ALTERNATIVE EVALUATION OF S&P 500 INDEX IN RELATION TO QUANTITATIVE EASING

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ABSTRACT
The paper focuses on the impact of money supply on the S&P 500 stock index. The main goal is by using selected indicators identify the bubble. That is meaning, according to the results bring to the investors recommendations what indicator they should to use for early identification of the price bubble. The paper deals with two „standard" indicator and one „behavioural". The first use the rational price bubble variable and compare it with the standard deviation, the second one deals with the ratio market capitalisation and GDP. As „behavioural" indicator analyses of EPUI and VIX index was used. Empirical results were confirmed by the „behavioural" variables. Higher accuracy of results acquired the second empirical method, where the divisor was used.

KEY WORDS
quantitative easing, money supply, MZM, S&P 500, price bubble, policy uncertainty index.

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Introduction

When investing into financial resources, there are many factors and risks that have to be taken into account, including our individual preferences. Many things, such as a potential yield, liquidity, an environment and economic activity, available information sources or available assets themselves, are only a fraction of what must be taken into consideration. In recent years, policy of central banks, which directly and indirectly influences financial or capital markets, as well as behaviour of investors have been very emphasized factors, and thus all the market subjects, which have different objectives, preferences, propensity to risk and overall behaviour.

To have a closer look at the market, the paper is focused on the stock index S&P 500, because it is a suitable representative not only of the American market, but it also serves as a benchmark for many mutual funds or as a measure of success also for retail investors. It is a big controversy among many today's economists, how and if there ever is an influence of the policy of the Federal Reserve Bank on valuation of the mentioned index, especially its large quantitative easing or behaviour of the investing crowd or alternatively another factors.

The paper is therefore focused on valuation and its recalculation in relation to increased money supply within quantitative easing and associated operations of the Federal Reserve Bank. The intention is also to evaluate results for the mentioned index in relation to behavioural finance. The research should also provide an answer to the question, whether there is, according to alternative valuation at the market, a price bubble or not. For identification of the price bubble there are used two standard methods based on calculation of standard deviation and its comparison and implication with other statistical variables. For confirmation of the price bubble there was also used a "behavioural" indicator connected to the mood of market players.

1. Literature survey

A price bubble is defined in many different ways by professional public. An appropriate definition is provided by e.g. Kubicová and Komárek (2011), who describe it as a status, when there is significant excess of demand over supply at the market, what subsequently causes increase of prices of assets in a greater extent than it would be otherwise usual. In other words, if there are no reasons of such high prices of assets and demand for them at the market, there do not exist fundamental factors. Czech National Bank (2012) states another definition as discrepancy in prices, alternatively in yields, which is higher than usual volatility, can be understood as a situation of a price bubble. In general, that is the first problem, how to identify if we speak about significant excess of demand over supply and then about the significant rising of prices, or if we speak only about the price correction or discrepancy. This idea is important for the identification of so-called rational price bubble.

For prices of shares, there may be also various indices used for statistical calculation of a price bubble according to the chart stated above (using mean deviations or deviations from fundamental values). The Shiller P/E ratio, the index of capitalization to GDP or many others are usually referred to as appropriate indices.

Scheinkman and Xiong (2003) are authors of the model, in which psychological influences and speculations of investors are stated as a cause of price bubbles. According to their observation, the market is characterized by excessive optimism. Investors are then led through deals with higher prices than a fundament. From a perspective of behavioural finances, their observation is confirmed also by De Bondt (2005). It is evident in his research, that purchases of investors are not based only on rationality and fundaments.

In the research carried out on a 200-year time period, Christiano et al. (2012) confirmed that price bubbles appear in a period of low inflation. Due to low demand, there is expansionary monetary policy applied during these periods in order to support consumption. After increasing inflation on a target level, interest rates are increased as well, however due to time delays it leads to uneven growth of asset prices in following periods. Spáčilová (2011) inclines to these statements. Monetary policy of low interest rates is usually referred to as very controversial, especially in long run. There are big speculations not only about influence of inflation but also about long-term effect on results of economy. From a perspective of shares valuation, the influence is very clear. Lower reference rates lead to decrease in riskless interest rates. Then in valuation models, profitability of investment intentions is increased not by activity of companies but by policy of a central bank.

Accompanying policy of low interest rates also by policy of increasing money supply is referred to as very controversial as well. As harmful cases from history, for example Shiratsuka (2003) states e.g. the price bubble at the Japanese market accompanied by big monetary expansion in the 80's of the 20th century (the Heisei boom), when, according to Širůček (2013), the average monthly growth rate of the stock index Nikkei 225 was 2.09%. Širůček (2013) also states that in case of this bubble, its influence was not proven thanks to increasing of money supply, what is confirmed by Okina et al. (2001), who state low interest rates and increase of loans as a cause. Another historical example can be the real estate bubble in 2008, where Holt (2009) considers low interest rates (cheap mortgages) and possibility of cheap speculative leveraged transactions at stock markets as an originator.

Influence of money supply on prices of shares or indices was already researched by Homa and Jaffe (1971). Correlation between these variables was modelled by a regression analysis using statistical data as well as growth indices of these variables. In both cases the correlation was significant from a statistical perspective (p-value < 0.05). For statistical data almost 97% of data was explained ($R^2 = 0,968$) based on a regression analysis, however with a significant serial correlation.

Another factor, which can have influence on formation of price bubbles, crepresent speculative trades. Speculative trades are carried out in order to find difference in prices of assets in time or in space. Especially during euphoria at markets, more transactions are done when market sentiment is better. According to Novotný (2009), it is a ripple effect, a pyramid game when the only necessary factor is whether there is another segment present at the market, who buys at a higher price and then this euphoria is a basis of uneven price growth, which is, however, never infinite. According to Maňák (2010), an example of speculative trades can be the American debt obligation market (CDO, collateralized debt obligation). At the time, when repurchase of debt obligations was announced by the Federal Reserve Bank, these obligations may have been purchased by asset managers and banks. These obligations were afterwards sold to the Federal Reserve Bank at a higher price.

Lately, an often mentioned factor influencing asset prices is psychology of the investing crowd. Rational behaviour of investors and economic entities in general was brought into question already in the past. Behaviour of people is affected by many influences, internal as well as external. Actual mood, experience, favourite things or also newspaper reports and news at markets, information from financial advisors or family members and another influence – that is all taken into account by behavioural economics.

According to Dvořák (2008), information or a fact can be of small influence, but it may be a trigger to a reverse trend. The most often, a trigger is information in media or at financial markets, political declarations including those of central bankers, etc. However, at the level of markets, the investing crowd is a very important subject. According to Le Bon (1994), the crowd is characterised by the fact, that crowd behaviour is completely different from behaviour of single individuals in the crowd. Individual people are not characteristic by sufficient capability to resist crowd behaviour, which is different, and they acquiesce to it. Veselá (2007) adds features of behaviour of the investing crowd, including for example exaggerated emotions and

reactions to them, intolerance and author-itativeness leading to scorning of criticism of crowd behaviour, succumbing to suggestion of more powerful (experts, media, etc.). Veselá (2011) also mentions that crowd psychology is an often basis or an accelerating factor of price bubbles.

A so-called uncertainty index (Economic Policy Uncertainty Index) is referred as a possible indicator for measuring moods at the market or its concerns. The index includes several factors measured for several periods ahead. The main factors include decision of central authorities (in fiscal as well as monetary policy), influence and changes of taxes, influence of economic news from 10 biggest media or economic forecasts (meaning forecasts of the Federal Reserve Bank of Philadelphia).

A similar indicator, which is more focused directly on stock markets and economic facts connected to them, is a so-called Equity market-related Economic Uncertainty Index. This index is focused on stock indices, news about economic development and shares development and furthermore on all economic data related to shares (such as volatility, interest rates, inflation rates, etc.).

2. Materials and methods

The objective of the article is, based on identifying influence of money supply on the stock index S&P 500, a correction of valuation and capitalization of the index S&P 500 with the aim to identify a price bubble at the stock market according to set indicators.

The partial objective is a comparison if market costs, according to a set indicator of behavioural finances, correspond with development of stock markets and a potential price bubble.

The empirical part of the work is focused on change of valuation of stock titles of the index S&P 500 in the time period of 1990 to 2014. The period was set in order to capture the time long enough to have a robust database of data and possibility to reveal extreme values (bubbles) with help of econometric methods.

The influence of money supply on formation of stock-market bubbles is expressed as a correlation between the monetary aggregate MZM and valuation of the index S&P 500. Subsequently, correction of valuation of the index S&P 500 and market capitalization is done by influence of increased money supply within quantitative easing of the FED. Usage of the monetary aggregate MZM in stock analyses is recommended by e.g. Croushore (2006) or Shostack (2003).

For cleaning the values from extremes, a simple 150-day moving average is used, to which a standard deviation and a rational price bubble are calculated, calculations of which are stated further in the text.

The index of market capitalization to the gross domestic product is used as the second index. Market Cap to GDP is a long-term valuation indicator that has become popular in recent years, thanks to Warren Buffett. Back in 2001 he remarked in a Fortune Magazine interview that "it is probably the best single measure of where valuations stand at any given moment". The market capitalization will be adjusted according to calculated amount of the mentioned value of the index S&P 500 and an initial value of the variable so-called Divisor. After adjusting the capitalization, the value of index ($TMC_{S\&P500}/GDP_{USA}$) is calculated and there is a median for a given time period calculated to it, including a standard deviation of a median.

The Policy Uncertainty Index is chosen as a supporting and "behavioural" indicator, which expresses behaviour of a market within the theory of behavioural finances.

We will observe the value of the supporting indicator in relation to the values of the above mentioned indices. EPUI index is used in combination with VIX stress index, what is on CBOE traded.

The calculation of the simple moving average (SMA) for the adjusted values of the index S&P 500 is done according to the formula (Adamec et al. 2013):

$$\hat{y}_t = \frac{1}{p}\sum_{i=-m}^{m} y_{t+i} = \frac{y_{t-m} + y_{t-m+1} + ... + y_{t+m}}{p}$$

The standard deviation σ from the simple moving average (SMA) is according to Blašková (2009) calculated as:

$$\sigma_{SMA} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Blanchard and Watson (1982) mentioned, that investors buying financial assets for higher price that its intrinsic value in the case (they believe) future capital gain. So, the irrational bubble grows. That is meaning, the bigger different between intrinsic value and market price, the higher probability that irrational bubble burst. Furthermore, first it is necessary to calculate a so-called rational price bubble (B_t). That is meaning, that rational price bubble is not the same like irrational price bubble. Investor has to make a differences between normal market volatility, misalignments of prices or irrational price bubble. Market price of security can be according to Blanchard and Watson (1982) or Musílek (2011) calculate as:

$$P = IV_t + B_t,$$

where:

$B_t < \sigma_{SMA}$ denotes normal volatility of assets (market volatility),

$B_t > \sigma_{SMA}$ denotes misalignment of prices (overvalued),

$B_t > 2\sigma_{SMA}$ denotes a market (irrational) price bubble (significantly overvalued).

The second indicator, which will be used to assess the presence of a price bubble at markets, will be the ratio of the market capitalisation index and the gross domestic product of the USA. Calculation of capitalization will be carried out according to the official prospects of the company Standard and Poor´s by the following formula:

$$Index\_level = \frac{\sum_i P_i \cdot Q_i}{divisor} = \frac{TMC_{S\&P500}}{divisor}$$

The simplest capitalization weighted index can be thought of as a portfolio consisting of all available shares of the stocks in the index. While one might track this portfolio's value in dollar terms, it would probably be an unwieldy number. Rather than deal with ten or more digits, the figure is scaled to a more easily handled number, currently around 1200. Dividing the portfolio market value by a factor, usually called the divisor, does the scaling. To assure that the index's value, or level, does not change when stocks are added or deleted, the divisor is adjusted to offset the change in market value of the index. Thus, the divisor plays a critical role in the index's ability to provide a continuous measure of market valuation when faced with changes to the stocks included in the index.

According to the below stated formula, the ratio index (Standard & Poor´s Dow Jones Indices, 2015) will be further calculated:

$$index = \frac{TMC_t}{GDP_t},$$

where TMC_t denotes the total market capitalisation in years. It is necessary to compare the index with its median and the standard deviation from median (σ_{median}) where:

$index < \sigma_{median}$ denotes normal volatility of assets (market volatility),

$\text{Index} > \sigma_{median}$ denotes misalignment of prices (overvalued),

$\text{Index} > 2\sigma_{median}$ denotes a market price bubble (significantly overvalued).

3. Results

Adjustment of values of the stock index is carried out as percentage deduction of influence of increased money supply. The aggregate MZM was decreased by the deduction of money supply formed with-in quantitative easing and the value of the index S&P 500 was decreased by this percentage as well. The influence, however, is not in the same proportion but it is adjusted by the correlation according to Homa and Jaffe (1971) in the value of 0.127. The chart below is the representation of the real trend of the index S&P 500 in comparison to the adjusted one. The differences are noticeable only since 2008.

Figure 1. Real and adjusted chart of S&P 500

Source: based on Federal Reserve ...2015a.

For a new time series, it is necessary to carry out a moving average in order to clear extreme values. Data of time series within statistical testing show stationarity, they do not show an autocorrelation or a serial correlation, they are statistically significant and they contain extreme values. Since potential price bubbles are statistically extreme values but the objective of this work is to identify these values, the time series is not divided according to structural breaks. The values of the initial time series of the index S&P 500 and the simple moving average (150-day) adjusted by the time series of the index S&P 500 are presented in Figure 2.

Figure 2. Real chart of S&P 500 and SMA of adjusted S&P 500
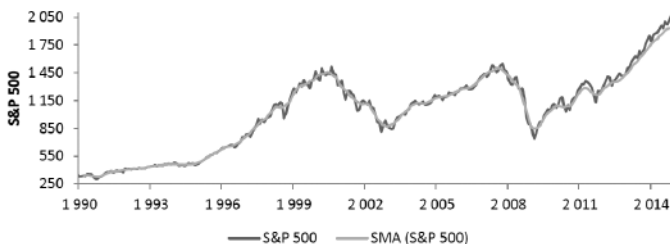
Source: based on Federal Reserve ...2016.

The variable of capitalization and the index of capitalization to GDP is adjusted in the same way as it was for the stock index S&P 500, by the influence of increased money supply.

However, for the calculated index there is not used a moving average but rather a median, from which a standard deviation is further calculated. The reason to use the median is because of stabilization of a variable (no changeability during years) for calculation of a rational price bubble. As it is stated e.g. by Lenzner (2014), according to W. Buffet, the usual rate of the capitalization index to GNP[1] (gross national product) at stock markets is from 75% to 90%. He refers values of the index over approximately 115% as significant overvaluation of markets.

Adjustment of the index of market capitalization is calculated according to percentage change of the aggregate MZM decreased by influence of correlation. The values of the initial divisor of the index are used to decrease the value of capitalization and for its calculation, since they are officially stated by the company Standard & Poor´s.

Calculations of GDP, capitalization and the derived index are carried out on a quarterly basis, always to the first day in a quarter. In the Figure 3there are noticeable changes in the values of capitalization since 2008.

Figure 3. Real S&P 500 and adjusted capitalization of S&P 500
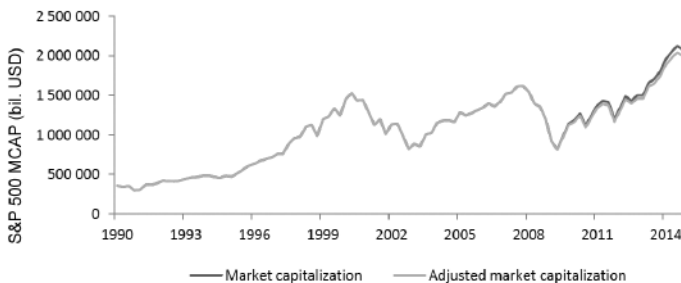
Source: Standard & Poor´s Dow Jones Indices 2015.

The following Figure captures the trend of the index of market capitalization to the gross domestic product in the years 1990-2014. The Figure also captures the median necessary for the calculation of the standard deviation from the median.

It is evident from the chart that the trend of indices is very similar, however, with increasing money supply released to economy the values are shifting away. The value of median for the index is calculated at the level of 89.73. At the moment it is already visible, what were the values of the index in the periods of bubbles at the stock market, thus around the years 2000 and 2008. The difference between the values of the years 2000 and 2008 or 2014 is, however, clearly visible. According to the calculation of a rational price bubble it does not have to be a price bubble of the stock market.

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[1] GDP (gross domestic product) is used in calculations, since its value is limitly aproaching to GNP (gross national product) for the economy of the USA.

Figure 4. Market capitalization of S&P 500 divided to GDP
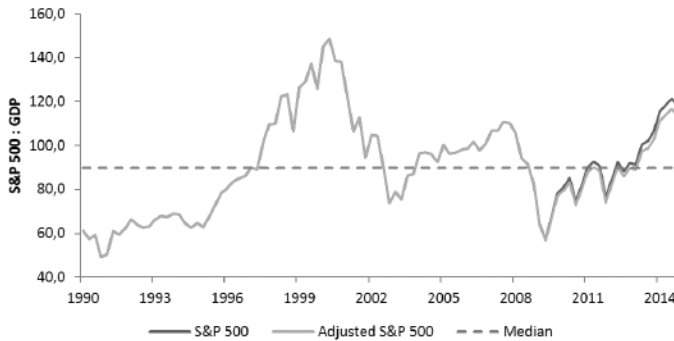
Source: own elaboration.

The first way of identification of a potential price bubble is calculated from data of the adjusted index S&P 500. The calculated rational price bubble, as difference between the market price of assets and the moving average of adjusted values (according to the theory considered as a fundament), is compared with the standard deviation of moving average of the adjusted values. Below, there is the chart with ratios of values of the times series of the rational price bubble and the standard deviation.

According to the theory stated by Musílek (2011), values of a rational price bubble (RPB) lower than a value of one standard deviation are considered as common volatility in a price of asset. A value of the ratio in the rage of 1-2 is considered as overvaluation of a price of asset. Last but not least, all values of the RPB ratio and a standard deviation higher than 2 are considered as significant overvaluation (undervaluation) and thus as a price bubble at the asset market.

Figure 5. Changing of rational price bubble toward standard deviation of SMA
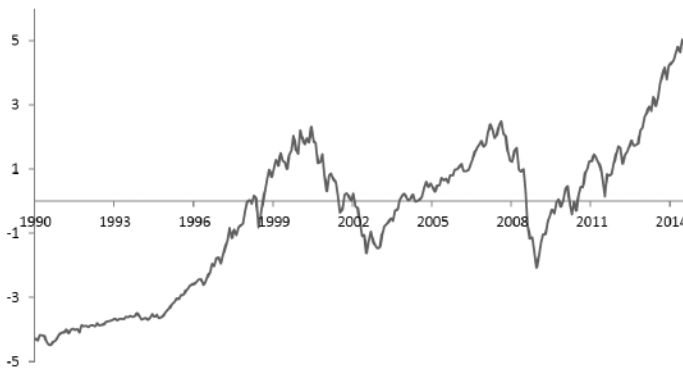
Source: own elaboration.

Based on the Figure 5, it can be assumed that the values of the stock index around the years 2000, 2008 and since 2013 carry marks of significant overvaluation and thus a price bubble at the stock market.

It has already been mentioned that since the end of the year 2008 there have been applied non-traditional monetary policy (expansion) of the Federal Reserve Bank (Board of Governors of Federal Reserve System, 2008-2015), specifically in the periods:

– December 2008 – March 2010 (QE 1),
– November 2010 – June 2011 (QE 2),
– September 2012 – October 2014 (QE 3).

After the fall of prices of equities following the financial crisis in 2008, prices started to gradually increase with approximately a half-year or a year time delay, which are mentioned for example by Spáčilová (2011). In the chart it is clear that the increase of stock prices corresponds with the period of quantitative easing and sub-

sequently there is visible stabilization or mild consolidation.

Since influence of additional money supply on stock prices is presented in the research of Home and Jaffe (1971), it is possible to deduce, based on the above, that influence of quantitative easing leads to increasing of stock prices and after 2008 it is one of the factors, which are the cause of significant overvaluation of stock prices (a price bubble).

The second way of calculation of a rational price bubble uses the index of market capitalisation of the index S&P 500 and the median of adjusted values of this index. Since this method uses the index giving two time series into ratio, the median is used as a stabilizing (changeless) variable for calculation of a rational price bubble. The results of RPB ratio and the standard deviation from the median of adjusted values are graphically presented at the chart stated below.

Figure 6. Changing of rational price bubble toward standard deviation
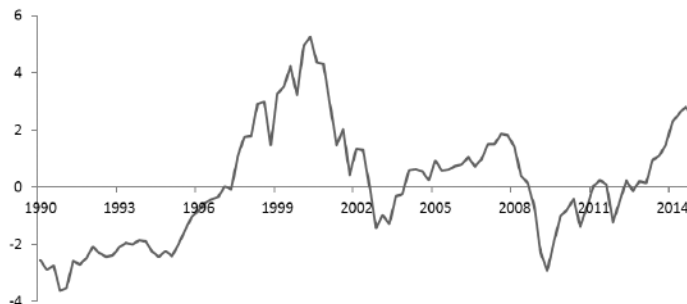
Source: own elaboration.

According to the stated graphical presentation, there is evident significant overvaluation of capitalisation around the years 2000 and after the year 2013. The data furthermore demonstrate that around the year 2008 there is noticeable overval-

uation approaching a price bubble. However, the ratio does not reach the values of a price bubble. Thanks to stabilization of the index by the median it is also possible to observe change of proportions of the time series of the RPB ratio to the stand-

ard deviation. The overvaluation in 2000 is highlighted much more, while overvaluation in the years 2008 and after the year 2012 is not so significant.

Despite, it is possible to observe the calculated rational price bubble in 2008 as well as in 2014. Effects of expansionary monetary policy are also noticeable with approximately a half-year up to a year delay, the same as it was in the previous method. This policy led to repeated fast growth of values of the ratio and its stabilization in the periods outside quantitative easing. In this case it is also possible to say that quantitative easing is one of the reasons of significant overvaluation with

the visibly measured price bubble at the stock market in the years 2000 and 2014 (measured by capitalization).

As additional indicator for recognising the price bubble as a "behavioural" indicator was Economic Policy Uncertainty Index (EPUI) used in order to evaluate mood at markets as measure of crowd psychology or influence of behavioural finances on formation of a price bubble. The index was chosen because of its wider range of facts related to economy and markets as well as monetary and fiscal policy. Calculation of the index was carried out for the chosen periods of years 1990-2014 on monthly bases.

Figure 7. EPUI Index during 1990-2014, USA
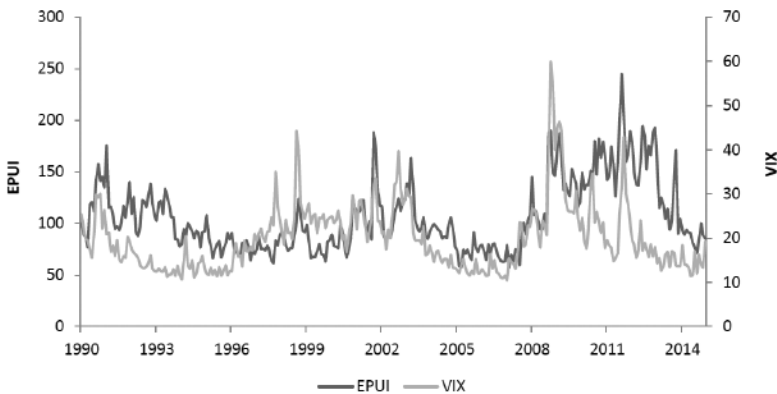
Source: Federal Reserve...2015b, 2016.

EPUI index was also compared with a stress index VIX, what measure the volatility, nervosity or irrational behavioural on the market. Figure 7 also represents capturing of the overall uncertainty about economy and political decisions, economic news in media and changes of taxes. In relation to price bubbles, there is noticeably increased uncertainty after the decrease of stock prices in the years 2001-2002.

The period of economic growth is typical by decrease of the uncertainty index (EPUI or VIX). The wider index EPUI is

in higher numbers only after the market crash in 2008. Again with a mild time delay, the level of uncertainty is significantly higher and decreases only during stable economic growth and decrease of unemployment after the year 2012. From a wider perspective, the trend of the index is corresponding with the trend of stock markets. The correlation coefficients for the individual periods (divided by the structural breaks in the meaning of the drop of share prices) are following:

– for the period 1990-2000 the correla-

tion coefficient is equal to -0,474,
– for the period 2000-2007 the correlation coefficient is equal to -0,563,
– for the period 2008-2014 the correlation coefficient is equal to -0,593.

The structural breaks were, according to the theory of Minsky (1982) taken into account and the time series was divided into three parts in order to calculate the correlation coefficient. This division is used to capture individual phases of trends in moods of economic subjects. There are noticeable lower values of uncertainty in periods of high market growths, which are referred as the periods of euphoria and speculative trades by Minsky. There is a very fast transformation at a market if it gets into financial distress, speculative trades regress and subjects are recognizing strong overvaluations of fundament. Subsequently, a stage of panic is reached and assets are strongly sold out.

In this case, the values of the uncertainty index EPUI well identify the periods of optimism at the markets, when speculative bubbles are created and the index as well as the VIX index grow. They are low in the periods before the years 2000 and 2008. Also, they significantly decrease to very low levels in the years 2013 and 2014, in the period of another calculated price bubble.

On the other hand, there is the explosive growth of the index during increased quantity of bad news from economy and financial markets, whether it was the period of "dot.com" bubble, the financial crisis in 2008 or the period of significant overvaluation in the year 2014 (2013).

The states of economic subjects and investors described by Minsky, are, according to found data, relevant description of influence of optimism and pessimism at markets. For the chosen period, 3 moments with significant overvaluation of shares were found, during which optimistic mood at markets was evident. After the fall in share prices, the trend in mood of investors is reversed and it reaches higher values.

Discussion and Conclusions

A part of the theory of Bispham's analysis was used in the article. The theory primarily serves for calculations at bond markets, its usage, however, is not excluded for another assets. Kubicová et al. (2012) identified possibility of calculation of a price bubble through relevant comparison of prices with a standard deviation.

Other used theories provide knowledge related to behavioural finances. These theories have only been becoming popular in the last decade. Accurate analyses and calculations, however, are not carried out on a sufficient data sample or with a significant result. Calculation of a correlation coefficient is carried out based on the theory of Minsky, which takes into account several degrees of financial crises and market moods (phases). From a perspective of found results, it is possible to observe that the values of the stock index S&P 500 as well as the index of capitalization are deviated by influence of additional money supply formed within the program of quantitative easing.

Calculations of a price bubble around the year 2000 can be referred as clearly identifying presence of a price bubble at the stock market (represented by the index S&P 500). Significant overvaluation is noticeable in both used methods. Similarly, market moods expressed by the index of uncertainty EPUI clearly refer to highly optimistic mood at the market before prices hit the peak. Reverse in the trend of prices is then perceptible also at increase of the uncertainty index. The results are thus consistent with e.g. Kohout (2011).

After the period around 2008, achieved results are slightly different. By usage of the first method connected with adjustment of the index S&P 500, the result of significant overvaluation is reached. In the ratio of a rational price bubble and a standard deviation, it is possible to observe only slight exceeding of two standard deviations. When these findings are confronted with the results reached by the second method, very similar values are obtained. However, in the second method the value of the rational price bubble did not exceed the values of two standard deviations. These similar results are a sign of high overvaluation of stock prices of the index S&P 500, however, presence of a price bubble is questionable here.

According to the data stated in the uncertainty index, it is possible to support the above mentioned statement by the low level of the uncertainty index before the year 2008. The subsequent increase of uncertainty is a sign of possible high overvaluation. This increase of uncertainty, however, is not in such an extent as it was in case of the price bubble around the year 2000. Besides, the values of the uncertainty index are falling rapidly already in the year 2009.

Similar results are obtained by the „stock meter" stated by Kohout (2011), which is presented in Figure 8. Overvaluation by less than 30% is much lower if the values are compared to the values of overvaluation around the year 2000. From the above it may be deduced that shares in the period around the year 2008 were in the state of higher overvaluation, however, presence of a price bubble at the stock market is not clearly proven. The period of the years 2013 and 2014 is the last, in which higher valuation was reported by a data analysis. However, also in this period there are different results shown by both methods. According to the first method, the market is in the state of significant overvaluation in 2013 as well as in 2014. The trend of growth of a rational price bubble over values of two standard deviations is relatively considerable here. The results acquired by the second method also show significant overvaluation in the year 2014 but not in the previous year 2013. The difference of the results can be caused by differences in calculations. In the method A, a moving average was used and a rational price bubble was calculated from a variable value. However, in the method B, a rational price bubble was calculated from a static value of median.

Figure 8. Over and undervaluation of DIJA 30, „Stock meter"
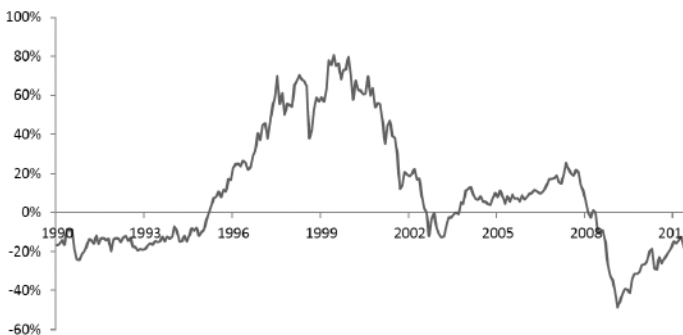
Source: Kohout 2011.

Higher accuracy of results acquired by the second methods also shown by the results of the "stock meter" published by Kohout (2011), as it was in the case of the period around the year 2000. The results of the author are even characterized by slight undervaluation in the year 2013. According to the trend of the "stock meter" in the year 2013, it is probable that the stated values will evolve toward fair valuations and subsequent overvaluation. However, data for 2014 are not available.

In case of the data of the uncertainty index, the fluctuation is evident in 2013 and also in the period before. Thus, clear identification of significant overvaluation is not indicated. However, in the case of the year 2014, the trend of the index has a clearly declining character toward very low values in comparison to the whole time series. It is possible to interpret this trend as optimistic mood at the market. At the same time, it is characteristic for so low values of the uncertainty index that it is a strong bull trend and high overvaluation of markets within the researched time series.

The result obtained for the years 2013 and 2014 are significant by higher diversity. On their basis it is possible to deduce that in the year 2013 there was no significant overvaluation. Then in the year 2014 data suggest high valuation, a low uncertainty index and a significant trend in growth of a price bubble above value of two standard deviations in both methods of calculations. Thus, it is possible to conclude that the year 2014 is, with high probability, characteristic by significant overvaluation, respectively by a price bubble at the US stock market (measured by the supplementary index S&P 500).

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