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Exchange Rate Risk Related to MICEX and RTS Indices

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Abstract: This paper examines the exchange rate risk on the Moscow Exchange. Two main Russian equity indices — MICEX and RTS — were chosen as the objects of research. These indices are calculated as capitalization-weighted, based on prices of fifty most liquid stocks of Russian companies related to the main sectors of the Russian economy. Both indices are calculated in real time and their bases are composed of identical stocks. The difference between MICEX and RTS is the currency in which they are denominated. While MICEX index is denominated in rubles, RTS index is denominated in US dollars. Data has been gathered from June 2000 till June 2014. Daily closing prices have been used. The main hypothesis was tested by using linear regression model and its adjustments. The established hypothesis that two correspondent indices, which differ only in currency in which they are denominated, have different price development in time was proven.

Key words: equity indices; exchange rate risk; Moscow exchange
JEL codes: G15, F31

1. Introduction

The connection of financial markets is thanks to the modern technologies closer than ever. Authors narrowed their focus on Russian financial market, Moscow Exchange, where two formally identical indices MICEX and RTS are quoted. The question posed is whether or not these two indices, differing only in the currency they are denominated in, have the same performance in time. According to the Moscow Exchange these indices have the same index calculation formula, but MICEX is denominated in rubles, while RTS in US dollars. Both indices are capitalization-weighted composite indices of the Moscow Exchange and they are based on prices of trades executed in highly liquid capitalized securities of issuers admitted to trading on the Moscow Exchange. The first calculation of RTS index was conducted in 1995 and two years later the MICEX index was quoted. Given the time period of the existence of the indices we can infer that there could be enough data to examine their price development and compare them. This article analyzes a connection between these two indices in terms of their price development and factors which determine changes of the indices' performance. Besides that authors examined the existence of the exchange rate risk related to these two indices and provide recommendations for different types of investors.

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2. A Selected Review of Literature

This paper is built on a unique hypothesis and is based on original research of authors. Authors have not found any text involving the same aim as it is defined in this paper. Russian indices have not been examined as a matter of exchange rate risk or currency risk recently.

However, Grigoriev and Valitova (2002) made research based on comparing MICEX Index and RTS Index in 2002. Their conclusions are not significant for this paper because the development of Russian markets since 2002 has been affected by plenty of circumstances, when the vast impact was observed during the financial crisis in 2008-9. They found out that 99% of fluctuations in MICEX index were caused by fluctuations of LUKoil, UES, Surgutneftegaz and Rostelecom stocks and 97% of fluctuations in RTS index were caused by fluctuations of LUKoil, UES, Norilsk Nikel and Rostelecom at the time of their research. For the purpose of this paper the reasons of similarities and differences in Russian indices performance were not essential. This paper should only provide recommendations for investors based on the performance itself. They used exchange rates to see both indices' value in US dollars. In this paper it was not necessary or even convenient to transform one currency to another one because we did not necessarily assume that investor do not operate with both currencies. There is no need to exchange rubles and US dollars after every investment.

Another approach to the MICEX index was presented by Birau (2013). Her paper provides an analysis of MICEX 10 index which consists of 10 blue-chip Russian stocks. It shows that Russian indices are highly influenced by financial crises. In this paper the same pattern is observed.

In his paper, Verdelhan (2010) works with a term exchange rate risk. He argues about different types of investors and changes in their risk-aversion over time depending on various habit preferences. Following his theory this paper approves that for different types of investors, different financial instruments are usable.

Emerging markets have been very often discussed recently. These markets are full of opportunities to invest and to gain high profits. Unfortunately, they are still developing and the risks are higher than in the regular well-developed financial markets. The first interesting question is connected with indices as financial instruments which explain the most about particular market. That was the stimulus for authors to focus on indices concretely in the Russian financial market represented by Moscow Exchange as the Russian market could be considered along with Brasil, India and China as the member of so called BRIC emerging markets. Russian indices are represented by MICEX index and RTS index.

According to Simon (Sechel & Ciobanu, 2014) the emerging markets are linked with the following parameters: the small size of economy, GNP per capita much lower than in developed countries, a reduced opening for accepting foreign investors, a high volatility of exchange rate which implies greater risk in trading. The least parameter is essential because in this paper the authors examined the exchange rate risk of the stock market indices in one of the emerging economies. Emerging countries are considered to be in a high-speed growing process and have a larger possibility to offer investors higher return than developed countries because of their fast growing potential.

In 2009 IMF stated that the BRIC represented 25% of global GDP and 40% of the world's population spread over three continents. In 2011, according to IMF, the BRIC represented 21.6% of global GDP and 41.8% of the world's population. In 2013 IMF (2014) calculation of global GDP of BRIC was 26.9% (Brazil 2.8%, Russia 2.9%, India 5.8%, China 15.4%) and of global population of BRIC was 41.8% (Brazil 2.8%, Russia 2.0%, India 17.7%, China 19.3%).

International Monetary Fund (2011) quoted that appearance of BRIC has been restructuring low-income countries' international economic relations. The industrial countries are still dominant development partners of low-income countries[1], however, according to IMF over the past decade the financial inputs from BRIC to low-income countries grew have increased very rapidly. Some emerging markets earned the prominent role in the global economy, IMF (2014), and the impact of BRICS growth has become significant in terms of factors enhancing other emerging market economies. Hence the BRIC emerging markets not only provide the investors from developed countries with high-yield opportunities, but also help to low-income countries to boost their economies and therefore BRIC could enhance the global economy. IMF (2014) calculated the average growth of BRICS[2] in period of years 1998-2013 (and the forecast five-year-ahead growth since 2013 to 2018) for Brazil 2.9% (3.5%), Russia 4.4% (3.5%), India 6.9 % (6.7%), China 9.6% (7%), South Africa 3.2% (3.5%).

Emerging markets are regarded as risky in comparison with developed countries which bear less risk. Sechel and Ciobanu (2014) indicate that financial investments conducted in emerging markets bear risk mainly due to their price volatility which is the consequence of collection of other risks attached to the investment, such as political risk (observed in politically less stable countries), inflation rate (affecting the value of investment and other macroeconomic factors), and change or exchange rate (which is directly related to the exchange rate risk examined in this article). Nonetheless, the investors can trade off higher risk for obtaining high profits which may be higher than those obtained in financial markets of developed countries. The other advantage for investing in financial instruments of emerging markets is the diversification of investor's portfolio owing to not strong correlation between emerging markets and developed countries.

It is generally known that each and every investor has different preferences in risk, rate of return and liquidity. In the ideal situation the investor would invest into financial instrument generating the highest rate of return, the lowest risk and the highest liquidity, but this is only hypothetical situation. The relationship between the rate of return and risk is positively correlated thus investors have to settle for investments with high return, but also high risk and low liquidity, or low return with low risk and high liquidity. Risk-averse investors prefer lower risk and lower rate of return, while aggressive investors would prefer higher risk and higher rate of return. In current financial system the investors do not have to deal with single risk alone, they can use diversification as one of the tools in order to lower the risk of their investments. It was Markowitz (1952) in his Portfolio Theory who demonstrated creating a portfolio with optimization of risk and return. Perold (2004) stated that the investors who diversify their investments face less risk per investment than investors who do not. And so they are not reluctant to obtain lower expected returns and to pay higher prices. Therefore investors might differ in their pricing of risk.

The question is how to detect the right financial instrument for certain level of risk. This paper provides answer to that question by using linear regression model. It is examined if there is difference in performance between MICEX and RTS indices in time and this difference is represented by the volatility or simply the risk. Because MICEX index is denominated in rubles while RTS index is denominated in US dollars, this paper investigates concretely exchange rate risk or currency risk. In conclusion authors provide precise recommendations which Russian index should aggressive investors prioritize and which one is more convenient for risk-averse investors.

[1] IMF regarding as low-income developing countries 60 countries at the bottom end of the national income per capita ladder. This group collectively account for an insignificant share of global GDP but is residence to 20% of the world's population.

[2] In 2010 was addend South Africa so the abbreviation BRICS includes Brazil, Russia, India, China, South Africa, which differs to the BRIC where we count Brazil, Russia, India, China.

3. Data

As mentioned forehead, according Moscow Exchange, the RTS index was first calculated in 1995 in US dollars and the MICEX index in 1997 in rubles, both in real time and on base value 100. The index current value (on 1st November 2014) of RTS was 1091.44, while of MICEX it was 1488.47. The index securities capitalization in US dollars of RTS was 165020000000 USD and of MICEX was 163376262603 USD.

Regarding to the available Moscow Exchange statistics the asset allocation of both indices included major industries such as energy (oil and gas), financials, materials (metals and mining), consumer and retail, telecommunication services and others. For instance, in the indices the global energy company GAZPROM weights up to 15%, oil producer LUKOIL 14.96%, Sberbank 11.39% representing the banking sector, retailer Magnit company 6.98%, nickel and palladium mining company Norilsk Nickel 5.15%, natural gas producer NOVATEK 4.53%, Rosneft 4.53% operating in petroleum industry and finally consumer services company Sistema 1.97%.

The methodology of calculation of RTS Index is the following (Moscow Exchange, 2014):

$$I_n = \frac{MC_n}{D_n} \tag{1}$$

The total capitalization (aggregate value MC_n) of all stocks as of the *n*-th moment of the Index calculation is divided by the value of divisor (D_n) of the *n*-th moment of the Index calculation. The divisor means the total capitalization (aggregate value) of all stocks as of the Index inception date, corrected regarding the changes of the List of constituents and the initial Index value.

The formula used on Index inception day was (Moscow Exchange, 2014):

$$D_1 = \frac{MC_1}{I_1} \tag{2}$$

Where MC_1 stands for a total capitalization of all stocks and I_1 for the Index value as of the Index inception date.

The initial value applied on the 22nd September 1997 was 100 for I_1 (Index value), MC_1 (Aggregate value of all stocks) equaled 240 287 712 872.71 RUB and D_1 (Divisor value) was 2 402 877 128.73.

In the *n*-th moment of the Index calculation the total capitalization (aggregate value) of all stocks is (Moscow Exchange, 2014):

$$MC_n = \sum_{i=1}^{N} P_i \cdot Q_i \cdot FF_i \cdot W_i \tag{3}$$

Where N is the total number of stock of one type issued by one issuer, P_i is price of the *i*-th stock in rubles, Q_i is the total number of *i*-the stock of one type issued by one issuer, FF_i is adjusting coefficient based on the number of stocks and outstanding stock represented by free-float coefficient (DRs), and W_i is weighting coefficient (restricting the share of the *i*-th stock's capitalization).

In case of MICEX Index, the methodology of calculation the dollar index is the same apart from currency (low index c). As for the initial values were applied on 1st September 1995 the value 100 for I_{c1} (Dollar Index value), MC_{c1} (Aggregate value of all stocks) equaled 12666080264 US dollars and D_{c1} (Divisor value) was 126 660 802.64.

In MICEX calculation of aggregate value of all stocks (MC_{cn}) as of the *n*-th moment of the Dollar index is

applied the same formula as for the RTS Index, however, the price of the *i*-th stock used in MICEX Index is quoted in dollars (P_{ci}), therefore is defined (Moscow Exchange, 2014):

$$P_{ci} = \frac{P_i}{K_n} \tag{4}$$

Where P_i is price of the *i*-th stock in rubbles, and K_n is US dollar exchange rate against the Russian ruble as of the *n*-th moment of calculation, approved by Moscow Exchange in accordance with the methodology of calculation.

From the above mentioned Moscow Exchange Index calculation methodology we can infer that both indices are truly calculated according to the equivalent formulas. However, they differ in defining the stock price which in RTS Index is given in rubles, on the contrary in MICEX Index the conversion into US dollars needs to be done, because the USD/RUB exchange rate is critical for the calculation.

For the matter of modeling part this paper works with time series based on daily closing prices of MICEX and RTS. The data for time series was collected from the 20th June 2000 to the 13th November 2013. This period covers almost the whole existence of these indices since they have been introduced to the Moscow Exchange. That makes the total number of observations to be 3497.

When we analyze the historical development of both indices it is clear that in the beginning of their existence their value was rising very quickly. Russian industrial and corresponding fields were growing and so did the shares of the corporations. Unfortunately in 2008 financial crisis arose and it had a huge impact on the whole world economy including the Russian. It is easily visible in the graphs. During the year 2008 the value of MICEX and RTS dropped down by 80% and since then they have never reached the historical maximum again. In Figures 1 and 2 we can compare the development of indices prices in our time range.

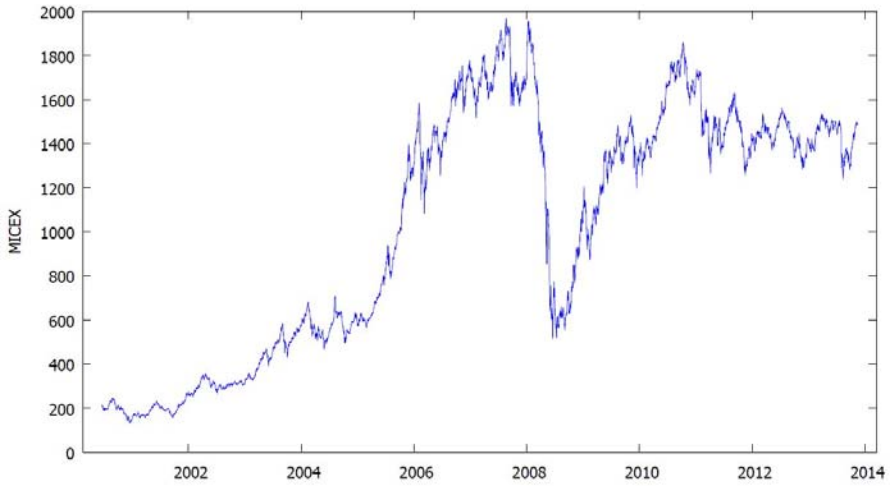

Figure 1 MICEX

Source: authors' own calculations based on Moscow Exchange data using software Gretl

By eye these graphs looked very similar therefore we found the correlation between M and R and it is equal to 0.984. That indicates that indices perform similarly, almost equally. This information is important for modeling because we must avoid models which have one variable as dependent and the other one as explanatory.

Beside the high correlation between M and R there was another problem-each index was not traded every day when the other one was, therefore there were some missing values in the given period. It was necessary to keep the dataset in 5-day form precisely hence the missing values were estimated by using linear regression, OLS

method, when 10 previous and 10 consequent observations were used. Currently known variables were: T = (1,..,3497) which stands for time in days, M which represents closing prices of MICEX index in the given period, R which represents closing prices of RTS index. Additionally new variable Gap = M-R have been defined. It stands for the difference of price of the two indices. If we draw a scatter plot of how Gap depends on time, we see that almost the whole time indices develop likewise but there are some evident exceptions (see Figure 3).

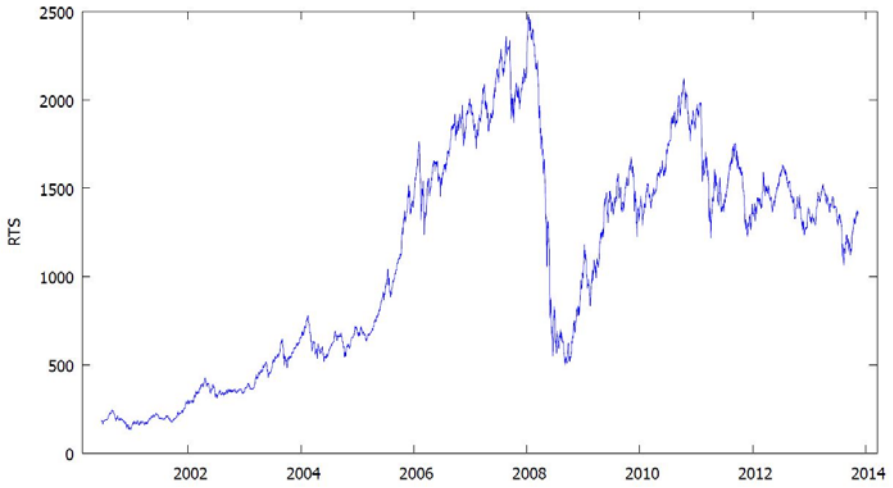

Figure 2 RTS

Source: authors' own calculations based on Moscow Exchange data using software Gretl

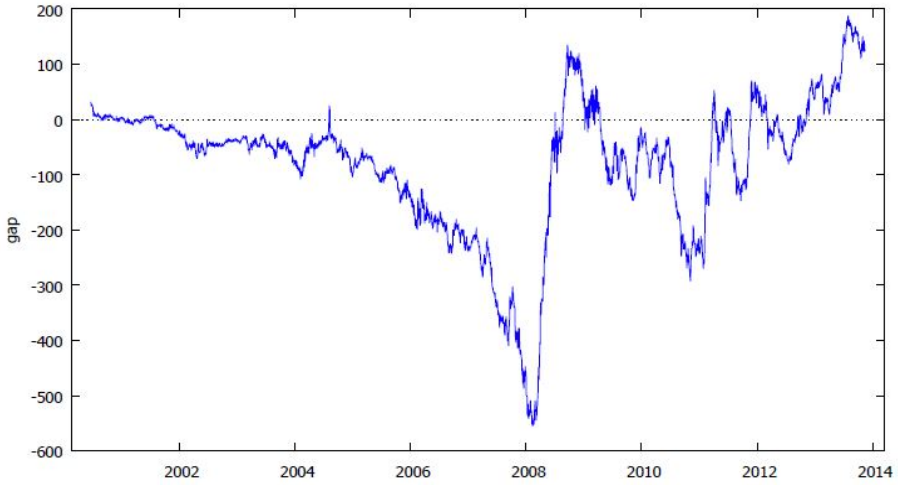

Figure 3 Gap

Source: authors' own calculations based on Moscow Exchange data using software Gretl

4. Methodology

As we follow the development of MICEX and RTS indices, we state a hypothesis that two correspondent indices that differ only in currency in which they are denominated do not have the same development in time. The aim of stating this hypothesis is to find out whether there is any currency risk existing. This should help investors to decide in which index it is more convenient to invest, concretely if there is any effect of currency risk on their possible profit.

When working with time series of financial instruments there is always a very high possibility of autocorrelation problem. First it needs to be tested whether there is any autocorrelation problem in both MICEX and RTS series. The results of the sequence autocorrelation model AR(15) with lagged variables M1 to M15 and R1 to R15 show that lagged variables M2 to M15 and R2 to R15 are not significant on a 5% confidence level, but there is certainly a problem with the first order autocorrelation. New variables were added to the model as a solution of this problem. Variables difM and difR represent first differences of variables M and R and variables l_difM and l_difR represent logarithms of first differences of variables M and R. Having done that the autocorrelation problem was avoided. That was verified by another autocorrelation test.

Consequently it was tested if there is any deterministic trend in the series and the result was that there was not. It meant that the value of an index was not determined by time. Unit root in these series was not found as well.

4.1 The First Differences Model Approach

After data quality was investigated, linear regression model was built using Cochran-Orcutt method and OLS method given by model 1:

$$difM_t = \beta_0 + \beta_1 \cdot difR_t + \varepsilon_t \quad (5)$$

Where ε_t is a white noise, β_0, β_1 are coefficients.

4.2 The Logarithms of First Differences Model Approach

Furthermore linear regression using Cochran-Orcutt method and OLS method given by model 2 was done:

$$l\_difM_t = \beta_0 + \beta_1 \cdot l\_difR_t + \varepsilon_t \quad (6)$$

Whereε_t is a white noise, β_0, β_1 are coefficients.

5. Results

The results of the model 1 using first differences are captured in Table 1.

Table 1 First Differences Model

OLS, using observations 2000/06/21-2013/11/13 (T = 3496), dependent variable: $difM_t$				
	coefficient	std. error	t-ratio	p-value
const	0.078	0.141	0.553	0.58
$difR_t$	0.850	0.006	142.3	0.00

Source: authors' own calculation using Gretl software

Having done this estimation following equation was achieved:

$$\widehat{difM_t} = 0.078 + 0.85 \cdot \widehat{difR_t} \quad (7)$$

While intercept is not significant on a 5% confidence level with p-value 0.58 and its coefficient is almost equal to zero, variable difR is significant on a 5% confidence level with p-value equal to 0 and the coefficient is significantly different from 1. Standard errors are very low.

The results of the model 2 using logarithms of the first differences are captured in Table 2.

Table 2 Logarithms of First Differences Model

OLS, using observations 2000/06/21-2013/11/13 (T = 3496), dependent variable: l_difM_t				
	coefficient	std. error	t-ratio	p-value
const	0.000	0.000	0.278	0.78
$difR_t$	0.881	0.008	109	0.00

Source: authors' own calculation using Gretl software

Having done this estimation following equation was achieved:

$$\widehat{l\_difM_t} = 0.881 \cdot \widehat{l\_difR_t} \quad (8)$$

While intercept is not significant on a 5% confidence level with p-value 0.78 and its coefficient is approximately equal to zero, variable l_difR is significant on a 5% confidence level with p-value equal to 0 and the coefficient is significantly different from 1 which was verified by t-test. Standard errors are very low.

Consequently it was investigated how strong both models are by comparing their information criteria. We focused on common criteria such as R-squared, Bayesan information criterion and Akaike information criterion. See Table 3.

Table 3 Information Criterions

IC	Model 1	Model 2
R-squared	0.85	0.77
BIC	24768.59	-21910.82
AIC	24756.28	-21923.14

Source: authors' own construction using Gretl software

It is obvious that according to information criteria Model 2 is more suitable than Model 1 and interpretation of this model's results is that the intraday change between the price of RTS and MICEX indices develops in the same direction, but RTS is more volatile, because percentage changes in M make only 88% of percentage changes in R. According to R-squared this model explains 77% of diversity of data which is a very satisfying result. Rho is equal to -0.31 confirming there is no problem with autocorrelation. Durbin-Watson's value is 2.6. That is close to 2 indicating there is no significant correlation present.

In respect to the recommendations for investors it is more convenient for aggressive investors to invest in RTS index as it is more volatile and therefore riskier. In the opposite, for conservative investors MICEX index would be appropriate to involve in his portfolio because it is less volatile than RTS index.

6. Concluding Remarks

In this paper authors assumed there was a certain currency risk related to the investments in Russian indices. For this purpose MICEX and RTS indices were chosen. Their base and calculation method are the same and the only difference is the currency in which they are denominated.

We stated a hypothesis that two corresponding indices which differ only in currency have different performance in time. The time period was from June 2000 till June 2014. Because of the autocorrelation problem the first differences and the logarithms of first differences models were used.

The results from the models were following. RTS is more volatile than MICEX hence it is more convenient for a conservative investors (due to their risk aversion) to invest in MICEX index. Lower volatility of MICEX index brings lower chance of losses, but also lower profits. On the contrary we would recommend RTS index to aggressive investors, because its volatility is higher and the chance of higher profits is greater and higher losses as well.

In general, when an investor has the opportunity to invest in correspondent indices which differ only in currency in which they are denominated, he should always consider exchange rate risk of his investment.

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