387067

Sample 2:
n = 452, variance = 0.4138
Test statistic: $F(451, 389) = 10.6907$
Double−sided critical area p = 7.029e-103
(one−sided critical area = 3.515e-103)

The results show that the variances are different. Risk of transactions is calculated below:

$CV_{low-priced\ stocks}$ = 4.66983
$CV_{high-priced\ stocks}$ = 5.09362

Risk analysis indicates that investments in low-priced stocks are lower. The variability of the sample is less diversified. Additionally, these stocks generate lower losses. It might be concluded that in short-term period, investments in low-priced stocks, negatively recommended are more efficient, which might be crucial for those investors who tend to keep losing positions.

Conclusions

Studies conducted in the area of behavioral finance proved that investors do not behave rationally and make decisions influenced by psychological factors. However, the question is whether the perceived price is one of the factors that strongly influence investors decision. The low price anomaly indicates that low-priced stocks

are attractive to buy and generate higher profits. On the other hand, market analytics communicate that purchase of low-priced stocks is riskier and they are usually issued by companies in a bad financial condition.

The low price anomaly has not been widely verified for the Polish capital market. Current studies proved that the effect is diverted. The author within this study proposed a different approach and has classified stocks in certain price ranges due to people's tendency to price clustering and nominal price perception. In addition, the author uses recommendations as an important factor supporting investment decisions and provides analysis conducted separately in the groups of positive and negative recommendations.

On the basis of the analysis conducted, it may be concluded that in the case of stocks positively recommended by stock analysts, low-priced stocks generate higher profits on average in one-year period. However, this is related with a higher variability and risk of investment. This phenomenon does not occur in short-term period, one month. Statistically, the average rate of return does not differ but the variability and investment risk is higher in the case of low-priced stocks.

In the case of negative recommendations, when losses are expected, in one-year period, the efficiency of investing in both groups of shares is similar in contrast to one-month investments. In short-time period, low-priced stocks generate lower losses and are characterized by lower risk.

Based on the final results related with nominal price of stock and rate of returns they generate; it might be concluded that low-price anomaly occurs on Warsaw Stock Exchange market but it is limited. One of factors is the price below which stocks might be defined as low. The author assumed 1 PLN for positive and 10 PLN for negative recommendations, however, this is just a proposition and needs further verification based also on the market condition.

The analysis conducted provides additional conclusions related with recommendations. First of all, it should be noticed that the number of negative recommendations is much lower than the number of positive ones. It indicates that the phenomenon of excessive optimism also occurs on Warsaw Stock Exchange and as a result, stock analysts tend to over-evaluate their predictions. On the other hand, within the group of negatively recommended stocks, there are those that generate profits. Results also differ in long- and short-time period. This may suggest that the efficiency of brokerage recommendations is low, which might be a presumption for further analysis in this area.

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