ATLANTIS PRESS

Correlation of Financial Markets and It Significance for the New Silk Road: The Case of Russia

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Abstract—The integration of countries and regions into global economic processes, among which we can mention The Belt and Road Initiative, is significantly affected by the existing interconnections of national financial markets. The paper gives a detailed analysis of the relation between the dynamics of the Russian stock market (based on the RTS index) and changes in external economic factors of the real and financial sectors. We propose to divide the period of the study (from 2002 to 2018) into different economic activity phases, which will allow to estimate the structure of the factors of the RTS index dynamics during pre-crisis, crisis and post-crisis periods. We used a correlation analysis of time series of indicators to analyze the structure of factors. We demonstrate that the structure of external factors of the real sector of the economy underwent changes as a result of the financial and economic crisis in 2008, just the relation between the RTS index and oil prices remained. In the period of Russian economy recovery from 2009 to 2014, the relation between the Russian market and the US consumer price index is again revealed. In the crisis of 2014, the structure of the external factors of the real economy became similar to that from 2002 to 2008. Conclusions are drawn that significant changes concerned the external financial factors structure influencing the Russian market only during the recovery of the domestic economy from 2009 to 2014. The practical implication is that the nature of world crisis is associated with globalization of financial markets. And overcoming global recession can be solved by means of international coordination of financial and economic policies.

Keywords: financial market, stock index, economic crisis, correlation

I. INTRODUCTION

One of the most important indicators of the national economy development is the dynamics of stock indices. The Russian securities market belongs to the category of emerging markets and is exposed to integration processes into the global economy. The study of changes in the structure of external factors is especially important in the conditions of alternating crises of 2008 and 2014. Chowdhury, Dungey and etc. [1] investigated the changing integration of emerging markets access to the global financial network in crisis periods. Global and regional aspect of emerging markets integration has been considered by Caporale, You and Chen [2]. In the global dimension, it was examined integrating within US economy. Dias, Silva and Dionisio [3] have revealed that integration process of emerging markets increase during the crisis to increased exposure of developed markets. It should not to be forgotten, however, that the integration process is going on during and out of global recession.

By virtue of the fact that integration leads to recession spread it is necessary to provide the international coordination policy. Park and Kim [4] has examined the conditions for effective coordination international policy in the field of financial regulation, including cross-border externalities. The role of international policy coordination mechanism to reduce the moral hazards of the financial intermediaries considering cross-border financial externalities was researched by Kim [5]. Zaremba, Kambouris and Karathanasopoulos [6] have revealed that the integration progresses in peaks and troughs instead of linearly. At the post-2000 markets exhibit the strongest integration in history. In connection with this problem, it is of interest to find correlation between Russian stock market and economy of foreign territories. This will enable us to identify the importance of development of the stock market in constructing a New Silk Road.

II. LITERATURE REVIEW

Evidence that the expected return on stock assets contains a premium that is related to business conditions was made clear in 1990 by the authors Fama and French [7]. The relation between the three most important indicators of economic development: economic growth, inflation and market capitalization for developed countries was have identified by the authors Pradhan, Arvin and Bahmani [8]. Jouins [9] have revealed a significance long-term influence of oil prices on almost all GCC stock markets, and for some revealed the impact of the MSCI World Index. Dong and Yoon [10] found out the sensitivity of Asian emerging markets to the dynamics of industrial production in OECD countries and gold prices. Basher, Haug, Sadorsky displayed a significant impact of oil demand shocks to some stock markets of oil-exporting countries, including Russia [11]. Particular attention is devoted to the impact of external factors to BRICS stock markets. For example, Mensi, Hammoudeh, Reboredo and Nguyen [12] revealed the effect of US stock market, gold and oil prices on these markets, and also proven the insignificance of the US political uncertainty index. The influence of the financial and economic crisis in 2008 on the correlation between the BRICS stock markets and the advanced economies revealed in works Gilenko and Fedorova [13], as well as Zhang, Li, Yu [14]. Alifanova and Evlakhova [15, 16] are thoroughly working on network and institutional approaches to the issue of financial market regulation in order to reduce risks and the impact of threats.

The goal of our paper, in contrast to other existing researches, is an assessment of the impact of a group of external economic factors to the dynamics of the Russian stock market with due allowance for two periods of macroeconomic shocks: 2008 and 2014.

III. METHODS

A. Data

The RTS index was used as a representative indicator of Russian stock market dynamics, because it is reflecting the total capitalization of shares of 41 listed companies, denominated in US dollars. It has made the selection of factors affecting the RTS index was decided on the basis of explicable economic mechanisms of influence and the presence of statistically significant links, which was identified in the Russian and foreign scientists' studies. Thus, we empirically investigate the structure of the relation between the RTS stock index and the main external economic factors: GDP and the U.S. consumer price index, prices for Brent crude, the US Federal Reserve interest rate, ECB refinancing rate, Dow Jones Composite Average and FTSE100. The sources of data are official sites of the Moscow Exchange, the US Bureau of Economic Analysis and the US Bureau of Labor Statistics, the US Federal Reserve and the European Central Bank, S&P Global and the London Stock Exchange.

B. Probing procedure

The whole period of the study from 2002 to 2018 divided into four significant economic substance periods. This division

is based on an event analysis of the Russian economy and a graphical analysis of the stock market dynamic: January 2002 - June 2008 - the period is from the beginning of the active capitalization growth of the RTS index until the crisis of 2008; July 2008 - September 2009 - the period is a sharp decline in stock market capitalization; October 2009 - September 2014 - post-crisis recovery of the positive dynamics of Russian stock market; October 2014 - October 2018 - sharp drop in oil prices, stable dynamic of the RTS index.

In the paper we applied the correlation analysis method for determining the presence and nature of the relation between the Russian stock market and external factors. This method of analysis is traditionally used by researchers in studying the dynamics of stock markets, because it demonstrates reliable and reasonable results. For example, Ferreira, Pereira, Silva and Pereira [17] used the tool the deterministic correlation coefficient to analysis changes in the trade-off between the stock market and the oil market under the impact of the 2008 crisis. Oztek and Ocal studied the correlation between stock markets and commodity markets under crisis conditions [18]. The Abounoori and Tour applied correlation analysis to study the interdependence between US and some Asian stock markets [19].

IV. RESULTS

A. Detection of the relation between variables

The performance of the relationship between the Russian stock market on the go market and the US GDP is provided in TABLE I.

Before the global financial and economic crisis, the relationship between the RTS index dynamics and US GDP value changes was sufficiently strong. There was no statistical relationship between these indicators during the period of macroeconomic shock. This can be explained by the chaotic dynamics of stock indices, which unrelated with the real sector at the end of 2008.

TABLE I. CORRELATION COEFFICIENT BETWEEN THE RTS INDEX DYNAMICS AND THE US GDP VALUES.

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.95 ***	14,55	1.71
July 2008 - September 2009	insignificance	1.20	2.35
October 2009 - September 2014	insignificance	-0.76	1.72
October 2014 - December 2018	0.87 ***	6.46	2.13
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

As a result of the economic crisis associated with an oil price downturn, from 2014 the relationship between the RTS index and US GDP has returned in the guise of strong and direct status.

The Consumer Price Index shows the inflation trend of goods and services according to consumer's viewpoint. Positive dynamic of prices is evidence for an increase in national welfare. The correlation between RTS index and the US Consumer Price Index is presented in **Ошибка! Источник ссылки не найден.**

TABLE II. CORRELATION COEFFICIENT BETWEEN THE RTS INDEX DYNAMICS AND THE US CPI

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.97***	35.44	2.64
July 2008 - September 2009	insignificance	-1.20	1.77
October 2009 - September 2014	-0.56***	-5.14	2.66
October 2014 - December 2018	0.71***	6.21	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

The first period characteristically exhibits a very strong direct relation between the examined indicators. In mid-2008, during the crisis, the correlation lost statistical significance. After the macroeconomic shock, the relationship direction interchanged to negative coefficient value. The recovery of the positive RTS index dynamics was accompanied with downward change in the consumer price index and with keeping the US Fed interest rate close to zero. In 2014, the relationship between variables came back direct and strong once again. One can easily see the reason for this dependence: side trend of RTS and US policy directed towards curbing inflation.

Before we go further results, it is worth observing that the oil market is represented by a spot and futures market. Currently oil became a financial asset in a derivatives market (the financialization of oil). Dynamic of it affects to pricing at spot-market [20]. Opinions as the capitalization growth of Russian stock market largely constrain with the oil market conditions, are confirmed by the data of TABLE III.

In the pre-crisis and crisis periods (2002-2009), the correlation coefficients between the RTS index and Brent futures show a direct and strong relation. The relationship between the variables in question became weak during the period of recovery of the RTS index positive dynamics.

TABLE III. CORRELATION COEFFICIENT BETWEEN THE RTS INDEX DYNAMICS AND PRICES FOR BRENT CRUDE OIL

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.91***	18.95	2.64
July 2008 - September 2009	0.95***	10.75	3,01
October 2009 - September 2014	0.29**	2.34	2.01
October 2014 - December 2018	0.66***	5.41	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

However, the oil shock in 2014 led to increase of correlation between the Russian stock market and oil prices. Since 2014, immediate players in the oil market, that is, oil companies and buyers, have been influenced its dynamics a little. Strong competition between oil-exporting countries at the spot-market led to future price reduction.

During the period from 2002 to mid-2008, the correlation coefficient between the RTS index dynamics and values of the ECB refinancing rate indicates a direct and measurable relation between them (TABLE IV.).

TABLE IV. CORRELATION COEFFICIENT BETWEEN THE RTS INDEX DYNAMICS AND VALUES OF THE ECB REFINANCING RATE

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.66***	7.58	2.64
July 2008 - September 2009	0.54**	2.33	2.16
October 2009 - September 2014	0.64***	6.33	2.01
October 2014 - December 2018	-0.60***	-4.52	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

In the crisis of 2008, these variables were closely related. In the period of the Russian economy recovery this interrelation had increased. We found out negative relationship between indicators after the oil shock in 2014.

The TABLE V. demonstrates a firm relationship between the Russian RTS Index and US interest rate change. Before the crisis and during the start of quantitative easing programs in the US economy, the interrelation of indicators was strong and direct.

TABLE V.   CORRELATION COEFFICIENT BETWEEN THE RTS INDEX DYNAMICS AND VALUES OF THE US Fed INTEREST RATE

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.78***	50.68	2.64
July 2008 - September 2009	0.67***	16.06	2.16
October 2009 - September 2014	insignificance	0.00	2.01
October 2014 - December 2018	0.71***	34.14	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

After the crisis, there is no relation between the indicators as a result of a long-term retention interest rate of 0.25%. Closing up QE-3 in 2014 has led to a return of statistical interrelation between the RTS dynamics and the US interest rate.

The relationship between the Russian RTS index and the American DJ CA was characterized as direct and very strong index before and during the financial and economic crisis (TABLE VI.).

TABLE VI.   CORRELATION COEFFICIENT BETWEEN DYNAMICS THE RTS INDEX AND DJ CA INDEX

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.95***	25.50	2.64
July 2008 - September 2009	0.86***	6.07	3.01
October 2009 - September 2014	-0.41***	-3.39	2.66
October 2014 - December 2018	0.85***	9.71	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

During the period from 2009 to 2014, the direction of the relation between the indicators under consideration has changed, but the interrelation has become weak. In the crisis, since 2014, the correlation between the American and Russian stock markets has been direct and strong.

In contrast to the US stock market, European indexes moving is almost simultaneously with moving of the Russian market. This fact is of utmost importance for speculative investor and for detection of the relation between variables. According to the data of TABLE VII. the RTS index was closely related with the dynamics of the capitalization of the 100 largest UK companies both before and during the global financial crisis.

TABLE VII.   CORRELATION COEFFICIENT BETWEEN DYNAMICS THE RTS INDEX AND FTSE100 INDEX

Period	Correlation	t-Statistic (obs.)	t-Statistic (critical)
January 2002 - June 2008	0.89***	17.21	2.64
July 2008 - September 2009	0.90***	7.42	3.01
October 2009 - September 2014	insignificance	-1.81	1.67
October 2014 - December 2018	0.81***	8.49	2.72
Note: *** – correlation coefficient significance at 1% level ** – correlation coefficient significance at 5% level * - correlation coefficient significance at 10 % level			

During the global economic recovery after shock of 2008, there was no correlation between the RTS and the FTSE 100. The relation between indicators is again characterized as direct and strong after the oil price downturn.

V.   DISCUSSION OF RESULTS

The structure of financial factors that influence on the Russian stock market in the studied period from 2002 to 2018 is presented in **Ошибка! Источник ссылки не найден.**.

During the global financial and economic crisis, the structure of factors that interrelated with the RTS index dynamics has changed. The statistically significant correlation coefficients show a positive relation between the RTS index and Brent crude quotes, the European Central Bank interest rate and stock indexes of the world's leading exchanges.

TABLE VIII.   ANALYSIS THE STRUCTURE OF EXTERNAL FINANCIAL FACTORS IN THE DIRECTION WITH THE DYNAMICS OF THE RTS INDEX AND IT SIGNIFICANCE

Period	Brent	ECB	DJA	FTSE	FRS
January 2002 - June 2008	+0,91	+0,66	+0,95	+0,81	+0,78
July 2008 - September 2009	+0,95	+0,54	+0,86	+0,89	+0,67
October 2009 - September 2014	+0,29	+0,64	-0,41	0	0
October 2014 - December 2018	+0,66	-0,60	+0,85	+0,90	+0,71

It is our opinion that the change in the structure of factors is due to the fact that the asset prices of all stock and commodity exchanges had downward dynamics and central banks took measures to prevent the effects of shock. Investors were not ready for passive investment strategies; therefore the speculative nature of transactions was prevailed. As a rule, a speculative investor in strategy development in keeping track of the dynamics of world stock and commodity exchanges.

From 2009 to the first half of 2014, the interrelation between the RTS index and the US consumer price index changed: the bull trend of the Russian market in this period was inconsistent with the price dynamics in the real US economy. The correlation with the DJ CA index changed to inverse. There was no correlation between the RTS and changes in the American refinancing rate and the leading UK

index, FTSE 100. In condition of oil price hike, investors had strong views on real economy indicators of oil-consuming countries. The main role was playing reports of international organizations for the oil extraction and consumption, even more than the oil futures dynamics. Therefore, the correlation between indicators is statistically weak.

Consequently, the Russian stock market was becoming less dependent on external factors during the recovery period.

After the oil price downturn, the Russian stock market dynamic was again closely related to the indicators of the US real sector of the economy. In addition, the correlation coefficients between the US factors and the RTS index are similar in economic substance to the values before the 2008 crisis. During the period from the second half of 2014 to 2018, the direction of the correlation between the Russian stock market and the ECB refinancing rate is changing. In the current geo-economic situation, the Russian market is more stable in contrast to the macroeconomic shock in 2008. Negative about the weak oil prices and the downfall of US markets, as well as the reaction to the central banks session were won back on the Russian market in the second half of 2014. Within this framework, investors have the opportunity to consistently make decisions, focusing on the external environment factors of both the real and financial sectors of the economy. The further dynamics of the RTS index are in a greater degree interested in the dynamic development of European companies.

VI. CONCLUSIONS

We investigated the structural changes influence of changes of external economic factors against the Russian RTS index. Correlation analysis showed structural changes in different periods of economic activity. In the pre-crisis time, the RTS index had a direct connection with the large part of the analysis indicators. In the period of the global financial and economic crisis, a positive relationship was kept only with the Brent crude quotations, the ECB interest rate and stock indices of the world's leading exchanges. In the post-crisis period, the RTS dynamics were correlated with the US consumer price index, as well as with oil prices and stock exchanges. Since 2014, the structure of external economic factors influencing the Russian stock market becomes analogous to the structure of the factors in the period 2002-2008.

It is of interest to estimate the structure of external economic factors after the 2014 geo-economic crisis and its comparison with the structure in the period 2009–2014. It could confirm the feasibility of using an analysis of this structure of factors to refine the criteria for choosing an investment strategy or building a medium-term scenario forecast.

From the above results it is clear that the correlation between Russian stock market and external financial indicators increases during the crises. At the same time, the results indicate that the correlation between Russian stock market and external real sector be lost. In this connection, it is worth noting that financial market integration intensifies in a world recession. This gives us the required characteristics of

fulminant spreading of crises from developed countries to emerging markets. Thus, we have good grounds for saying that overcoming global recession can be solved by means of international coordination of financial and economic policies. And there is an obvious need for the development and appliance the concept of the New Silk Road as the way of achieving the above objective.

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