ISSN ONLINE 1822-8038
ISSN PRINT 1822-8011
INTELEKTINĖ EKONOMIKA
INTELLECTUAL ECONOMICS
2017, 11(1) p. 5–17

EVALUATION OF FLUCTUATIONS IN THE STANDARD & POOR'S 500 SECTORAL INDEX PRICES

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DOI: 10.13165/IE-17-11-1-01

Abstract. *This article evaluates fluctuations in the Standard & Poor's 500 sectoral index prices, taking into account the impact of fundamental macroeconomic stock price determinants assessed by individual expectation categories. Models for stock price prognostication have also been developed and verified. In this research, fluctuations in the Standard & Poor's 500 sectoral index prices are evaluated, taking into account each fundamental macroeconomic determinant and a separate expectation category. This research has enabled the identification of indices with high price fluctuations. Statistically reliable prognostication models have been empirically verified, and the most reliable prognostication models for indicating rise or declines in index prices have been identified.*

Keywords: *index, price, fluctuation, stock.*

Introduction

This research is most relevant to investors and speculators whose investment portfolios are linked to the US stock market.

The factors involved in the macroeconomic environment are among the most significant considered when assessing the determinants of stock price fluctuations. Lithuanian and foreign researchers have confirmed the existence of significant links between stock prices and particular macroeconomic indicators (Fama

1969); (Chen, Roll, Ross 1986); (Nishat, Shaheen 2004); (Adam, Tweneboah 2008); (Pilinkus, Boreika 2009); (Pilinkus, Boguslauskas 2009); (Danilenko 2009); (Teresienė 2009); (Jasienė, Paškevičius 2010); (Popa, Bolos, Scarlat, Delcea, Bradea 2014); (Gurgul, Wójtowicz 2014); (Chia, Lim 2015); (Sinha, Kohli 2015); (Mukherji 2015); (Baranidharan, Vanitha 2016).

Nevertheless, it should be noted that fluctuations in stock prices are determined not only by macroeconomic indicators, but also by data in companies' financial statements. Researchers have found that statistics related to dividends and net profits have a significant impact on a company's stock price (Hussin, Ahmed, Ying 2010); (Chen, Fraser 2010); (Mian, Sankaraguruswamy 2012); (Chen, Jiang, Lee 2015). The research has found that stocks in the US, the UK, Japan and Korea are to a large extent influenced by statistics related to net profits, whereas stocks in developing countries, such as Malaysia, Taiwan, Thailand and Indonesia, are substantially determined by statistics related to dividends.

The third factor that has a significant impact on the fluctuation of stock prices is market expectation – in other words, optimistic and pessimistic expectations by stock market participants have a fundamental impact on fluctuations in stock prices (Sharma, Mahendru 2010).

Problem of the research: Evaluation of the trends and fluctuations in the Standard & Poor's 500 (S&P 500) sectoral index prices in relation to fundamental stock price determinants and individual expectation categories.

The purpose of the research is to evaluate fluctuations in the Standard & Poor's 500 (S&P 500) sectoral index prices in relation to fundamental stock price determinants and individual expectation categories.

Objectives of the research:

1. To review fundamental macroeconomic and microeconomic stock price determinants, with reference to the results of an analysis of scientific literature.
2. To prepare a methodology for an evaluation of the impact of fundamental stock price determinants on the Standard & Poor's 500 (S&P 500) sectoral index prices.
3. To evaluate fluctuations in the Standard & Poor's 500 (S&P 500) sectoral index prices, taking into account the impact of fundamental stock price determinants, when the impact is assessed by individual expectation categories; and to develop and verify stock price prognostication models.

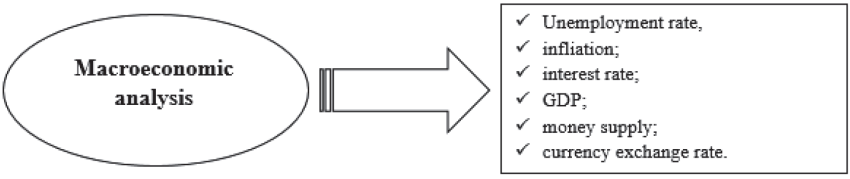
Research methods: 1. Systematic analysis of the scientific literature. 2. Comparative analysis. 3. Multi-criteria evaluation. 4. Correlation and linear regression analysis. 5. Analytical-logical method.

1. Theoretical analysis of the impact of macroeconomic and microeconomic determinants on stock prices

With regard to the theory of investment, fundamental analysis has been considered the key way of evaluating decision-making for investments (Bernstein, 1975). According to (Lekavičienė and Stašys 2005), fundamental analysis covers everything that emerges outside the boundaries of stock markets and is helpful for establishing the directions of stock price movements. Although the scientific literature contains a variety of interpretations with regard to the concept of fundamental analysis, some similarities can be found between them. With reference to (Lileikienė and Dervinienė 2010), (Kancerevyčius 2009) and (Norvaišienė 2006), fundamental analysis is the analysis of a company aimed at establishing which factors have the most significant impact on the long-term growth, development, price and value of the object under analysis. According to the researchers, the basic presumption in fundamental analysis is that the stock price in the market is determined by its real value, which is in turn determined by the **macroeconomic and specific (microeconomic) features of the same issuer.**

Scientific literature is rich in research aimed at identifying macroeconomic stock price determinants (see Figure 1). (Chen, Roll and Ross 1986) were the first to find that stock prices are inclined to react to economic changes – in other words, that macroeconomic determinants have a strong impact on stock price and return on stock.

Figure 1: *Macroeconomic determinants*



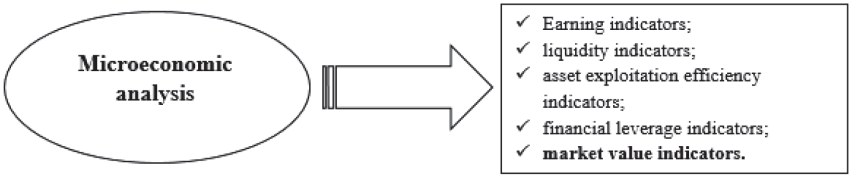
Source: *compiled by the authors with reference to (Cibulskienė and Butkus 2009) and (Norvaišienė 2006).*

(Bekhet and Mugableh 2012) and (Chia and Lim 2015) analysed the links between the Malaysian stock index and macroeconomic determinants such as variable amounts of money (P3), GDP, the industrial production index and the currency exchange rate. (Sirucek, Hsieh 2012) established the links between macroeoconomic variables and the stock index in Poland. (Tripathy 2011), (Kalra 2012) and (Sinha and Kohli 2015) investigated the impact of particular macroeconomic indicators on stock price fluctuations in India,

while (Mukherji 2015) carried out similar research in India and China. Hsing (2011) found that the US and German stock indices have a positive impact on the Lithuanian stock index (OMXV). Research conducted by (Gurgul and Wójtowicz 2014) showed that news announcements relating to the dynamics of macroeconomic indicators, particularly with respect to the rate of employment in the US, has a significant impact on the prices of stocks traded on the Warsaw stock exchange.

(Christopher, Rufus and Ezekiel 2009) focused on the analysis of microeconomic stock price determinants such as earnings per share and dividends per share (see Figure 2). According to the researchers, there are numerous stock price determinants, but earnings per share (EPS) is the factor that has the most significant impact on fluctuations.

Figure 2: *Microeconomic determinants*



Source: *compiled by the authors with reference to (Cibulskienė and Butkus 2009) and (Norvaišienė 2006).*

(Mallikarjunappa and Dsouza 2014) and (Sehgal and Bijoy 2015) found that microeconomic determinants significantly influence the Indian stock exchange. (Mian and Sankaraguruswamy 2012) researched how the disposition of investors influences stock prices when companies announce news about their profits. It was established that stock price sensitivity determined by good news about profits is relatively stronger at times of large market fluctuations, whereas sensitivity determined by bad news about profits is relatively stronger at times of small fluctuations. According to (Cibulskienė and Grigaliūnienė 2006), earnings per share is one of the most essential indicators in showing the profitability of a potential investment.

In contrast, studies conducted by (Hussin, Ahmed and Ying 2010) and (Abrokwa and Nkansah 2015) showed that dividends per share (DPS) have a more significant impact on stock price fluctuations than EPS. However, it should be noted that these studies were conducted on rather narrow stock exchanges in Malaysia and Ghana. (Bhar and Malliaris 2011) confirmed the hypothesis that dividends per share have a significant impact on stock return on both low and high volatility US stock exchange.

2. Methodology for evaluating the impact of fundamental stock price determinants

The S&P 500 index, which comprises 10 sectors under the Global Industry Classification Standard (GICS), was selected for the research. This refers to a relative index that captures the prices of all stock together. It therefore reflects fluctuations in stock prices over time and reveals the reaction of prices to the dynamics of fundamental and technical determinants.

Data for the nine-year period from 31-01-2006 to 31-12-2014 was used for the research. The statistical data was processed using "Bloomberg" software. The types of statistical data intervals used for the macroeconomic and microeconomic determinants are presented in Table 1.

Table 1: *Distribution of the statistical data intervals for the determinants analysed*

Determinant	Data for (a period)	Value	Number of data
Unemployment rate	Month	Per cent (%)	324
Consumer price index	Month	Monthly/monthly, per cent (%)	324
Real BVP	Quarter	Monthly/monthly, per cent (%)	108
Base interest rate	6 weeks	Per cent (%)	225
Earnings per share	Month	Monetary ($)	3564
Dividends per share	Month	Monetary ($)	3564

Source: *compiled by the author.*

The big number of the data analysed is determined by including both factual and prognostic data, as well as considering the difference between them.

After developing the database containing the fundamental stock price determinants selected for the research in consideration of the results of an analysis of the scientific, a correlation analysis was conducted. For interval variables with a normal distribution, a Pearson correlation coefficient was calculated (see Equation 1):

$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}, \quad (1)$$

Higher values of the Pearson correlation coefficient indicate higher interdependence between two variables. The estimated values for this coefficient are interpreted as follows:

- $0.00 < |r| < 0.19$ **very weak** correlation;
- $0.20 < |r| < 0.39$ **weak** correlation;
- $0.40 < |r| < 0.69$ **medium-strong** correlation;
- $0.70 < |r| < 0.89$ **strong** correlation;
- $0.90 < |r| < 1.00$ **very strong** correlation

For further analysis of stock price fluctuations, the estimated correlation coefficients must be verified for statistical significance. Here, the hypothesis on the significance of a correlation coefficient can be raised:

$H_{0:}$ r = 0 (the value of the coefficient is statistically insignificant, i.e. there is no correlation between the variables)

H_A r ≠ 0

To verify the statistical significance of the estimated correlation coefficients, the software package QI Macros 2015, a supplement for Excel 2013, was used. If the p value was higher than the selected level of significance (0.05), the hypothesis on insignificance of the correlation coefficient was not declined. Only macroeconomic and microeconomic stock price determinants that have a statistically significant impact on the S&P 500 sectoral index will be analysed.

After analysing the data for the nine-year period, the average and medium fluctuations (average and median) of the S&P 500 and sectoral indices were estimated for each category of expectations. The sample shows which weight in a category of expectations is amounted by an individual stock price determinant, and reveals which prognostications (in terms of meeting, not meeting or exceeding expectations) in the context of this determinant prevailed over the nine-year period analysed.

For each macroeconomic and microeconomic determinant, a linear regression equation was composed. To verify the statistical significance of each equation, the software package QI Macros 2015, a supplement for Excel 2013, was used. If the p value was higher than the selected level of significance (0.05), verification of the equation was not continued. The statistically significant models underwent further verification.

3. Results of the empirical research

3.1. Evaluation of the fluctuations of sectoral index prices

In this section, we present the summarised data of the empirical research. This shows which macroeconomic and microeconomic determinants had positive or negative impacts on index price fluctuations per expectation category over the nine-year period analysed. The positive or negative impact had to exceed a margin of 2 per cent, considering the sample intervals (monthly, six weeks or quarterly). Because the results of this research highlight possible stock price fluctuations when the indices meet, fail to meet or exceed expectations, they might be useful for investors in forming their investment portfolios.

Summary conclusions were drawn considering the following criteria:

1. Index price fluctuations (average or median) fall out of the interval (+2%; -2%].
2. The values between the average and median must not significantly differ, i.e. their directions must not be opposite.

Tables 3 to 5 show the results of estimations for each category of expectations. Table 3 shows index price fluctuations when the dynamics of the determinants meet the expert prognoses and the first condition.

Table 3: *Index price fluctuations when the dynamics of the determinants meet the expert prognoses*

Sector	Unemployment rate	Base interest rate
Durable goods		2.06%
Daily consumer goods		2.00%
Energetics	2.59%	
Industrial goods	2.14%	
Materials	2.51%	

Source: *compiled by the authors.*

The data in Table 3 shows that when the unemployment rate and base interest rate meet expert prognoses, the fluctuation of the presented indices is higher than +2 per cent (with the dynamics of the unemployment rate measured at monthly intervals, and the base interest rates at six-week intervals).

Table 4 shows index price fluctuations when the dynamics of the determinants do meet the expert prognoses, but meet the first condition.

Table 4: *Index price fluctuations when the dynamics of the determinants do meet the expert prognoses*

Sector	Inflation (adjusted)	Real GDP	Dividends per share
S&P 500 index	2.27%	2.84%	
Durable goods		6.34%	2.40%
Finance	2.15%	4.44%	
Industrial goods		3.40%	
Materials	2.25%	2.57%	
Information technology		2.60%	
Telecommunications		2.27%	

Source: *compiled by the authors.*

When the expert prognoses do not meet investors' expectations on the dynamics of inflation, real GDP and dividends per share, the fluctuation of the researched stock price indices is higher than +2 per cent (the dynamics of the inflation rate and DPS were measured at monthly intervals, and those of real GDP at quarterly intervals).

Table 5 shows index price fluctuations when the dynamics of the determinants exceed expert prognoses and meet the first condition.

Table 5: *Index price fluctuations when the dynamics of the determinants exceed the expert prognoses*

Sector	Real GDP
S&P 500 index	2.37%
Durable goods	4.86%
Materials	2.48%
Information technology	4.89%

Source: *compiled by the authors.*

The data in Table 5 shows that when the dynamics of real GDP exceed expert prognoses, index price fluctuations are higher than +2 per cent.

3.2. The results of verification of the stock price prognostication models

In this section, we present the results on the verification of prognostication models when discrepancies in average index price fluctuations reach more than 5 per cent, which shows that a model is either overestimated or underestimated. The tables have been developed using the following criteria:

1. An "overestimated" evaluation means that the result of the prognostication model, comprising a particular macroeconomic determinant and index price fluctuation, is strongly overestimated in comparison to the average fluctuation of the index over the nine-year period (i.e. when the deviation exceeds 5 per cent; model result > factual result).
2. An "underestimated" evaluation means that that the result of the prognostication model, comprising a particular macroeconomic determinant and index price fluctuation, is strongly underestimated in comparison to the average fluctuation of the index over the nine-year period (i.e. when the deviation exceeds 5 percent; model result < factual result).
3. All other values that have not been included further in the research show index price fluctuations in the interval (0-5%; -5-0%).

Table 6 summarises the data of the prognostication model verification when the values of the determinants meet expert prognoses and one of the two conditions.

Table 6: *Summarised results of the prognostication model verification when the values of the determinants meet expert prognoses*

Sector	Unemployment
Finance	Overestimated (11.05%)

Source: *compiled by the authors.*

The value shows that the prognostication model is overestimated by 11.05 per cent in comparison to the average index price fluctuation in the finance sector over the nine-year period. In other words, with reference to historical data, the dynamics of the unemployment rate should not be considered when they meet expert prognoses.

Table 7 summarises the data of the prognostication model verification when the values of the determinants do not meet expert prognoses, but meet one of the two conditions.

Table 7: *Summarised results of the prognostication model verification when the values of the determinants do not meet expert prognoses*

Sector	Unemployment	EPS	DPS
Daily consumer goods		Overestimated (10.80%)	Overestimated (16.11%)
Finance	Underestimated (5.82%)		Overestimated (14.10%)
Health protection		Overestimated (14.10%)	
Industrial goods		Overestimated (5.40%)	
Information technology			Overestimated (8.28%)

Source: *compiled by the authors.*

Special attention should be drawn to the value estimated for the finance sector. The value of 5.82 per cent shows that the prognostication model is underestimated by 5.82 per cent in comparison to the average index price fluctuation in the finance sector over the nine-year period. In other words, with reference to the historical data, the dynamics of the unemployment rate should be considered when they do not meet expert prognoses.

Table 8 summarises the data of the prognostication model verification when the values of the determinants exceed expert prognoses and meet one of the two conditions.

Table 8: *Summarised results of the prognostication model verification when the values of the determinants exceed expert prognoses*

Sector	Unemployment	Real GDP	EPS	DPS
S&P 500 index		Underestimated (8.36%)		
Durable goods		Underestimated (6.76%)		
Finance				Underestimated (15.45%)

Sector	Unemployment	Real GDP	EPS	DPS
Health protection	Overestimated (~5.00%)			
Industrial goods		Underestimated (10.38%)	Underestimated (7.09%)	
Materials		Underestimated (8.83%)		
Information technology		Underestimated (6.48%)		Underestimated (5.40%)
Telecommunications		Underestimated (6.46%)	Underestimated (7.89%)	

Source: *compiled by the author.*

The data in Table 8 shows that the majority of the prognostication models are underestimated comparing their values to the average values of sector index price fluctuation. This means that an investor that followed the model using historical results could expect higher index prices when the determinants exceeded expert prognoses.

Conclusion

1. Analysis of the scientific literature has revealed that fundamental stock price determinants are divided into two categories: macroeconomic and microeconomic determinants. Macroeconomic stock price determinants include the unemployment rate, inflation, the base interest rate, GDP, money supply and the currency exchange rate, whereas microeconomic determinants include earnings per share, dividends per share and the price-earnings ratio of shares.
2. Analysis of the links between sectoral index prices and stock price determinants in individual expectation categories has shown the sectoral indices with price fluctuations in the interval (+2%; -2%] in individual expectation categories. The research has revealed that when the dynamics of the unemployment rate meet expert prognoses, the fluctuation of index prices in the energetics, industrial goods and materials sectors is higher than +2%. When the dynamics of the base interest rate meet expert prognoses, the fluctuation in index prices in the durable and daily consumption goods sectors is higher than +2%. When the dynamics of adjusted inflation does not meet expert prognoses, the fluctuation in the S&P 500 and the index prices in the finance and materials sectors are higher than +2%. When the dynamics of the real GDP rate do not meet expert prognoses, fluctuations in the S&P 500 and the index prices in the durable goods, finance, industrial goods, materials, information tech-

nology and telecommunications sectors are higher than +2%. When the dynamics of DPS do not meet expert prognoses, the fluctuation of the index price in the durable goods sector is higher than +2%. When the dynamics of real GDP exceed expert prognoses, the fluctuations in the S&P 500 and the index prices in the durable goods, materials and information technology sectors are higher than +2%. The research has not revealed any fluctuations that go beyond -2%.

3. Verification of the stock price prognostication models by individual expectation categories has enabled the identification of "underestimated" and "overestimated" prognostication models, which could indicate positive or negative stock price changes. Price increases that exceed 5% have been observed for the following prognostication models: between the dynamics of the unemployment rate not meeting expectations and the finance sector; between the dynamics of the real GDP rate exceeding expectations and the S&P 500 index, and the durable goods, industrial goods, materials, information technology and telecommunications sectors; between the dynamics of EPS exceeding expectations and the industrial goods and telecommunications sectors; and between the dynamics of DPS exceeding expectations and the finance and information technology sectors.

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