Wuhan coronavirus (SARS-CoV-2) spread in Russia: macroeconomic production function in regard to Brent crude oil price

Anton A. Afanasiev, Dr. of Sci. (Econ.), Associate Professor
e-mail: *aanton@cemi.rssi.ru*

Olga S. Ponomareva
e-mail: *fondf@cemi.rssi.ru*

Abstract
The new Wuhan coronavirus, named by virologists SARS-CoV-2, has become widespread all over the world since spring 2020 and has led to significant human and economic losses. In this regard, predicting the spread of the Wuhan coronavirus by studying the laws of its dynamics is an urgent social and macroeconomic problem. We checked the accuracy of the econometric forecasts performance for the autumn-spring phase of the Wuhan coronavirus spread in Russia, which we made earlier on the basis of the Gaussian quadratic exponent [3, 4]. Average forecast errors for October 15, 2021 – March 20, 2021 ranged from 10% to 16%. The Gaussian quadratic exponents studied by us for 5 months indicate the landmarks (laws) of the dynamics of the Wuhan coronavirus spread in Russia in the form of forecast corridors with average errors of 10-16%. Moreover, one of the studied functions accurately predicted the peak daily population (30.2 thousand people) on November 30, i.e. 24 days before reaching the actual peak on December 24 (29.9 thousand people).) And another function predicted the peak date for the day (December 23) before the actual peak date (December 24), although its projected peak daily population (48 thousand people) was 18 thousand people higher than the actual one (30 thousand people). We also offered an analytical modification of the macroeconomic production function of Russia in regard to the Brent crude oil price by considering the average annual level of use of fixed assets as a piecewise linear function of the number of people hospitalized with symptoms of severe acute respiratory syndrome (SARS). This number is an increasing function of the daily number of Russian citizens infected with the Wuhan coronavirus. In addition, we conducted an econometric study of the macroeconomic production function of Russia in regard to the Brent crude oil price for the pre-coronavirus years (1990-2019). The results of the study showed that the coefficients of the production function for 2018 and 2019 are almost unchanged compared to 2016 and 2017. This indicates a certain stabilization of the process of expanded reproduction of the Russian national economy in the pre-coronavirus period of 2016-2019. That happened after a period of economic recession in 2015-2016, accompanied by a decrease in the coefficient of neutral technological progress and an increase in the GDP elasticity to fixed assets, along with a fairly stable dependence on the world oil price. The investigated production function has a good predictive power: the values of the arithmetic mean error of ex-post forecast range from 1 to 7%, and the mean error for 19 years ahead is 4.5%. Dmitri Medvedev noted in his article [6, p. 22]: «This coronavirus pandemic is a unique event as it directly affects all aspects of our lives. In this difficult period, transparency is the main prerequisite for survival. It is important to share scientific and practical information, skills and various technological solutions». We hope that the results of our research will contribute to the study, analysis and understanding of a new research object – the Wuhan coronavirus – and may be used by public authorities, medical and economic research institutes to predict human and economic losses due to the Corona-virus and to develop effective measures to minimize them.

Keywords: *econometric study, Russian economy, macroeconomic production function, Brent crude oil price, econometric forecasting, forecast execution, fall-summer phase, Wuhan coronavirus, SARS-CoV-2, COVID-19, factors capacity use rate, SARS-CoV, daily hospitalized with symptoms of SARS*

References

1. Afanasiev A.A. Execution of the econometric forecast for the daily number of Moscow citizens infected with the Wuhan coronavirus (26 April – 9 May 2020). [Electronic resource]. – URL: https://istina.msu.ru/conferences/presentations/297636272/ (Access date: 15.03.2021, in Russian).

2. Afanasiev A.A. Econometric forecasting of the daily number of Moscow citizens infected with the Wuhan coronavirus from March to July 2020 (abridged version of 25 April 2020). [Electronic resource]. – URL: https://corona.indem.ru/Forecast_CV-19_In_Moscow.pdf (Access date: 02.04.2021, in Russian).

3. Afanasiev A.A. Econometric forecasting of the officially published daily number of people infected with the Wuhan coronavirus in Russia for 2020-2021. In: Strategic planning and development of enterprises: plenary reports of the 21st Russian Symposium. Moscow, November 9-10, 2020 / ed. by G.B. Kleiner and. A.A. Nikonova. – Moscow: CEMI RAS, 2021. – Pp. 120-134. (In Russian).

4. Afanasiev A.A., Ponomareva O.S. Wuhan coronavirus spread in Russia: macroeconomic production function in regard to transport and communication infrastructure // Business Informatics. – 2020. – Vol. 14. – No 4. – Pp. 76-95. (In Russian).

5. Afanasiev A.A., Ponomareva O.S. The macroeconomic production function of Russia in 1990-2017 // Economics and Mathematical Methods. – 2020. – Vol. 56. – No. 1. – Pp. 67-78. (In Russian).

6. Medvedev D.A. Security Cooperation during the Novel Coronavirus Pandemic // Russia in Global Affairs. – 2020. – Vol. 18. – No 3. – Pp. 10-22. (In Russian).

7. Russian statistical yearbook 2019. Statistical handbook. Rosstat. – Moscow, 2019. (In Russian).

8. Russian statistical yearbook 2020. Statistical handbook. Rosstat. – Moscow, 2020. (In Russian).

9. Russian Economic Barometer. Quarterly Bulletin. – 2020. – No. 4. (In Russian).

10. Russia in figures 2019: Statistical handbook. Rosstat. – Moscow, 2019 (in Russian).

11. Chinese Academy of Sciences. (2020). Wuhan coronavirus has strong ability to infect humans. Press release, 21 January 2020. [Electronic resource]. – URL: https://view.inews.qq.com/w2/20200121A0M08X00?tbkt=F&strategy=&openid=o04IBALMrLyGDx bWNOPoDM1IfG-s&uid=&refer= wx_hot (Access date: 15.03.2020, In English).

12. Jiang S., He Y., Liu S. SARS vaccine development // Emerging infectious diseases. – 2005. – Vol. 11. – No. 7. – Pp. 1016-1020. (In English).

13. Shereen M.A., Khan S., Kazmi A., Bashir N., Siddique R. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses // Journal of Advanced Research. – 2020. – No. 24. – Pp. 91-98. – DOI: 10.1016/j.jare.2020.03.005. 23. (In English).

14. Bank Commodity. Price Data. (The Pink Sheet). March, 2021. [Electronic resource]. – URL: http://pubdocs.worldbank.org/ en/226371486076391711/CMO-Historical-Data-Annual.xlsx (Access date: 15.03.2020, In English).

15. Zhou P., Yang X-L., Wang X-G. et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin // Nature. – 2020. – Vol. 579. – Pp. 270-273. (In English).

About authors

Anton A. Afanasiev, Doctor of Sci. (Econ.), Associate Professor, Leading researcher, Central Economics and Mathematics Institute, Russian Academy of Science, Moscow.

Olga S. Ponomareva, Senior researcher, Central Economics and Mathematics Institute, Russian Academy of Sciences, Moscow.

For citation

Afanasiev A.A., Ponomareva O.S. Wuhan coronavirus (SARS-CoV-2) spread in Russia: macroeconomic production function in regard to Brent crude oil price // Market economy problems. – 2021. – No. 1. – Pp. 24-46 (In Russian).

DOI: https://doi.org/10.33051/2500-2325-2021-1-24-46