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Fundamental factors affecting the MOEX Russia Index: structural break detection in a long-term time series

Anastasiia Saltykova

National Research University Higher School of Economics (Perm, Russia).
Laboratory of Interdisciplinary Empirical Studies. Analyst. Research assistant.
ADSaltykova@hse.ru

Agata Lozinskaia

National Research University Higher School of Economics (Perm, Russia).
Department of Economics and Finance. Associate Professor.

Introduction

- Fundamental analysis is widely used to study the Russian stock market and have great importance to study stock market in Russia deeply.

- Recent studies, however, indicate that **the influence of fundamental factors changes over time**

Reasons:

- changing in the stock market regimes (Cheremushkin, 2014),
- speculative bubbles (Pesaran and Timmerman, 2002), etc.

- macroeconomic forecasting (early warning systems (Bussiere and Fratzsher, 2006; Solntsev et al., 2011)
- the investment strategy development

Purpose

Retrospective analysis of fundamental factors and the detection of structural breaks in stock market in Russia **over a long time interval**

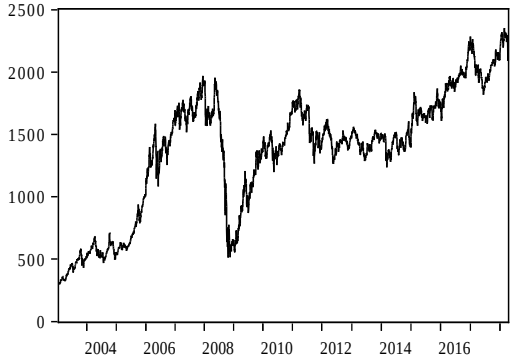
Data

Dependent variable			
IMOEX	the MOEX Russia Index	daily data	FINAM
Fundamental factors:			
NIKKEI	NIKKEI 225	daily data	FINAM
SANDP	S&P500		FINAM
BRENT	Brent crude oil price		FINAM
USDCB	ruble/USD official exchange rate		FINAM
MIBOR	1-month Moscow interbank offer rate		CBR
TBILL	3-month US Treasury bills rate		Treasury USA

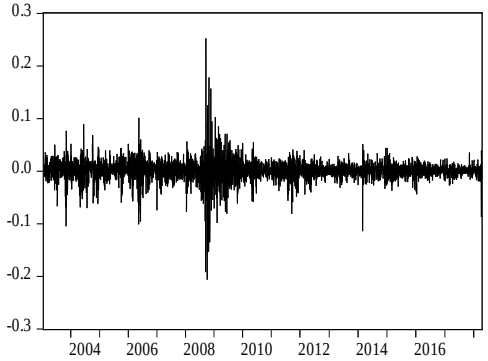
Data analysis

Non-stationary data are transformed based on the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests:

- log-return, $\Delta\ln(p_t) = \ln(p_t/p_{t-1})$, of stock market indices, oil price and exchange rate
- first differences ($\Delta y_t = y_t - y_{t-1}$) of interest rates in the Russian Federation and the USA



IMOEX, daily data, 2003:01-2018:04



IMOEX, daily log-return, 2003:01-2018:04

Methodology

1. Estimate ARIMA and ARIMA-GARCH models with fundamental factors of Russian stock market

2. Use rolling regressions with the ARIMA-GARCH model (1,1) with fundamental factors specification in order to estimate time-varying coefficients βi in equation:

$$\Delta\ln(IMOEX_t) = \beta_0 + \beta_1*\Delta\ln(IMOEX_{t-1}) + \beta_2*\Delta\ln(SANDP_{t-1}) + \beta_3*\Delta\ln(BRENT_{t-1}) + \\ +\beta_4*\Delta\ln(NIKKEI_t) + \beta_5*\Delta\ln(USDCB_{t-1}) + \beta_6*\Delta MIBOR_t + \beta_7*\Delta TBILL_{t-1} + \varepsilon_t.$$

3. Test for unknown structural breaks - the Quandt-Andrews and Bay-Perron tests (Rapach and Wohar, 2006; Cheremushkin, 2014):
    - for the multivariate ARIMA model with fundamental factors
    - For bivariate regression models (for each of the six fundamental factors)

Empirical results (1)

	ARIMA	ARIMA-GARCH (1,1)
$\Delta \ln(IMOEX)_{t-1}$	-0.0954***	-0.0722***
$\Delta \ln(NIKKEI)_t$	0.3847***	0.1960***
$\Delta \ln(S\&P500)_{t-1}$	0.1179	0.1060***
$\Delta \ln(BRENT)_{t-1}$	0.1024***	0.0621***
$\Delta \ln(USDCB)_{t-1}$	0.0215	0.0077
$\Delta MIBOR_t$	-0.0055***	-0.0025*
$\Delta TBILL_{t-1}$	-0.0157	0.0025
Constant	0.0005	0.0010
Variance		
$\widehat{\varepsilon^2_{t-1}}$	-	0.1143***
$\widehat{\sigma^2_{t-1}}$	-	0.8660***
Adjusted R^2	0.10	0.08
Observations	3478	3478

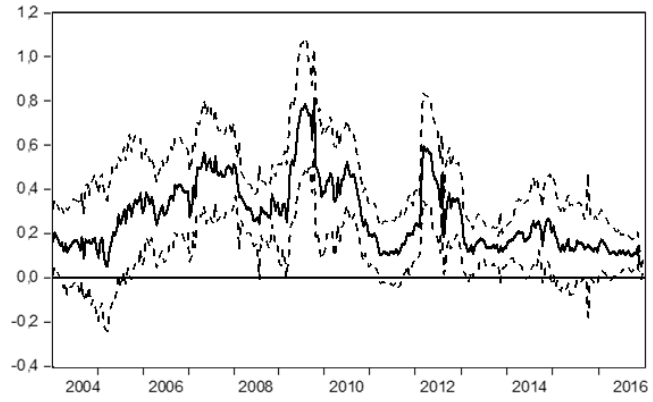
Notes: *,**, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Empirical results (2)

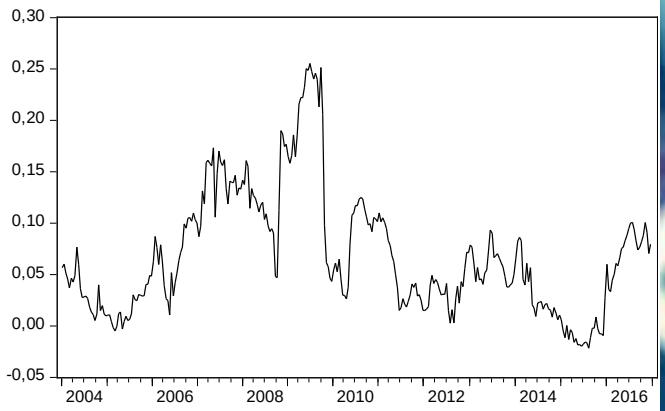
ARIMA-GARCH(1,1) model with fundamental factors in rolling window

$\Delta\ln(\widehat{IMOEX}) = 0{,}001 - 0{,}072 * \Delta\ln(\widehat{IMOEX}_{t-1}) + 0{,}106 * \Delta\ln(\widehat{S\&P500}_{t-1}) + 0{,}062 * \Delta\ln(\widehat{BRENT}_{t-1}) + 0{,}196 * \Delta\ln(\widehat{NIKKEI}) + 0{,}008 * \Delta\ln(\widehat{USDCB}_{t-1}) - 0{,}003 * \Delta\widehat{MIBOR} + 0{,}003 * \Delta\widehat{TBILL}_{t-1}$

$\widehat{\sigma_t^2} = 7 * 10^{-7} + 0{,}114 * \widehat{\varepsilon_{t-1}^2} + 0{,}867 * \widehat{\sigma_{t-1}^2}$



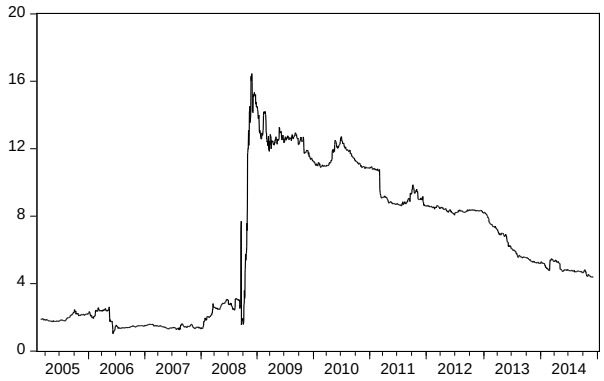
Evolution of coefficients NIKKEI



Evolution of the regression R^2

Empirical results (3)

Detection of structural breaks in multivariate model



F-statistics for the Quandt-Andrews test for the ARIMA model with fundamental factors

Structural breaks:

- The Quandt-Andrews test
  - November 28, 2008

- The Bai-Perron test
  - April 25, 2006
    (On May 22, 2006 year the MICEX index fell by 9.65 %)

  - November 28, 2008
    (the global financial crisis of this year)

Empirical results (4)

	(1) 23.01.2003-24.04.2006	(2) 25.04.2006-27.11.2008	(3) 28.11.2008-30.12.2016
$\Delta\ln(IMOEX)_{t-1}$	0.0051	-0.1619**	-0.1039***
$\Delta\ln(NIKKEI)_{t}$	0.2433***	0.7878***	0.2405***
$\Delta\ln(S\&P500)_{t-1}$	0.2117***	0.2251	0.0115
$\Delta\ln(BRENT)_{t-1}$	0.0933***	0.2625***	0.0819***
$\Delta\ln(USDCB)_{t-1}$	0.4502	-0.3861	0.0201
$\Delta MIBOR$	-0.0052**	-0.0088	-0.0035*
$\Delta TBILL_{t-1}$	0.0005	-0.0310	0.0117
Constant	0.0016**	-0.0005	0.0006*
Adjusted R^2	0.04	0.28	0.05
Observations	806	645	2027

Notes: *,**, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Conclusion

- Influence of fundamental factors on the IMOEX **is not constant** (the power and direction).
- The regression coefficients for the different regimes, defined by the structural breaks, can **vary markedly over time**.
- **Structural breaks**: April 25, 2006 year and November 28, 2008 year. They are probably associated with the dramatic falls of the stock market index (Cheremushkin, 2014; Rapach and Wohar, 2006).
- Structural breaks for multivariate and bivariate regression models can differ that was revealed in stock market in USA earlier (Rapach and Wohar, 2006).

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