CERTAINTY INDICES ON FINANCIAL MARKETS

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If one said that "we are not in a bubble territory[1]", others would wonder whether it is true or not. By the term "a speculative bubble" we assume an unsustainable increase in prices brought on by investors' buying behavior rather than by genuine, fundamental information about value (Shiller, 2000).

Hereby, the major stream of empirical research towards speculative bubbles is guided on clarification of superfluous overpricing or underestimation on financial markets, particularly, house markets (Agnello and Schuknecht, 2011; Case and Shiller, 1989; Corgnet et al., 2015; Engsted et al., 2016; Richmond and Roehner, 2012; Rousová and van den Noord, 2011) and stock markets, that represent the area of our study.

Regarding stock markets, there are two major distinguish paths. The first is based on studies of stock returns volatility and its significant deviation from expected values (Jarrow, 2015; Deringer, 2015; Phillips et al., 2015). The second view proposes an engineering of relative indicators that should be able to catch so-called positive or negative bubbles (Bunn and Shiller, 2014; Campbell and Shiller, 1988a, 1988b, 2001; Fernandez et al., 2014).

On the one hand, stock returns serve as instant consequences of market confidence, so as empirical evidence of that confidence, on the other. Considering mean reversion of stock returns (Bali and Demirtas, 2011; Boehme and Çolak, 2012; Dunis et al., 2011; Fama and French, 2007; Hsieh and Hodnett, 2012; Kadous et al., 2014; Lin et al., 2014; Serletis and Rosenberg, 2009; Shiller, 1984; Spierdijk et al., 2012), each excess deviation in stock returns performs as an alarm signal to the market. But the question is what exact levels depict an acuity of deviation: 20%, 30% or even more? And how to avoid a data dependence of such remarkable levels? Cause the higher market periods we choose, the higher levels of acuity we get.

Meanwhile, the idea of deviation scrutiny in stock returns leads further - to the creation of a special indicator that would convince the existence of speculative bubbles on the market. Amid the variety of those revealing indicators, Robert Shiller's cyclically adjusted price–

[1] Warren Buffett's Letters to Berkshire Shareholders, available at: http://www.berkshirehathaway.com/letters/2016ltr.pdf

earnings ratio, or CAPE ratio, has served as one of the best forecasting models for long-term future stock returns (Siegel, 2016). Also, CAPE is one the most widespread approach for market booms and bubbles detection.

Concurrently, International Center for Finance at Yale School of Management proposed a group of Stock Market Confidence Indices[2] to measure investor confidence and related investor attitudes. This approach is based on the regular questionnaire investor attitude surveys on U.S., Chinese and Japanese markets. Herewith respecting the quite significant contribution of Stock Market Confidence Indices, we focus on CAPE.

The aim of this paper is to present a complementary indicator for CAPE that supports bubble detection on financial markets, basically, emerging stock markets. The paper is organized as follows. Section 1 describes a complementary indicator to CAPE approach. It also covers CAPE obstacles for bubble detection on emerging markets. Section 2 depicts the results of indicators implementation on U.S. stock market. Section 3 presents conclusions.

1. Market Confidence Level (MCL) as a Complementary Indicator to CAPE

Developing an argument for CAPE criticism, three points commonly arise. They are payout ratios, accounting standards, and fundamental methodological weaknesses.

To expand the first case about payout ratio, Shiller and Bunn (2014) proposed and adjusted CAPE by calculating the ratio on the basis of theoretical total return EPS (Earnings per share), which presumes a payout ratio of 0% - that is total share buybacks (Keimling, 2016).

Considering the inconstancy in accounting standards, Siegel (2016) recommended substituting GAAP earnings by the NIPA data in CAPE estimation. The author argues that latter improves a forecasting ability of the CAPE model and forecasts of US equity returns increase significantly. Despite the suggested data substitution, CAPE based on GAAP earnings is still strongly accepted as a powerful indicator for bubble prediction.

To answer the third CAPE objection, that is fundamental methodological weaknesses (such as declining payout ratios and differing accounting standards) which cause the limitation in country-by-country comparability of CAPE, we reckon that CAPE is a bubble assessment within the framework of each particular market (or country). The comparison of CAPE levels in USA and Russia, for example, is incoherent, but CAPE estimation on U.S. and Russian markets apart is quite essential. CAPE highs serve as alarms for investors to be intent via possible bubble boom on a particular market throughout its historical data.

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[2] Stock Market Confidence Indices, available at: http://som.yale.edu/faculty-research/our-centers-initiatives/international-center-finance/data/stock-market-confidence

Despite wide discussion and points of criticism, CAPE is still remaining one of the powerful measurement of market overwhelming. It defines possible bubbles creation both for developed and developing countries (market areas).

However, we argue that the case of account-based cheating and non-transparent accounting has emerged as additional obstacles for CAPE on emerging markets, withal to short-term historical data. Therefore, we propose to construct a complementary indicator to CAPE, that is based on the only composite index returns, Market Confidence Level (MCL):

$$\mathrm{MCL}_t^k = \frac{\sum_{k=0}^{n-1} \mathrm{CIR}_{t-k}}{n} \cdot \left(1 + \frac{\mathrm{CIR}_t}{\frac{\sum_{k=0}^{n-1} |\mathrm{CIR}_{t-k}|}{n}}\right), \quad (1)$$

where: CIRt – composite index return at t-period (in real prices);

k – confidence level; n –confidence length.

This equation expresses market confidence level through the mean composite index return on the selected confidence k-level ($\frac{\sum_{k=0}^{n-1} \mathrm{CIR}_{t-k}}{n}$). This value is growing or declining by the rate equals a fraction of each composite index return (CIRt) in the mean absolute composite index return on the selected confidence k-level ($\frac{\mathrm{CIR}_t}{\frac{\sum_{k=0}^{n-1} |\mathrm{CIR}_{t-k}|}{n}}$).

Needless to say that MCL couldn't be launch in a stable financial market with no price changes ($\sum_{k=0}^{n-1} |\mathrm{CIR}_{t-k}| = 0$). MCL should be useful to alarm both extra optimistic or pessimistic conditions on financial markets. Thus, MCL expresses a market indicator of positive bubbles and negative bubbles.

We make further assumptions regarding MCL. First, every possitive MCL peaks above double standard deviation ($\mathrm{MCL} \geq 2 \cdot \sigma$) warn about too optimistic investors behavior. Otherwise, every possible negative MCL meanings behind troughs more than double standard deviation ($\mathrm{MCL} \leq 2 \cdot \sigma$) caution lots of market's pessimism.

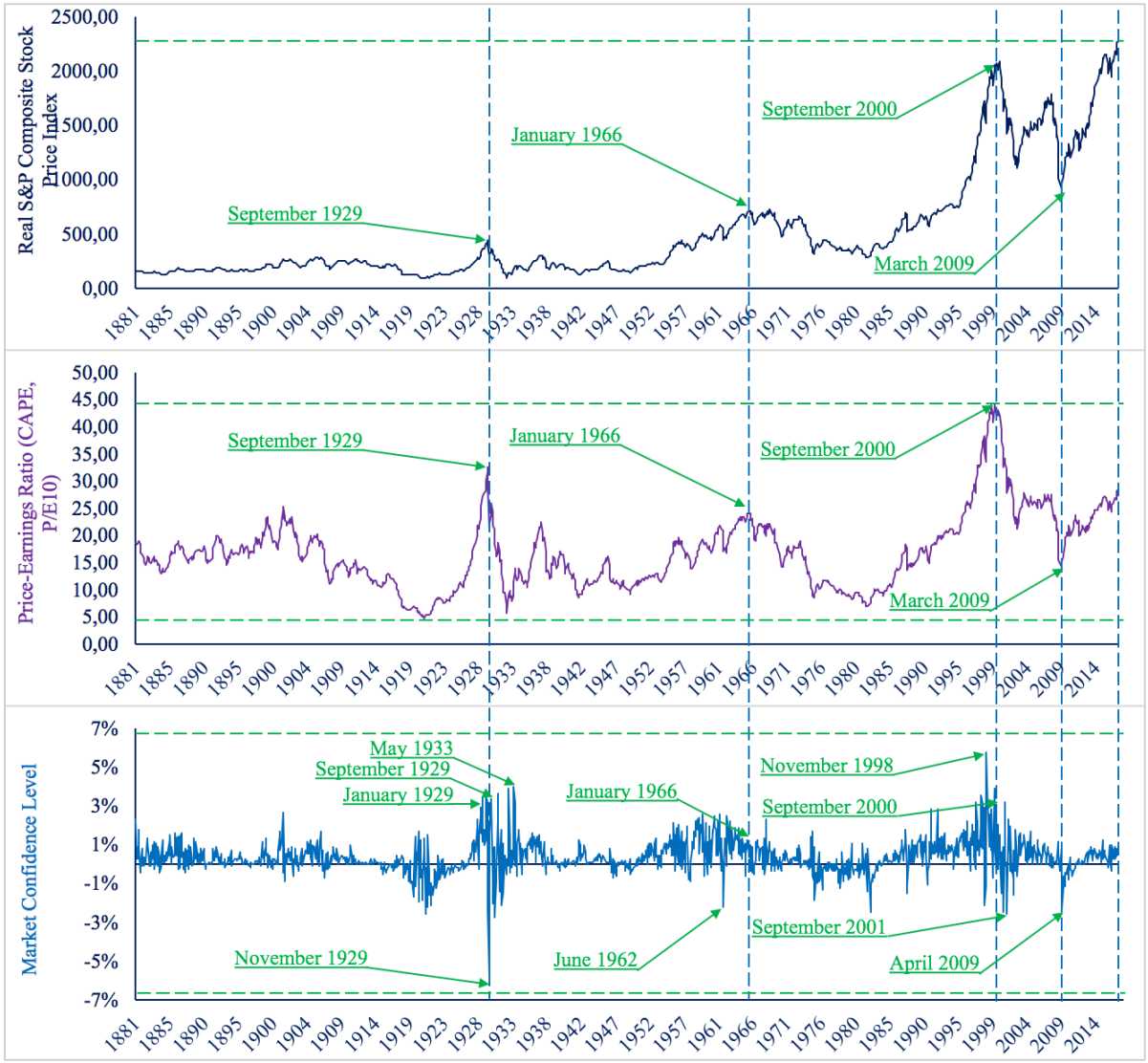
Second, we assume a neutral area for $\mathrm{MCL} \in [-\sigma; +\sigma]$, when the market amends.

Finally, MCL should catch the same or close results as CAPE does on financial markets, whether we could (on developed markets) or couldn't (on emerging markets) proper calculate CAPE. Besides MCL enlarge CAPE in negative bubble detection. To illustrate our assumptions, we provide empirical results in Section 2.

2. The Linkage Between CAPE and MCL on U.S. Stock Market

To discovering a linkage between MCL and CAPE on U.S. stock market, we set the confidence level equals 10 years (k=120) in our equation and sampling period from January

1881 till March 2017, based on CAPE data for U.S. market[3]. The comparison is presented on the following plot:



Pic.1. U.S. market: CAPE, MCL and Real S&P Composite Stock Price Index, 1881-2017.

MCL indicates peaks of market's optimism in similar time-period to CAPE (September 1929, January 1966, September 2000), as shown on the Pic.1. Furthermore, MCL reveals a rapid switching of investors attitudes next to historical peaks that identify strong uncertainty on the market of a negative bubble (November 1929, September 2001, April 2009).

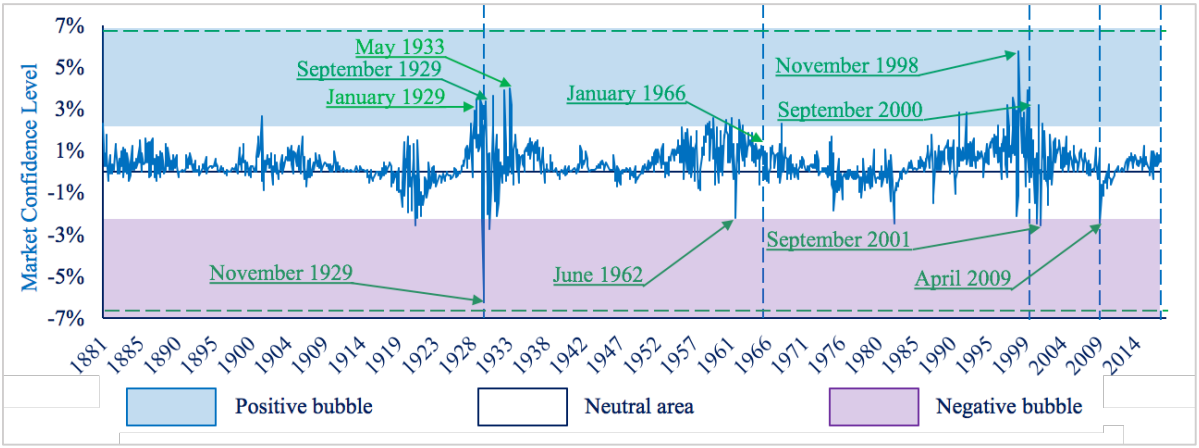
As indicated in Table 1, MCL illustrates its record highs on U.S. stock market at May 1933, November 1998 and November 1999, so as extreme troughs at November 1929, September 2001 and April 2009.

[3] SnP-500 stock price data presented in the book «Irrational Exuberance», available at: http://www.econ.yale.edu/~shiller/data.htm

Table 1. MCL features on U.S. stock market (1881-2017)

MCL alarms	**MCL levels**	
	U.S. stock market	**Common market**
Neutral area	MCL ∈ [-0,81%; 0,81%]	$-\sigma \leq MCL \leq \sigma$
Positive bubble	MCL ∈ [1,63%; +∞)	$MCL \geq 2 \cdot \sigma$
Negative bubble	MCL ∈ (-∞; -1,63%]	$MCL \leq -2 \cdot \sigma$
Extreme peaks	1) MCL= 3,98% (May, 1933); 2) MCL= 5,68% (November, 1998); 3) MCL= 3,88% (November, 1999).	-
Extreme troughs	1) MCL= -5,80% (November, 1929); 2) MCL= -2,61% (September, 2001); 3) MCL= -2,39% (April, 2009).	-

Neutral area for MCL spreads between minus 0,81% and plus 0,81%, as shown on the Pic.2. For any MCL values above 1,63% the indicator alarms about possible positive bubble on the market, so as every negative MCL values behind minus 1,63% express possible negative bubbles, simultaneously.



Pic.2. Market Confidence Level on U.S. stock market, 1881-2017.

Nowadays CAPE equals 29,77 that is high but lower than those CAPE extreme peaks on U.S. stock market in 2000 (74,66) and in 1929 (32,56). Thus, CAPE warns investors to be discreet and more attentive regarding market overwhelming in the USA. Meanwhile, MCL relieves the severity of possible bubble boom on U.S. stock market in the beginning of 2017 but also indicates positive investors attitudes in the neutral area (MCL=0,68%).

3. Conclusion

Market Confidence Level (MCL) is suggested to implement as one of a complementary tool for CAPE for three main reasons. First of all, MCL estimations use composite index returns (in real prices) that ensure the independence of any accounting standards and its further changes, so as possible non-transparent financial data. The latter puts forward MCL to analyzing both developed countries and emerging markets.

Then, MCL provides detection for both overconfidence and tough pessimism on the market. And, finally, MCL could be launched not only on stock markets but also possess an opportunity for bubble detection on commodities market or single stocks and bonds estimation.

Although, based on stock returns, MCL contains mean reversion that should be studied further. Moreover, MCL needs to improve a selection option of confidence level (k-level) by the means of the statistical validity.

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