Analysis of Factors Affecting Modern Stock Markets

Ruslan G. Bodrov[*]
Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Tatyana V. Nikonova
Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Lilia M. Yusupova
Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Irina A. Kodolova
Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Anatoly V. Pashkeev
Kazan Federal University, Institute of Management, Economics and Finance, Kazan, 420008, Russia

Abstract
The main attraction of stock instruments is the opportunity to make a profit. The prices of a financial asset in the securities market are formed under the influence of a variety of factors, with often multidirectional impact. The objective of the paper is to study and analyze the factors affecting securities and identify those that will effectively predict the dynamics of financial markets. The authors concluded that for the adoption of effective strategic decisions in the field of portfolio investment, portfolio management of financial instruments, the mathematical models have to be applied. The paper presents investment decisions using computer technical analysis. The obtained research results are practical in nature and can be used in investment, analytical, valuation and portfolio activities related to effective investment in securities.

Keywords: Analysis of securities; Derivative financial instruments; Analytical methods; Trading volumes; Technical analysis.

1. Introduction

Technology is a symbol of knowledge in industrial development and the main source of increasing firms' competitiveness and competitiveness of the economies of the countries. Therefore, industrial development based on technology is the main strategy in achieving the top economic rank of the region and the world. The selection of investment projects for the development of technology has been considered in all organizations especially in advanced technology organizations.

By increasing competition and resource constraints of organizations, selecting the appropriate project that can increase profitability and utility and coordinate with the resources of the organization has become a necessity and inappropriate selection of the project leads to negative effects on the organization. One of the new techniques in project management is selecting a portfolio of projects. The proper selection of the project portfolio will result in the organization's limited resources being used for strategic goals. That is why project portfolio management has become very important.

To make effective strategic decisions in the field of portfolio investment, formation and management of a portfolio of financial instruments, the mathematical models used in foreign practice are needed. The skills of evaluation and analysis are decisive and contribute to increase in the competitiveness and value of the company.

2. Methods

Evaluation of the effectiveness of portfolio management is determined through risk assessment and analysis of the probable distribution of the profitability of securities. Therefore, every specialist in the field of economics should have an idea of these methods used in transactions with securities.

The prices of a financial asset in the securities market are formed under the influence of a variety of factors, often with multidirectional impact (Agrawal *et al.*, 2010; Van Aaken and Kurtz, 2009).

The influence of the factor may be ambiguous: at the meeting of the Federal Reserve System (FRS) of the USA in January 2014, a decision was taken to reduce the program of "quantitative easing" (QE) by $10 billion. Subject to the reduction in December 2013, the buyout program fell to $65 billion a month, which is a negative factor for the stock markets. However, these actions by representatives of the Federal Reserve showed a positive assessment of the current dynamics of economic growth in the US. Since 2008, three programs of "quantitative easing" have been implemented (Table 1).

*Corresponding Author

Table-1. Dynamics of financial market indicators during the period of the "quantitative easing" of the FRS

Indicator	Indicator growth rate, %		
	QE1	QE2	E3
S&P500	36	24	1
Micex	133	19	13
Oil	68	27	- 8
Gold	36	21	- 16
USD/RUB	7	- 10	7

Russia in general has benefited from quantitative easing conducted by the FRS. Russia is a classic emerging market with its inherent high level of risks, which the streams of cheap liquidity from the FRS are rushing in, as with former high risks make profitability grow due to the reduced cost of funding (McGrattan and Prescott, 2005; Safiullin *et al.*, 2015).

We shall estimate the dependence of GDP and financial market dynamics. Opponents of "quantitative easing" say that within the QE, the FRS took on balance more than $4.2 trillion, 61% of which falls on government bonds and 30% – on mortgage debts, while GDP grew by only 0.25% or $40 billion, but these actions prevented deflation in the US economy and a deep fall in GDP (Kodolova *et al.*, 2017). Analysis of Table 2 shows that during the period of QE, the total US GDP growth was 21.28%, while Russia's GDP grew by 91.69% at current ruble prices and 20.65% in dollar terms. The significant difference between ruble and dollar growth is explained by the fall in the ruble exchange rate in 2014. The decline in GDP is also significant in 2015, both in the ruble and in dollar terms. The reasons for this are the low price of oil and the sanctions (Van Aaken and Kurtz, 2009).

We shall also note that the first crisis phenomena in the USA economy began much earlier than in Russia, but the consequences of the crisis turned to be more severe for the Russian economy (Yusupova *et al.*, 2016).

Table-2. The volume and dynamics of nominal GDP in the USA and Russia

Year	USA		Russia			
	Value, $ billion	Change, %	Value, billion rubles	Change, %	Value, $ billion	Change, %
2004	11,853.3	6.38	17,027.2	7.2	590.9	37.42
2005	12,623.0	6.49	21,609.8	6.4	764.0	29.29
2006	13,377.2	5,97	26,917.2	8.2	989,9	29,57
2007	14,028.7	4.87	33,247.5	8.5	1299.7	31.30
2008	14,291.6	1.87	41,276.8	5.2	1660.8	27.78
2009	13,938.9	-2.47	38,048.6	-7.8	1222.6	-26.38
2010	14,526.6	4,22	46,308.5	4.3	1524.9	24.73
2011	15,060.0	3.67	60,282.5	4.3	2031.8	33.24
2012	15,650.0	3.92	68,163.9	3.6	2170.1	6.81
2013	16,691.5	6.65	73,133.9	1.8	2230.6	2.79
2014	17,428.1	4.41	79,199.7	0.7	2003.9	-10.16
2015	18,121.3	3.98	83,232.6	- 2.8	1326.3	-33.81
2016	18,624.7	2.78	86,148.6	-0.2	1246	-6.05
2017	19,284.0	3.54	87,480.2	1.5	1267	1.69

The structure of GDP should also be taken into account. A high share of services in GDP creates conditions for the volatility of economic indicators during the crisis.

Table-3. The structure of GDP in the USA and Russia

Sectors of economy	USA, %	Russia, %
Industry	19	35
Services	80	60
Agriculture	1	5

In terms of the share of investment banks in their number in the world, the United States has a big advantage: 34.8% (nearest competitor – Switzerland - 8%). In this regard, the emphasis should be shifted to the location of production in the USA, and not in the Asian region. Analyzing the data of Tables 2 and 3, we get the conclusion: on average, the US GDP is 11.1 times higher than in Russia, and the share of real production in Russia's GDP is 1.8 times higher than in the US GDP. This means that real industrial production in the US is 11.1/1.8 = 6.16 times higher than in

Russia. If we take into account the shadow sector, the gap will become even less noticeable.

To determine the degree of statistical dependence of GDP and the financial market in Russia, we compare the growth dynamics of these indicators for 2000 – 2017.

Table-4. Dynamics of the GDP and MICEX index growth in Russia

Year	GDP growth, %	MICEX index growth, %
2000	51	-5
2001	22	65
2002	21	34
2003	22	62
2004	29	7
2005	27	83
2006	25	68
2007	24	12
2008	24	-67
2009	-6	121
2010	19	23
2011	29	-17
2012	12	5
2013	6	2
2014	12	-7
2015	5	26
2016	3	27
2017	7	-7

Calculation of the correlation dependence of growth of GDP and the MICEX index gives a value of 0.26. The reverse correlation is explained by the time lag of GDP growth compared with the growth of the MICEX index. A high share of the industry in the GDP is also the cause of the negative correlation, since in the crisis periods the financial markets are more sensitive.

An uncontrolled pursuit of profit has already had negative consequences, for example: the collapse of Enron; issuing of trader's bonus. All this led to the fact that attempts were made at the G20 level to reduce the risks from the strategies pursued by banks (Cammack, 2012; Trung, 2015). The data in Table 5 make it possible to verify the existence of large risks due to a high level of leverage in the financial sector. The high levels of credit ratings of financial institutions raise doubts.

Table-5. Open positions in the derivatives market for 2011

Banks	Assets, $ billion	Derivatives, $ billion	Derivatives / Assets, %	Credit rating
JPMORGAN CHASE BANK NA	1811	64,376	3554.72	A3
CITIBANK NATIONAL ASSN	1289	49,127	3811.25	A3
BANK OF AMERICA NA	1452	45,416	3127.82	Baa1
GOLDMAN SACHS BANK USA	104	43,693	42,012.50	Baa1
HSBC BANK USA NATIONAL ASSN	206	3664	1778.64	Aaa3
WELLS FARGO BANK NA	1162	3251	279.78	A2
MORGAN STANLEY BANK NA	67	1699	2535.82	Baa2
STATE STREET BANK&TRUST CO	212	1391	656.13	Aaa3
BANK OF NEW YORK MELLON	256	386	150.78	Aa3
PNC BANK NATIONAL ASSN	263	305	115.97	Baa2
Average	682.2	21,330.8	5802.34	

In terms of "derivatives to GDP ratio" in the world the value will be 1003.4%. In 2017, the volume of open positions in the world for OTC derivatives was more than $532 trillion (Ma and Fung, 2002). The total amount of derivative financial instruments exceeded $600 trillion, and world GDP in 2017 was $79 trillion.

Another factor that affects the stock market is the movement of capital. Its withdrawal from the country has a negative impact (Table 6) (Capital outflow from Russia, 2012).

Table-6. Dependence of capital outflow from Russia on MICEX index profitability

Years	Capital outflow, $ billion	MICEX index profitability%,
2008	129.9	-67.21
2009	52.0	121.32
2010	38.3	23.21
2011	80.5	-16.94
2012	54.6	5.42
2013	62.7	1.69

The correlation coefficient of capital outflow and profitability of the MICEX index is - 0.95. The increase in capital outflow provokes an accelerated decline in the MICEX index. However, in addition to the above factors,

when analyzing securities, it is necessary to consider the investment quality of the shares (the coefficient p/e = 5.1 in Russia is low, which indicates that the market is undervalued), and the debt load of economic entities and the population.

The foregoing proves that the macroeconomic approach does not allow predicting the movement of the value of securities with high reliability.

An important way to assess the feasibility of investing in financial instruments is to determine the estimated investment characteristics. The most famous models are the following: the random walk model, the fair play model, the average profitability model, and the reflexivity model.

However, from the point of view of forecasting, these models prove to be insufficiently effective, since they do not take into account the whole set of factors affecting prices. The experience of long-term observations in the stock markets shows that in the dynamics of stock prices there are also some empirical patterns (anomalies). The most famous of them are: "size effect", "January effect", "pre-holiday effect", "day-o-the-week effect", and "presidential cycle" (Rossi, 2015).

Modern software provides an additional advantage for the analysis of securities. A MetaStock professional tool for technical analysis allows you to conduct a comprehensive analysis of various financial markets and includes many tools.

Table-7. An example of algorithmic representation of trading strategy using signals of combinations of three moving averages for MetaStock

Item	Opening conditions
Enter Long	Cross(CLOSE, Mov(C,opt1,E)) AND Mov(C,opt1,E) > Mov(C,opt2,E) AND Mov(C,opt2,E) > Mov(C,opt3,E)
Close Long	Cross(Mov(C,opt1,E), CLOSE)
Enter Short	Cross(Mov(C,opt1,E),CLOSE) AND Mov(C,opt2,E) > Mov(C,opt1,E) AND 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 8.

Table-8. Moving average optimization parameters

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

Figure 1 shows an example of testing a trading strategy for shares of Aeroflot JSC.

Fig-1. An example of testing a trading strategy for shares of Aeroflot JSC

Table 9 shows the values of the optimization parameters for the period from June 2015 to June 2017. The average profitability of the three moving average trading strategy will be: 24.38%. Standard deviation: 27.85%. Variation factor: 1.14.

Table-9. Three moving average trading strategies

Shares	Parameters opt1, opt2, opt3	Number of profitable	Number of unprofitable	Profitability, %
Avtovaz	4, 35, 100	13	26	23.2
Aeroflot	4, 80, 180	17	21	100.5
Gazprom	13, 65, 100	20	19	13.3
Norilsk Nickel	5, 40, 100	11	21	6.6
KAMAZ	6, 20, 180	9	18	19.2
Lukoil	3, 100, 110	24	22	13.9
Magnit	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 the buy-and-hold strategy to the same shares for the same period. The profitability of the strategy is shown in Table 10. The average profitability of the buy-and-hold strategy will be: 24.88%. The standard deviation is 58.37%.

Variation factor: 2.35. Comparison of the variation factors of the two strategies 1.14 and 2.35 makes it possible to draw a conclusion about the twofold advantage of three moving averages strategy over the buy-and-hold strategy.

Table-10. Parameters of the buy-and-hold strategy

Shares	Price on 11.06.15, rub.	Price on 05.06.17, rub.	Profitability, %
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	2564.9	2734.5	3.3
Magnit	10,950	8989	-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-11. An example of algorithmic representation of trading strategy of Relative Strength Index (RSI) signals for MetaStock

Item	Opening conditions
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 [6; 24] with a pitch of 1.

Table-12. The Relative Strength Index (RSI) strategy

Shares	otp1	Number of profitable	Number of unprofitable	Profitability, %
Avtovaz	6	13	6	9.5
Aeroflot	11	4	3	-22.6
Gazprom	10	9	1	34.7
Norilsk Nickel	6	14	4	23.5
KAMAZ	16	2	1	-0.1
Lukoil	18	2	0	42.9
Magnit	12	8	1	40.2
Rosneft	7	10	4	33.5
Sberbank	15	-	2	-2.0
Transneft	23	2	0	48.0

The average profitability of the Relative Strength Index (RSI) strategy will be: 20.76%. Standard deviation is 23.41%. Variation factor: 1.13.

3. Discussions

Comparing the three moving averages strategy (variation factor: 1.14) and the Relative Strength Index (RSI) strategy (variation factor: 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 (variation factor: 2.35) is lower than the effectiveness of the three moving averages strategy (variation factor: 1.14) and the Relative Strength Index (RSI) strategy (variation factor: 1.13).

4. Summary

The above calculations prove that theoretical methods allow us to determine the correct direction of the search for an investment solution.

The application of modern mathematical software for analysis of securities, as a professional tool for technical analysis of MetaStock, allows for a comprehensive analysis of various financial markets and includes many tools, trading systems and experts. The MetaStock package presents a number of effective services that allow you to optimize and test strategies with securities.

5. Conclusions

In the modern developing financial markets, the stable investment results in the medium-term horizons can be achieved using technical analysis methods, preferably with computer optimization of the parameters of the applied indicators and strategies.

These results were obtained in this paper. Parameters of moving average periods for the three moving averages strategy were optimized.

Optimization of the Relatve Strength Index (RSI) averaging period was also carried out, which served as the basis for another strategy formed. Both strategies showed to be twofold effective than the popular buy-and-hold strategy.

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