Usable Statistical Indicators in the Analysis
Portfolios of Financial Instruments

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Abstract

Statistics indicators specific chronological series to permit the establishment of the average efficiency of a portfolio of tools for a defined period of time and compare it with the return on other financial instruments or portfolios of securities. It also provides a number of valuable information for the investor of capital, the latter having such an opportunity to diversify its portfolio by attracting financial instruments with a radament higher.

Key words: Specific statistical indicators, series historical record portfolio of financial instruments.

1. General aspects

Analyze economic phenomena, including those related to the specific activity of the capital market, can be started by using a set of specific indicators, which can be determined trend overview of data subject to research. In this respect, in the literature of our country and abroad, have been defined indicators which define both terms variation in series, as well as average values what characterizes.

Indicators expressed in absolute sizes

• Absolute Change (salary) with fixed base:
  \[ \Delta_{t/1} = y_t - y_1; \ t = \overline{2,n} \]

Absolute Change (average gain) based in chain:
  \[ \Delta_{t/t-1} = y_t - y_{t-1}; \ t = \overline{2,n} \]

Indicators expressed in relative sizes
• The rate of change (increase, decrease) with fixed base:

$$I_{t/1} = \frac{y_t}{y_1}; \quad t = \frac{2}{n}$$

$$I^{(\%)}_{t/1} = \frac{y_t}{y_1} \cdot 100; \quad t = \frac{2}{n}$$

• The rate of change (increase, decrease) based in chain:

$$I_{t/t-1} = \frac{y_t}{y_{t-1}}; \quad t = \frac{2}{n}$$

$$I^{(\%)}_{t/t-1} = \frac{y_t}{y_{t-1}} \cdot 100; \quad t = \frac{2}{n}$$

• Rhythm (increase, decrease) with fixed base:

$$R_{t/1} = \frac{\Delta y_{t/1} \cdot 100}{y_1} = \frac{y_t - y_1}{y_1} \cdot 100 = \left(I_{t/1} - 1\right) \cdot 100 = I^{(\%)}_{t/1} - 100$$

• Rhythm (increase, decrease) based in chain:

$$R_{t/t-1} = \frac{\Delta y_{t/t-1} \cdot 100}{y_1} = \frac{y_t - y_{t-1}}{y_{t-1}} \cdot 100 = \left(I_{t/t-1} - 1\right) \cdot 100 = I^{(\%)}_{t/t-1} - 100$$

• Absolute value of a percentage of the rate of increase of recognition (decrease) with fixed base:

$$A_{t/1} = \frac{\Delta y_{t/1}}{R_{t/1}} = \frac{y_1}{100}$$

• Absolute value of a percentage of the rate of increase of recognition (decrease) based in chain:

$$A_{t/t-1} = \frac{\Delta y_{t/t-1}}{R_{t/t-1}} = \frac{y_{t-1}}{100}$$

**Average indicators of chronological series**

Media is one of the fundamental indicators any series of data, by default series type chronologically. It is important to note that, in the case chronological series, the method for the determination of this indicator will vary depending on the type series (times or intervals). As follows:

• The average of a series of dynamic ranges may be determined by adding together series and imatirea terms value thus obtained by the
total number of observations undergoing analysis. The relationship of the calculation of this indicator may be transcribed as follows:

\[ \bar{y} = \frac{\sum_{i=1}^{n} y_i}{n} \]

- Unlike those mentioned above, the relationship of calculation on the average of a series of dynamic moments is more complex and can be summed up as follows:

\[ \bar{y}_{cr} = \frac{\sum_{i=2}^{n} (y_{i-1} + y_i) t_{i-1}^2}{2 \sum_{i=1}^{n-1} t_i} \]

- In the case in which moments: \( t_1, t_2, \ldots, t_n \) are equally spaced, the average weighted becomes a chronological chronological average simple and can be determined in this way:

\[ \bar{y}_{cr} = \frac{\frac{y_1 + y_2 + \ldots + y_i + \ldots + y_n}{2}}{n - 1} \]

- Average gain of a series dynamic:

\[ \overline{\Delta} = \frac{\sum_{i=2}^{n} \Delta_{t/i-1}}{n} = \frac{\Delta_n}{n-1} = \frac{y_n - y_1}{n-1} \]

- The index average change (increase, decrease) of a dynamic series:

\[ \overline{I} = n^{-1} \prod_{i=1}^{n} I_{t/i-1} = n^{-1} \sqrt[n]{I_{n/1}} = n^{-1} \sqrt[n]{\frac{y_n}{y_1}} \]

- Average rate of increase (decrease) of a dynamic series:

\[ \overline{R} = (\overline{I} - 1) \cdot 100 \]

\[ \overline{R} = I^{\%} - 100 \]

Specific indicators statistics series timeline can be successfully used in the context of analyzes carried out on the activity of the capital market in general or of portfolios of financial instruments. So, with the help of these sizes can be statistical analysis, for example, the variation of daily yield of a financial instrument or a portfolio of financial assets.
Also, statistics indicators specific chronological series to permit the establishment of the average efficiency of a portfolio of tools for a defined period of time and compare it with the return on other financial instruments or portfolios of securities. It also provides a number of valuable information for the investor of capital, the latter having such an opportunity to diversify its portfolio by attracting financial instruments with a radament higher.

2. Analysis of yield financial instruments using models of type time series

In practical activity, previewing development of profitability financial assets may be carried out using econometric modeling models linear type time series (ARMA – Auto Regressive Moving Average). In this case, as well as profitability later a financial instrument or a portfolio of financial instruments can be estimated on the basis of the values recorded by this indicator in previous periods of time.

From a theoretical point of view, it is important to note that, in order to be able to use a series of data relating to developments in financial profitability of the asset value during preview with a view to this indicator for the periods of time immediately above, it is necessary that this solution to the condition of stationaritate. The introduction of the concept of stationaritate it is assumed that the data which has been analyzed shows an average constant and a variation in finite time.

A Stationaritatea stochastic process in a broad sense (mean stationarity) presumed that this process has a constant average time finished and variant. Stationaritatea in a narrow sense (covariance stationarity) assumes, in addition, the fact that the covariance levels \( \text{cov}(X_t, X_{t+k}) = \text{cov}(X_t, X_{t+k+h}) \) for any \( k \) and \( h \). In practice modeling, in most cases, is used stationaritatea in a narrow sense.

From the point of view statistico - mathematically, autoregresive processes with mobile medium (Auto Regressive Moving Average – ARMA) can be defined as follows:

- The process \( (X_t)_t \) is a stationary process.

\[
X_t - \Phi_1 X_{t-1} - \Phi_2 X_{t-2} - \ldots - \Phi_n X_{t-n} = Z_t + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} + \ldots + \theta_m Z_{t-m}
\]

where:

- \( (Z_t)_t \rightarrow \) white noise of zero mean and dispersion constant \( \sigma^2 \);
- \( \Phi_i, \theta_i \rightarrow \) Coefficients.
o From a theoretical point of view, in any model type average autoregresiv with mobile (ARMA) can be identified two components distinct, namely: componenta autoregresivă definită prin termenul din partea stângă a egalității precedente $(X_t - \Phi_1X_{t-1} - \Phi_2X_{t-2} - \ldots - \Phi_nX_{t-n})$;

o Moving average component defined by the term of the right-hand previous equality $(Z_t + \theta_1Z_{t-1} + \theta_2Z_{t-2} + \ldots + \theta_mZ_{t-m})$.

To be able to continue this analysis based on linear models type time series (ARMA - Auto regressive moving average), it is necessary to define precisely the concepts underlying stationaritate and white noise.

Many times, in practical work, it is difficult to identify simultaneous presence of the two components shown above. Due to this fact, in the literature are presented three types of models by which they may be analyzed time series, namely:

o autoregresive models – AR(p);

o moving average models – MA (q);

o average autoregresive models with mobile – ARMA (p,q)

To be able to identify, estimate and validate the results obtained using autoregresive models with mobile medium ARMA, as well as to use these results in future forecasting of the evolution of this phenomenon to be analyzed (in the case under consideration, in estimating future profitability of financial assets or a portfolio of financial instruments) is used procedure Box - Jenkins. To facilitate analyzes carried out using this procedure, it has been implemented successfully in specialized software packages, such as E-Views.

With regard to the analysis financial instruments using autoregresive models AR(p) it can be seen that that the return on a financial asset can be defined as a function of regression which take account of the values recorded by these indicator in previous periods of time, as follows:

$R_{t} = \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \ldots + \alpha_n R_{t-n} + \sigma_t$

or:

$R_{t} = \sum_{i=1}^{n} \alpha_i R_{t-i} + \sigma_t$

where:

- $\alpha_i$ = the regression coefficients as function;
- $R_{t-i}$ = profitability financial asset value during the period $t-i$;
- $\sigma_t$ = the term residual (white noise).
On the basis of the items referred to above, the value of average profitability of a financial asset can be determined with the aid of the following relations of calculation:

\[ E(R_t) = \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \ldots + \alpha_k R_{t-k} \]

or:

\[ E(R_t) = \sum_{i=1}^{\infty} \alpha_i R_{t-i} \]

As we can see, using this relationship of calculation can be estimated profitability further progress of a financial asset using only the information on the values of this indicator recorded during the periods of time analysis previous econometric modeling. The second model for the analysis of the time series is the average element type MA(q) and involves the determination cost-effectiveness a financial asset solely on the basis of the values of white noise periods prior, as follows:

\[ R_t = Z_t + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \ldots + \beta_n Z_{t-n} + c \]

or:

\[ R_t = Z_t + \sum_{i=1}^{n} \beta_i Z_{t-i} + c \]

where \( c \) is a constant value.

As known, the average value of white noise is non-existent. Under these conditions, the determination profitability forecast shall be reduced to a relationship of the form:

\[ E(R_t) = c \]

Through a combination of the two models for the analysis of the time series shown above will obtain the model autoregresiv with mobile medium (ARMA). On the basis of the items analyzed in the first part of this work may be found that profitability determine the amount of a financial instrument using ARMA model involves the use of complex mathematical relationships, what incude both autoregresiva component, as well as the mobile medium. Such a relationship can be transcribed as follows:

\[ R_t = \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \ldots + \alpha_k R_{t-k} + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \ldots + \beta_m Z_{t-m} \]

or:

\[ R_t = \sum_{i=1}^{n} \alpha_i R_{t-i} + Z_t + \sum_{i=1}^{m} \beta_i Z_{t-i} \]
From a theoretical point of view, the procedure for the estimation of a model with an average autoregressive ARMA involves performing mobile following successive stages:

- Stationarity test series. If it is stationary it proceeds to step three, if it does not travel through the next step.
- It is stationary series of data by differentiation. The great majority of non-stationary series are integrated of order 1, I(1), so there is stationarizeaza series by the first difference.
- On the basis of the coefficients of autocorrelation (function of autocorrelation) and partial correlation coefficients (partial autocorrelation function) is determined autoregressive models the series start for the analysis of the data. Thus, if there is a value of h equal to q from which the autocorrelation function value drops to zero, then for processing series is used a process MA(q) or a process ARMA includes a component MA(q). In the case in which the value of autocorrelation function partial drops instantly to zero, starting with an offset value equal to p, then it is recommended that the time series to be processed by means of a process AR(p) pure or through a process that includes this component.
- It is estimated parameters ARMA models.
- shall be tested characteristics autoregressive models that have been estimated in the previous step. This verifies that the coefficients model are significant (different from zero) statistically, autoregression regression residues, the property of homoscedasticitate, stability parameters and timing characteristics waste.
- To choose the most appropriate model using different criteria for analysis. Thus, to choose the model that has the highest values for $R^2$ adjusted or lowest value for this version or dispersion residues. Also choose the model which has the lowest values for information criteria (Akaike, Schwartz).
- On the basis of the model selected shall be made various analyzes and forecasts.

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