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Possibilities of Application of Analytical Methods on the Present Securities Market

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Abstract

The most important goal of this paper is to critically examine and analyze traditional approaches to substantiating analytical decisions on the securities market and to identify those that can be effectively used to select attractive securities in modern emerging markets, taking into account the specific characteristics of these markets. The paper examines the feasibility of justifying investment decisions using the analysis of calculated characteristics of the expected yield on securities, as well as computer technical analysis. Most of the above research results are of an applied nature and can be used by investors, professional analysts, portfolio managers when assessing the expected effectiveness of investments in securities and other financial assets.

Keywords: Financial markets; Securities analysis; Analytical methods; Profitability; Technical analysis.

1. Introduction

T Economic and mathematical methods and models are now effectively used both in theoretical research in the field of investment, and in practical analytical work in the financial market. There is a large number of theoretical developments on the substantiation of investment decisions in the financial market. However, many of the classical models in practice are of little use due to the large number of constraints in which the results of the analysis predicted the dynamics of the stock market (McClanahan *et al.*, 2011); (Usseglio, 2015).

Professional investment is based on the identification of possible risks, the likelihood of their occurrence and the consequences from them. Investment decisions are developed and economically justified as a result of analysis of alternative investment options. Decision making is complicated by the fact that many alternatives are not uniquely preferable in comparison with each other, and the fact that there is no full certainty of the future.

The investment decision can be both rational and intuitive. The best solution should be the one adopted on the basis of analysis that summarizes the strategic and tactical goals of the investor, its capabilities, the current market situation and the prospects for its development.

The factors necessary for making the optimal investment decision should be divided into general and individual (Lintner, 1965); (Aharoni, 1966).

General data are data that are external, independent of the investor (exogenous). This includes information related to the object of investment: the situation in the stock market, its individual sectors and the economy as whole, information about the movement of market prices on assets, about the financial condition of issuers, and about the legislation. The above information is absolutely objective and, accordingly, the same for any investor.

Individual data are data characterizing subjective factors that influence the actions of a particular investor with an asset in a particular market.

A special area of analysis in the stock market and a specific method of analytical substantiation of investment decisions in respect of securities is the calculation of characteristics that determine the investment attractiveness of securities and the comparison of the values of these characteristics obtained by calculation with the limit values that satisfy the investor or that are acceptable to it, or having the values of the same characteristics calculated for other investment assets available to the investor.

Mathematical models used to assess the investment qualities of securities do not give a direct indication of the specific levels that the market price of a financial instrument can achieve in the future, they only reveal the laws of behavior of the security in question compared to other securities and the market as a whole, depending on various factors.

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Determination of the future market price dynamics for a financial instrument, which is the basis of an investment decision, is only a variant of evaluating the investment qualities of a financial instrument, no matter what models and methods of analysis are used (Breeden, 2005); (Campbell *et al.*, 1997).

We will consider below in this paper the effectiveness of some widely used approaches to the analytical substantiation of investment decisions in today's financial markets characterized by increased risks and excessive volatility.

2. Methods

Investment assets with uncertain future receipts and, in particular, shares, are a very complex financial instrument in terms of formalized quantitative analysis, including an assessment of their main investment characteristics. Uncertainty about the sums of future receipts and the timing of their receipt not only leads to difficulties in determining the initial data for calculating the profitability and risk indicators, but also to the availability of fundamentally opposite methodological approaches to this calculation. The measure of expected return is used in the investment analysis as a measure of profitability for common shares and other assets with uncertain future returns.

The expected return of a share can be calculated as its average profitability for various variants of the pace of developments that can affect the economic efficiency of investment weighted by the probability of realizing each of these options. Another method uses extrapolation of data on the actual return on a stock in previous periods, while the actual yield of a stock in each

of several past periods is considered as one of the options for profitability in the coming period. The probability of realizing each of these options is assumed to be equal.

These methods have a significant disadvantage: the averaging error as a result of arithmetic averaging of the rates of growth in the market price; the value of the expected yield is significantly overestimated both with a general (total) decline in the price for the period, and with a general price increase. This is due to the effect of the comparison base, as a result, positive values of the retrospective return which are the object of averaging, are always more weighty than negative ones.

In addition, the overstatement degree of the expected return of shares directly depends on the amplitude of fluctuations in their market prices (market volatility), and therefore, for various stocks which price has changed in the aggregate for all the periods under consideration, different values of the expected yield can be obtained.

To eliminate this effect, is allowed with the transition to a geometric average of the growth rates of the investor's welfare, and the logical continuation and the most accurate embodiment of this idea is the logarithmic expected return, where the average retrospective returns for each of the periods are calculated on the basis of the condition of continuous accrual of compound interest during the relevant time interval:

$$r = \ln \frac{P_1 + D}{P_0} \quad , (1)$$

Where r is the yield per share for the period;

P 0 - the market price of the share at the beginning of the period;

P 1 - the market price of the share at the end of the period;

D - dividends paid during the period.

In contrast to the calculation of other similar

indicators, the method of calculating the logarithmi

expected return negates the obvious imbalance between the marginal negative and marginal positive values of the yield per share, since the logarithmic yield can potentially

vary from minus to plus infinity. In this case, the logarithmic yield is also a symmetric indicator, that is, its values for cases of a decrease and an increase in the market price of the share will differ from each other only in sign, but not in absolute value (module).

Using the logarithmic yield for the periods during which the dividends were not paid, we can calculate the profitability for the entire period and bring the result to the time interval of the required duration by the following formula (Cox *et al.*, 1979):

$$\bar{r} = \ln \frac{P_n}{P_0} : n \quad , (2)$$

Where $\bar{r}$ - Expected yield per share;

P n - the share price at the end of the last period;

P 0 - the share price at the beginning of the first period;

n is the number of periods.

Taking into account the payment of dividends, data on prices will be required for calculation only at the beginning and end of the time interval under consideration and for the inter-dividend dates (Campbell and Shiller, 2001):

$$\bar{r} = \frac{\ln\left(\frac{P_n}{P_0} \cdot \prod_{k=1}^{n}\left(1 + \frac{D_k}{P_k}\right)\right)}{n} = \frac{\ln \frac{P_n}{P_0} + \sum_{k=1}^{m} \ln\left(1 + \frac{D_k}{P_k}\right)}{n} \quad (3)$$

Where $\bar{r}$ - Expected yield per share;

P n - the share price at the end of the last period;
P 0 - the share price at the beginning of the first period;
n is the number of periods;
D k - the amount of dividends paid as of day k;
P k is the share price at the day k;
m is the amount of dividend payments for n periods.

Formula (3) in the absence of dividend payments is automatically reduced to formula (2). Thus, it is possible and expedient to preliminarily calculate the yield per share without taking into account the dividends paid, and then adjust the value obtained by dividend payments using the following formulas (Jackwerth and Rubinstein, 1996):

$$\bar{r} = \left(\bar{r}^{*} + 1\right) \cdot \prod_{k=1}^{m}\left(1 + \frac{D_k}{P_k}\right)^{\frac{1}{n}} - 1 \quad (4)$$

$$\bar{r} = \bar{r}^{*} + \frac{\ln\prod_{k=1}^{m}\left(1 + \frac{D_k}{P_k}\right)}{n} = \bar{r}^{*} + \frac{\sum_{k=1}^{m}\ln\left(1 + \frac{D_k}{P_k}\right)}{n} \quad (4)$$

Where $\bar{r}$ - Expected yield per share;

$\bar{r}^{*}$ - Expected yield per share without taking into account dividends;

n is the number of periods;
D k - the amount of dividends paid as of day k;
P k is the share price at the day k;
m is the amount of dividend payments for n periods.

3. Results and Discussion

Theoretically, provided that the financial market is absolutely effective, and at any time the market share price practically equal to its fair investment value, and the company's development forecasts and discount rates remain stable, it can be argued that in the medium term (without taking into account short-term market price fluctuations), the growth rates of the market value of shares adequately reflect its profitability, since they take into account both the value of expected dividends and the increase in the value of the issuing company by reinvesting undistributed profits.

However, in reality, the most significant movements in market share prices are caused precisely by a change in market opinion about the issuer's prospects and changes in the level of share valuations by the market (the degree of undervaluation or overvaluation of the share compared to its fair value), that is factors that cannot be reflected in past data on the movement of market prices or predicted based on the study of these data (Baker and Wurgler, 2007); (Baker and Wurgler, 2002).

At the same time, if we proceed from the almost unquestionable assumption that the market share price changes under the influence of changes in the forecasts of future revenues due to owning it, then the changes in the

market price and expected revenues should compensate each other quite accurately while retaining some unchanged value of the yield indicator, which in this case is understood as the discount rate balancing expected future receipts and the current market value of the share.

Thus, proceeding from the above considerations, it is possible to put forward the hypothesis of "persisting of the yield per share", according to which short-term fluctuations in the market share price do not change its profitability, but, on the contrary, indicate the "adaptation" of the market share price to a change in the forecast of future revenues due to owning it while maintaining a stable value characteristic for this share discount rate, in which the expected future earnings due to owning shares, taking into account the expected timing of their receipt of investment the market correspond to the current market price of the share.

If this hypothesis is accepted, fluctuations in market share prices, whether actually occurring in the past or anticipated in the future, cannot be recognized as an adequate basis for determining the yield per share. The yield per share in this case will be recognized as changing only under the impact of changes in the overall market return on financial assets, taking into account the risk inherent in investing in a particular share issue.

Thus, for each share there should be some conditionally constant profitability understood as a discount rate that balances the current market price and the amount and timing of future earnings from the ownership of the share around which the actual yield fluctuates due to changes in the market price under the influence of short-term conjuncture factors.

The conditionally constant yield per share should depend first of all on the prevailing market interest rate

on risk-free assets, which reflects the minimum level of profitability of financial investments required by investors, taking into account the demand and supply in the money

market, current and projected inflation, the exchange rate of the national currency and other objective factors.

The difference between the yield per a particular share and the market risk-free return is determined by the level of riskiness of investments in shares in this market and the individual risk of the issuer. The individual risk of an issuer, in turn, depends on a number of interrelated factors, including the probability of its unanticipated bankruptcy

or significant deterioration of its financial condition, from the possibility of executing by the company's managers or its major shareholders the actions that result in market losses for minority shareholders, from sustainability of the company's position in the sales markets, and others.

Thus, the change in the above characteristics inevitably leads to a change in the share price due to the change in the rate used by the market to discount future earnings due to owning this share, even if the forecast of future receipts is unchanged. Naturally, the price of a share is significantly influenced by market factors reflecting the mood of market participants or a short-term imbalance between the demand and supply for shares of this issue.

In our opinion, the hypothesis of persisting of profitability in terms of both initial assumptions and conclusions is not inconsistent with the basic concepts currently adopted in investment analysis, including the notions of an efficient financial market, the theory of rational expectations, the theory of the time value of money and the resulting principles of valuing financial assets based on the discounting of future receipts, and others. The hypothesis on persisting of profitability is also fully supported by market practice, that is, the actual reaction of the market share price to changes in the factors considered above, turns out to be in principle coinciding with the reaction described by this hypothesis.

The yield per share determined on the basis of recognition as justified the hypothesis on persisting of profitability, can be considered as an adequate estimate of the expected yield per share for the forthcoming period, provided that external factors determining the conditionally

constant profitability of this share will remain unchanged, including forecasts of future revenues, based on information on the financial position and prospects of development of the issuer's activity.

It is possible to determine a conditionally constant yield characteristic for a share by expertise (component-wise) or empirically based on an analysis of the reaction of the market share price to the receipt of any material information relating to the market as a whole or to the issuer of this share. In other words, accepting this hypothesis, we come to the possibility and necessity of using the models which are traditionally used to determine the market yield of fixed percentage financial instruments for the evaluation of the share returns.

We believe that the average price movement during a day (hour, week) can be used as an alternative indicator that effectively characterizes the potential profitability of short-term and ultra-short-term (including intraday) operations in the share market; that movement characterizes the potential for speculative profit provided that the investor has the opportunity to alternately take both long and short positions for this share.

However, we should pay attention to the fact that this approach to assessing the profitability of ordinary shares is effective only at medium- and long-term intervals, while the short-term dynamics of the share price cannot be adequately assessed on the basis of an analysis concerning the internal properties of the share, because it is under strong influence of unpredictable and often random conjuncture factors. Thus, for short-term speculative operations, the calculation of investment performance of securities is not a reliable method of analytical justification for investment decisions.

Currently, the most widely used and universal

approach to the formation of a short- and medium-term investment strategy in the financial market is technical analysis.

An additional advantage for the analysis of securities is provided by modern software. Thus, the professional technical analysis tool MetaShare allows conducting a comprehensive analysis of various financial markets and includes many tools, trading systems and experts. The package MetaShare presents a number of effective services that allow optimization of test strategies with securities.

For example, the System Tester service allows testing and selecting the most successful trading strategies on the historical data of a security based on existing or user-developed technical analysis indicators. An additional advantage is the possibility of optimizing the parameters of indicators for a security. Designed to simulate real trading conditions, System Tester allows modifying the signals to the input and output, the size of the opened positions, the size of the commission. The test results are displayed by the monetary balance dynamics graph (Donner and Potere, 2007); (Gup, 2012).

To optimize the strategy based on the signals of combinations of three moving averages, the conditions for opening and closing a long position are set, as well as the conditions for opening and closing a short position

Table 1. An example of the algorithmic representation of a trading strategy on signals of combinations of three moving averages for MetaShare

Position	Terms of opening
Enter Long	Cross (CLOSE, Mov (C, opt1, E)) Mov (C, opt1, E) Mov (C, opt2, E) Mov (C, opt2, E)
Close Long	Cross (Mov (C, opt1, E), CLOSE)
Enter Short	Cross (Mov (C, opt1, E), CLOSE) Mov (C, opt2, E) Mov (C, opt1, E) Mov (C, opt3, E) Mov (C, opt2, E)
Close Short	Cross (CLOSE, Mov (C, opt1, E))

The parameters opt1, opt2, opt3 are the periods of moving averages that will be optimized to obtain greater profit on transactions. In this case, the optimization will be carried out for the selected security. The optimization parameters are listed in Table 2.

Table 2. Parameters of optimization of moving averages

	opt1	opt2	opt3
Minimum value	3	20	100
Maximum value	20	100	200
step	1	5	10

Fig-1. Example of testing the trading strategy for shares of JSC " Aeroflot"

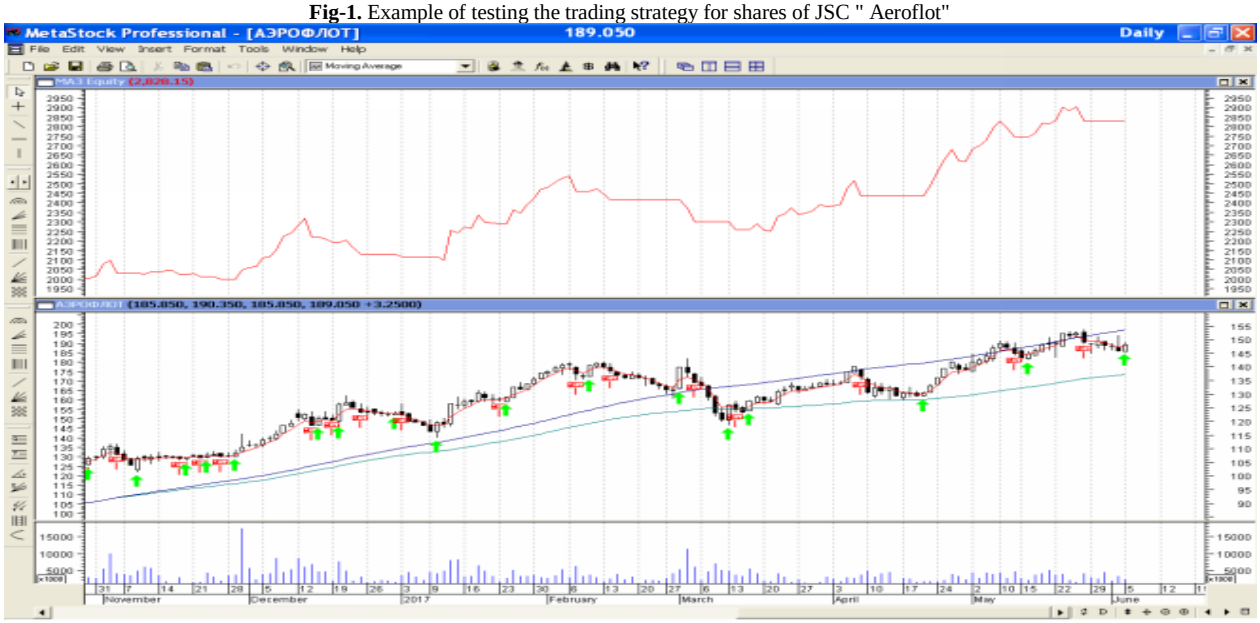

Table 3 shows the values of the optimization parameters for the period from June 2015 to June 2017. The average profitability of the strategy by the signals of combinations of three moving averages will be: 24.38%. Standard deviation: 27.85%. Coefficient of variation: 1.14.

Table 3. Strategy by signals of three moving averages.

Shares	Options opt1, opt2, opt3	Number of profitable positions	Number of loss-making positions	Yield,%
AvtoVAZ	4, 35, 100	13	26th	23.2
Aeroflot	4, 80, 180	17th	21	100.5
Gazprom	13, 65, 100	20	19	13.3
Norilsk Nickel	5, 40, 100	eleven	21	6.6
KAMAZ	6,20,180	9	18	19.2
Lukoil	3, 100, 110	24	22	13.9
Magnet	17, 100, 200	5	8	4.9
Rosneft	9, 95, 150	14	15	10.7
Sberbank	3, 70, 100	25	35	30.2
Transneft	19, 20, 100	5	12	21.3

For comparison, we apply to the same actions for the same period the strategy of "buy and hold." The yield of this strategy is shown in Table 4. The average profitability of the "buy and hold" strategy will be: 24.88%. Standard deviation: 58.37%. Coefficient of variation: 2.35. Comparison of the coefficients of variation of the two strategies 1.14 and 2.35 makes it possible to draw a conclusion about the twofold advantage of the strategy by the signals of combinations of three moving averages over the strategy of "buy and hold".

Table 4. Parameters of the "buy and hold" strategy

Promotions	Price 11.06.15, rub	Price 05.06.17, rub	Yield,%
AvtoVAZ	10.94	9.24	-7.8
Aeroflot	41.1	189.05	180.1
Gazprom	146	119	-9.3
Norilsk Nickel	9590	7887	-8.9
KAMAZ	37.6	52.8	20.2
Lukoil	2,564.9	2,734.5	3.3
Magnet	10,950	8,989	-9.0
Rosneft	245.9	305	12
Sberbank	71.14	154.7	58.8
Transneft	134,800	160,000	9.4

To optimize the strategy based on the Relative Strength Index (RSI) signals, conditions are set for opening and closing a long position, as well as the conditions for opening and closing a short position

Table-5. An example of an algorithmic representation of the trading strategy on signals of the Relative Strength Index (RSI) for MetaShare

Position	Conditions for opening a position
Enter Long	Cross (RSI (opt1), 30)
Close Long	Cross (70, RSI (opt1))
Enter Short	Cross (70, RSI (opt1))
Close Short	Cross (RSI (opt1), 30)

The opt1 parameter is the averaging period for the RSI, which will be optimized to generate greater profit for transactions in the interval (Aharoni, 1966); (Baker and Wurgler, 2007) in steps of 1.

Table-6. Strategy by signals of the Relative Strength Index (RSI).

Shares	Opt1 parameter	Number of profitable positions	Number of loss-making positions	Yield,%
AvtoVAZ	6th	13	6th	9.5
Aeroflot	eleven	4	3	-22.6
Gazprom	10	9	1	34.7
Norilsk Nickel	6th	14	4	23.5
KAMAZ	16	2	1	-0.1
Lukoil	18	2	0	42.9
Magnet	12	8	1	40.2
Rosneft	7th	10	4	33.5
Sberbank	15	-	2	-2.0
Transneft	23	2	0	48.0

The average yield of the strategy by the signals of the Relative Strength Index (RSI) will be: 20.76%. Standard deviation: 23.41%. Coefficient of variation: 1.13.

Comparing the strategy based on the signals of the combinations of three moving averages (coefficient of variation: 1.14) and the strategy based on the signals of the Relative Strength Index (RSI) (coefficient of variation: 1.13), we see the minimal advantage of the oscillator over the trend strategy. This is due to the lack of a pronounced trend in the shares during the period under review.

The effectiveness of the buy-and-hold strategy (coefficient of variation: 2.35) is lower than the effectiveness of the strategy based on the signals of combinations of three moving averages (coefficient of variation: 1.14) and the strategy based on the signals of the Relative Strength Index (RSI) (coefficient of variation: 1.13) (Gup, 2012); (Zhen *et al.*, 2013) .

4. Conclusion

The above calculations prove that theoretical methods allow us to determine the correct direction of the search for an investment solution. The use of modern mathematical software for the analysis of securities such as a professional tool for technical analysis MetaShare allows for a comprehensive analysis of various financial markets and includes a variety of tools, trading systems and experts. The package MetaShare presents a number of effective services that allow you to optimize and test strategies with securities.

In the conditions of modern developing financial markets, stable investment results on medium-term horizons can be achieved using technical analysis methods, preferably with computer optimization of the indicator parameters and strategies used. These results were obtained in this paper. Parameters of moving average periods for a strategy based on signals of combinations of three moving averages were optimized. Optimization of the averaging period of the Relatve Strength Index (RSI) was also carried out, on the basis of which another strategy was formed. Both strategies showed efficiency which is two times higher than the effectiveness of the popular buy-and-hold strategy.

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