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MARKET INDICES AND THEIR APPLICATIONS

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Abstract
Market indices are very important variables that show market trends and changes. They are wide used by investors around the world like signals for potential investing. This paper contents overview of market indices, methods for their computing, and their applications. We classify these indices according to method for their computation. In this way, we have two main groups of market indices: indices based on concept of average, or price pondered market indices and standard indices or value pondered market indices. Further, we explain stock market indices used at United States of America markets. The most known indices of these markets, DJIA and S&P 500, will be fully explained. After computation different stock indices, we use them for two applications: first, for technical analysis of financial markets, and, second, for modelling the absolute returns of different stock indices and exploring the forecast ability of an alternative measure of risk.

Keywords: market indices, technical analysis, modelling, forecasting

1. INTRODUCTION

Indices used over world financial markets, service for indicating currently state of that markets, respectively, in order to show if the market have been in expansion or contraction. On the ground of historical information, one may determine extant trend that can be used for prognosis coming market behavior focused on securities. The value of securities have been attended continuously. That makes it possible for investors to react to increase or decrease in value of some securities. Because of that, potential investors are very interesting in monitoring market indices, in order to maximize income of their investments. It is also, very important for potential investors to know which companies'

shares some indices are consisted of, and what kind of methods are used for indices calculating. Further, regarding fact we live in information society and global business is not just reality but imperative, many of investors, interested in monitoring financial market around the World, must be familiar with indices used at that markets. To be informed about indices used at well-developed markets, like those at USA market, is as important as to be familiar with indices at growing markets. The examples of both kind of indices are going to be given in this paper.

2. MARKET INDICES DEFINITION

Indices are relative numbers that, if they lined up, show tendency, volume and velocity of some economy and social occurrences. Basic market volatility are often measured by market averages or indices consisted of a group of securities, whose mission are to reflect whole market. A large number of averages and indices are fabricated in order to reflect volatility of whole markets. The most known market indices are certainly, Dow Jones Averages and Standard & Poor's Index.

2.1 MARKET INDICES BASED ON CONCEPT OF AVERAGE, OR PRICE PONDERED MARKET INDICES

Market indices based on concept of average, or price pondered market indices are calculated by adding shares price of chosen companies and dividing their sum by a number defined as "divisor" in that moment. The most famous index in this group is certainly Dow Jones Averages.
The base for calculating is portfolio consisted of one shares for each company included in index. Ponder of some company is defined by company share price. The base algebraic definition of average is:

$$average = \frac{\sum_{i=0}^{n} P_{it}}{d}$$

where:
Pit – the i share price at time t
n – number of shares included in average
d – divisor

A very important characteristic of average is that stock split, or excluding some share from index and replacing it with another company share, requires divisor adjustment, in order to eliminate its influence on average value.
The most known indices in this group are: Dow Jones Averages and particular Dow Jones Industrial Average (DJIA), Value Line Composite Averages consist of 1600 shares from NYSE and OTC, Nikkei Average consist of 225 the biggest Japanese companies, est.

2.2 STANDARD OR VALUE PONDERED MARKET INDICES

Standard or value pondered market indices are obtained by putting in relation total market value of chosen companies in present time, with total market value of chosen companies in base period.
The base algebraic definition is:

$$Indeks = \frac{\sum P_i Q_i}{\sum P_0 Q_0} \cdot n$$

where:

Pi – present market price,

Qi – present number of shares,

Po – market price in base period,

Qo – number of shares in base period,

n – base value established for base period.

Market value of shares is obtained by multiplying number of shares with its price. Base value is the value set for base period.

Index value and ponder value depend of two factors: price and number of shares. Other activities of companies that change their value (like issue of new shares, fusion, stock split, and etc.) require adjustment of divisor in order not to change index value.

The most known indices in this group are: Standard & Poor's 500 composite index, NYSE indices, NASDAQ indices, Amex index, Wilshire 5000, Russell2000 est.

2.3 THE MAIN PURPOSE OF INDICES AND MARKET CHANGES DESCRIPTION

The main purposes of indices are:

1. Description of what happen at market, which means establish whether market is in expansion or contraction.
2. Forecasting
3. Focus on securities, which service is to follow trends of securities, continuously, which enable investors react on time if price of some securities goes up or down.

Market indices like DJIA and S&P provide some useful indicators about stock market performances.

The second purpose of market indices is index derivatives generating. Those derivatives are index option and index futures, and base instrument of this contracts is stock market index.

3. THE USA MARKETS INDICES

The most known indices at the USA markets are: Dow Jones Averages including industry, transportation and utilityes; Standard & Poor's 500 composite indices and separate indices including industrial companies (S&P Industrials), transportation companies (Transportation Index), utility companies (Utility Index) and financial companies (Financial Index); further, there are NYSE indices: industrial, trnsportation, utility, financial: Indices anaunced by National Association of Securities Dealers using NASDAQ (National Association of Securities Dealers' Automated Quotation) sistem: composite, industrial, insurance and banks; American Stock Excange (Amex) Market Value Index which include almost all 800 shares in demand at this stock market. For smaller companies, there is Russell2000.

3.2 S&P 500 COMPOSITE STOCK PRICE INDEX

In 1923. year, Standard & Poor's Corporation have declared market index based on 233 shares with 26 subindices. In 1957. year, it has been decided to incrise number of shares at 500.

3.2.1 S&P CALCULATING METHOD

S&P Index is base index that is quotient of total market value of 500 chosen companies at exact day, with total market value of chosen companies in base period (1941.-1943.). Total market value in base period has been replaced by 10, in other words 1941.-1943.=10.

In practice, for daily calculating, S&P Index value is being obtained by dividing of total market value of 500 chosen companies by divisor. Divisor replace value in base period and enable index value comparing during the time.

$$\text{Index value} = \frac{\text{total market value of 500 chosen companies}}{\text{The last index's divisor}}$$

Index and index's divisor is calculated in this way:
First, total market value of 500 chosen companies is to be calculating for base period: number of issued shares is to be multiplied by its price, and all 500 values is to be added. In addition, the obtained market value in base period is to be indexed so that if market value is, for example $100.000.000 and if it is considered that worth 10 index's points, it is obtained: $100.000.000=10.

Next step is calculating index's divisor for base period. It is obtainde from next equation:

$$\text{Index value} = \frac{\text{Market value}}{\text{Index's divisor}},$$

from wich comes:

$$\text{Index 's divisor} = \frac{\text{Market value}}{\text{Index value}},$$

which means that:

$$\frac{\$100.000.000}{10} = 10.000.000 \cdot$$

The index's divisor obtained in this way enable index value calculating for next day by dividing market value for that day by index's divisor. For example, if total market value of 500 chosen companies in next day has grown at $110.000.000, than:

$$S \& P\,500\,\text{index} = \frac{\$110.000.000}{10.000.000} = 11.$$

3.3. DOW JONES AVERAGE

All the Dow Jones Averages are calculated in the same way, so that Dow Jones Averages calculating will be explaned on Dow Jones Industrial Average (DJIA) example.

The base for DJIA is calculated is of shares of the companies the most representative for USA market, in the autor's opinion.

$$DJIA = \frac{\sum_{i=1}^{30} P_{it}}{d}$$

where:
P_{it} is price of share i in the time t,
D id divisor.

Defining divisor value is dictated by requirement that taking measures by companies, that do reflect on shares' price, like for example, stock split, are aallowed to exert influance on index value. The new divisor's equation is:

$$New\ divisor = Curent\ divisor \cdot \frac{Total\ adapted\ market\ value}{Total\ not\ adapted\ market\ value}$$

The total not adapted market value is obtained by adding the final price of 30 shares. The total adapted market value is obtained when the final price of a share has replaced by new price.

4. INDICES OF FAST GROWING MARKETS

At the less developed markets, there are less number of companies. Therefor, index envelop all or the most of shares. Under such circumstances, index serve for trends at share market identification and for following dynamics of shares market development.

4.1 AUSTRALIA STOCK EXCHANGE (ASX) PRICE INDEX

Australia Stock Exchange Price Index envelop about 300 companies that are in demand at Australia Stock Exchange (ASX). The chosen companies represent 29 economic sectors that are 2/3 market capitalization at ASX.

$$\begin{matrix} current \\ index \\ value \end{matrix} = \begin{matrix} yesterday's \\ index \\ value \end{matrix} \times \frac{current\ close\ price\ sum}{addapted\ yesterday's\ close\ price\ sum}$$

4.2 KOREA COMPOSITE STOCK PRICE INDEX (KCSPI)

KCSPI envelop all 683 companies that are in demand at Korea Stock Exchange – KSE. The KCSPI computing formula is:

$$KCSPI = \frac{current\ total\ market\ value}{base\ total\ market\ value} \times 100$$

5. TECHNICAL ANALYSIS

In this section we will show some of technical analise. That will be following graphic methods: OHLC, Candlestick and Monumentum, MA and Bollinger Bands .

Graphic 5.1 OHLC : three months NYA

Graphic 5.2 NYA Candlesticks three months

Graphic 5.3 Monumentum for N=12

MA-Moving Averages are used like signals for buying or selling,e.g. MA cuttings are signals for buying or selling.

Smoothed serie for $X_1...X_n$ is calculated by following equation

$$\sum_{j=-p}^{q} a_j x_{t+j}, \qquad t= p+1,\ p+2,...n\text{-}q,$$

and a_j is set of ponders satisfying next relation

$$\sum_{j=-p}^{q} a_j = 1$$

If m=n=p and $a_j = a_{-j}$ we have symmetrical MA. Next plot shows cuttings of nine terms MA and eighteen terms MA.

Graphic 5.4 MA

If one adds and subtracts two standard deviation on simple MA, one gets Bollinger Bands. If price of some share crosses low bond it is a signal for buying, and opposite.


Graphic 5.5 Bollinger Bands

6. MODELLING AND FORECASTING

It is common way for market risk measuring by using market indices. A way for risk measuring is using absolute returns from next equation:

$$r(t) = \frac{Ln(P(t)) - Ln(P(t-1))}{Ln(P(t-1))}$$

The mean of those returns is used like volatility, e.g. like risk, and they can by modeled by ARIMA models. Next plot shows fitting the series of absolute returns of DJIA by ARIMA(1,1,1) model.
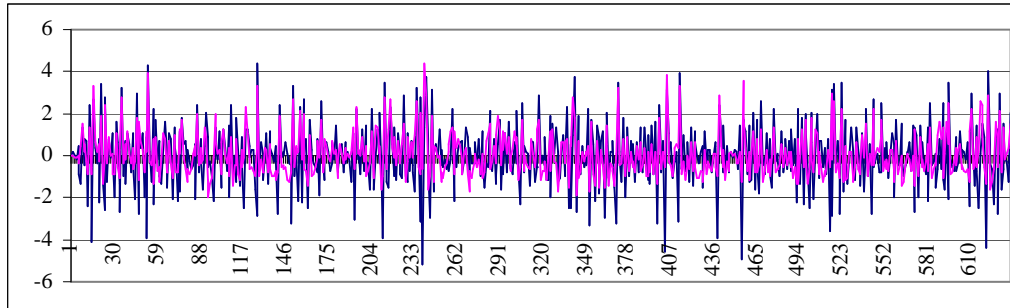
Graphic 6.1 Fitting the series of absolute returns of DJIA by ARIMA(1,1,1) model

When your modeling is successful, you can do a good forecast for your series. Next plot shows minimum mean square error forecast for DJIA from previous sample given by its conditional expected value:

$$\hat{X}_n(h) = E(X_{n+h} \mid X_n, X_{n-1}, ...)$$
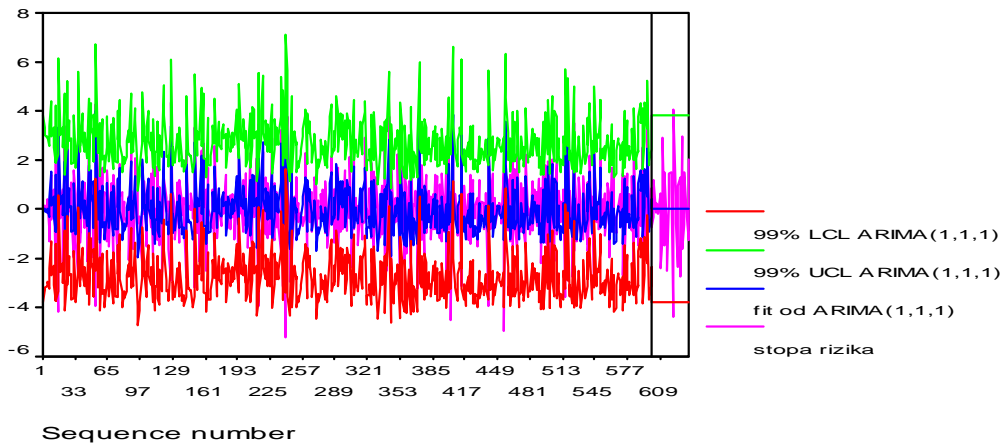
Graphic 6.2 Minimum mean square error forecast for DJIA

7. CONCLUSION

This paper contents overview of market indices, methods for their computing, and their applications. We explained stock market indices used at United States of America markets and some indices of fast-growing markets. After computation different stock indices, we used them for two applications: first, for technical analysis of financial markets, and, second, for modelling the absolute returns of different stock indices and exploring the forecast ability of an alternative measure of risk.

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