

Ministry of Education and Science of Ukraine
Sumy State University
Academic and Research Institute
of Business, Economics and Management

SOCIO-ECONOMIC CHALLENGES

Proceedings
of the International Scientific and Practical Conference

(Sumy, March 22-23, 2021)



Sumy
Sumy State University
2021

330.3:005(063)

S62

Editor-in-Chief

Prof., Dr. **Vasilyeva Tetyana**, Director of Academic and Research Institute of Business, Economics and Management, Sumy State University

*Approved by the Academic Council of Sumy State University
(protocol № 5, 26 June 2021)*

S62 Socio-Economic Challenges : Proceedings of the International Scientific and Practical Conference, Sumy, March 22–23, 2021 / edited by Prof., Dr. Vasilyeva Tetyana. – Sumy : Sumy State University, 2021. – 302 p.

Proceedings of the International Scientific and Practical Conference "Socio-Economic Challenges" are devoted to finding a systemic solution to multidisciplinary problems in the field of modern development, management, administration of various systems, corporate social responsibility, innovation management in various fields of environmental management.

For scientists, scientists, students, graduate students, representatives of business and public organizations and higher education institutions and a wide range of readers.

330.3:005(063)

© Sumy State University, 2021

FORECASTING THE DEVELOPMENT OF COVID-19 IN UKRAINE BY FOURIER SERIES

*Mariya Kashcha, PhD student,
Roman Marchenko, student,
Sumy State University, Ukraine*

With the advent of COVID-19, Ukraine has suffered a significant blow in the economic sphere, which was already in a rather unstable state. Therefore, a sharp slowdown in economic development, the transformation of the depression in industry into an industrial downturn, reduced the amount of work performed in the transport sector. in the field of tourism, hotel and restaurant business, etc. in the field of services. There is a decrease in investment activity and an increase in the number of officially registered unemployed among the population. The relevance of this topic is that it allows you to analyze the development of the disease on COVID-19 and get a complete picture of the situation to choose the best strategy to prevent further development of the infection.

The impact of the pandemic has left an indelible mark on many areas of the world economy: trade, labor market, tourism, education and not only, which is reflected in the works (Alkubaisy, 2020; Constantoglou, 2020; Lopez, et al, 2020; Miller, 2020; Srivastava, 2019; Sysoyeva, et al.,2017; Tovmasyan, et al., 2020;). The economic crisis that accompanies any negative manifestations in the social sphere of life attracts the views of researchers from all over the world (Balas et al., 2019; Kaya, 2020; Palienko, et al.,2018; Yelnikova, et al., 2020; Zolkover, et al.,2020). As a result, many researchers (Aslan et al, 2018; Bejtkovsky, 2020; Chinedum, et al.,2019; Gallo,et al., 2020; Mohsen, 2018) drew attention to the quality of medical services, and also focus on the need for a symbiosis between the economy and the health sector. The work (Njegovanović, 2020) examines in detail the impact of the pandemic on financial decision-making, and also emphasizes the importance of correctly assessing the forecast of the following negative impacts on the economy.

As a research tool, let us consider harmonic analysis, which will take into account the general trend and seasonal fluctuations (Bhowmik, 2020; Moskalenko, et al., 2020). The object of study, we choose the data from 18.01.21. to 22.03.21 daily: number of registered deaths in Ukraine caused by COVID-19. As a prediction tool, we use data extrapolation using harmonic analysis using the decomposition of a discrete time series into a Fourier series. The data decomposition procedure is iterative when we divide the data in half, so a prerequisite for the process is the number of observations equal to 2^n . We used the following methodology:

1. Remove the linear trend (1) from the time series:

$$y_t = 1,204t + 115,7 \quad (1)$$

$$U_t = S_t + y_t \quad (2)$$

2. Using MathCad, and the built-in Fast Fourier transform package, we will divide the studied series, 64 observations long, into 32 harmonics, from which we will choose the three that are most significant and have the greatest relative value: U_1, U_9, U_{18} , and the rest of the harmonics will be considered insignificant.

3. Calculate the coefficients of the Fourier series, amplitude (3) and argument (4):

$$A_n = \frac{U_n}{e} \quad (3)$$

$$F_n = \arg(U_n) \quad (4)$$

The result of the analysis is the constructed oscillatory component of the time series (5):

$$S_t = 58,7 \cos\left(\frac{\pi t}{4} + 0,043\right) + 26,2 \cos\left(\frac{36\pi t}{13} - 1,8\right) + 81,1 \cos\left(\frac{9\pi t}{5} - 2,2\right) \quad (5)$$

To build a forecast, using the constructed schedule (5), it is necessary to return the trend component (1), and substitute the following values of $t = [64..85]$. Given that the input data range is 64 observations, the most optimal number of predicted values will be 21, which are presented in table 1:

Table 1

The result of the harmonic analysis for the indicator: mortality from COVID-19

Date	Predicted value	Date	Predicted value	Date	Predicted value
23.03.2021	235	30.03.2021	194	06.04.2021	257
24.03.2021	274	31.03.2021	161	07.04.2021	278
25.03.2021	289	01.04.2021	201	08.04.2021	199
26.03.2021	205	02.04.2021	210	09.04.2021	195
27.03.2021	207	03.04.2021	184	10.04.2021	132
28.03.2021	160	04.04.2021	250	11.04.2021	106
29.03.2021	141	05.04.2021	233	12.04.2021	181

Source: Constructed by authors.

As a test of the adequacy of this model, we calculate the coefficient of determination, it turned out to be 59%, which indicates sufficient quality, but encourages further searches for more relevant models or an increase in the number of harmonics in the construction of the Fourier Series. This research will be useful for students, graduate students and researchers who focus on the economy of health, and for are socially active citizens of the country.

References

Aslan, I., & Morsunbul, D. (2018). Preferences for job life quality and motivation in healthcare. *Marketing and Management of Innovations*, (2), 79-93. <http://doi.org/10.21272/mmi.2018.2-07>

Alkubaisy, A. (2020). Corporate Social Responsibility Practice in the Gulf Cooperation Council Countries amidst the COVID-19 Pandemic. *Business Ethics and Leadership*, 4(4), 99-104. [https://doi.org/10.21272/bel.4\(4\).99-104.2020](https://doi.org/10.21272/bel.4(4).99-104.2020)

Balas, A.N., Kaya, H.D. (2019). The Global Economic Crisis And Retailers' Security Concerns: The Trends. *SocioEconomic Challenges*, 3(2), 5-14. [http://doi.org/10.21272/sec.3\(2\).5-14.2019](http://doi.org/10.21272/sec.3(2).5-14.2019).

Bejtkovsky, J. (2020). Social Media Platforms as HR Marketing Tool in Selected Healthcare Service Providers. *Marketing and Management of Innovations*, 1, 294-302. <http://doi.org/10.21272/mmi.2020.1-25>

Bhowmik, D.(2020). Trends, Cycles and Seasonal Variations of Ukrainian Gross Domestic Product. *Financial Markets, Institutions and Risks*, 4(3), 80-94. [https://doi.org/10.21272/fmir.4\(3\).80-94.2020](https://doi.org/10.21272/fmir.4(3).80-94.2020)

Chinedum N., Chinwuba M. S., & Rejoice O. E. (2019). Innovation in Service Quality Measurement: a Case of Nigerian Healthcare Sector. *Marketing and Management of Innovations*, 1, 143-150. <http://doi.org/10.21272/mmi.2019.1-11>

Constantoglou, M. (2020). Destination Management in Lesvos, Greece. Characteristics, Preferences, Images, Satisfaction and Overall Experience. *Business Ethics and Leadership*, 4(3), 81-106. [https://doi.org/10.21272/bel.4\(3\).81-106.2020](https://doi.org/10.21272/bel.4(3).81-106.2020)

Gallo, P., Mihalcova, B., Vegsoova, O., Dzurov-Vargova, T & Busova, N. (2019). Innovative Trends in Human Resources Management: Evidence for the Health Care System. *Marketing and Management of Innovations*, 2, 11-20. <http://doi.org/10.21272/mmi.2019.2-01>

Kaya, H.D. (2020). The Depth of the Financial System: A Comparison of Developed and Less Developed Countries. *Financial Markets, Institutions and Risks*, 4(4), 109-118. [https://doi.org/10.21272/fmir.4\(4\).109-118.2020](https://doi.org/10.21272/fmir.4(4).109-118.2020)

Lopez, B.S., Alcaide, A.V. (2020). Blockchain, AI and IoT to Improve Governance, Financial Management and Control of Crisis: Case Study COVID-19. *SocioEconomic Challenges*, 4(2), 78-89. [https://doi.org/10.21272/sec.4\(2\).78-89.2020](https://doi.org/10.21272/sec.4(2).78-89.2020).

Miller, A.D. (2020). A Hidden Danger to Our Children's Classrooms within Educational Leadership & Peering Practices. *Business Ethics and Leadership*, 4(4), 28-55. [https://doi.org/10.21272/bel.4\(4\).28-55.2020](https://doi.org/10.21272/bel.4(4).28-55.2020)

Mohsen, Y., Hussein, H. M., & Mahrous, A. A. (2018). Perceived service value, customer engagement and brand loyalty in health care centres in Egypt. *Marketing and Management of Innovations*, (3), 95-108. <http://doi.org/10.21272/mmi.2018.3-08>

Moskalenko, B. A., Mitev, P. (2020). An Algorithm of Decomposing the Trend and Cyclical Components of FDI Inflows: the Case of Ukraine. *Financial Markets, Institutions and Risks*, 4(3), 95-101. [https://doi.org/10.21272/fmir.4\(3\).95-101.2020](https://doi.org/10.21272/fmir.4(3).95-101.2020)

Njegovanović, A. (2020). Financial Decision Making in The Framework of Neuroscience / Anthropology with Review to The Pandemic and Climate Change. *Financial Markets, Institutions and Risks*, 4(4), 55-65. [https://doi.org/10.21272/fmir.4\(4\).55-65.2020](https://doi.org/10.21272/fmir.4(4).55-65.2020)

Palienen, M., Lyulyov, O. (2018). The Impact of Social Factors on Macroeconomic Stability: Empirical Evidence for Ukraine and European Union Countries. *SocioEconomic Challenges*, 2(1), 103-116. DOI: 10.21272/sec.2(1).103-116.2018

Srivastava, R.V. (2019). The Role of Coping in Salespeople's Satisfaction and Its Effect on Salespeople's Ethics. *Business Ethics and Leadership*, 3(1), 118-123. [http://doi.org/10.21272/bel.3\(1\).118-123.2019](http://doi.org/10.21272/bel.3(1).118-123.2019)

Sysoyeva, L., Kleinschmidt, H. (2017). Corruption and migration policy. EU crisis management revisited *SocioEconomic Challenges*, 1(1), 48-53. <http://doi.org/10.21272/sec.2017.1-05>

Tovmasyan, G., Minasyan, D. (2020). The Impact of Motivation on Work Efficiency for Both Employers and Employees also During COVID-19 Pandemic: Case Study from Armenia. *Business Ethics and Leadership*, 4(3), 25-35. [https://doi.org/10.21272/bel.4\(3\).25-35.2020](https://doi.org/10.21272/bel.4(3).25-35.2020)

Yelnikova, Y., Miskiewicz, R. (2020). Implementation mechanism of impact investing in the post-conflict regions. *Financial Markets, Institutions and Risks*, 4(3), 53-62. [https://doi.org/10.21272/fmir.4\(3\).53-62.2020](https://doi.org/10.21272/fmir.4(3).53-62.2020)

Zolkover, A., Renkas, J. (2020). Assessing The Level Of Macroeconomic Stability Of EU Countries. *SocioEconomic Challenges*, 4(4), 175-182. [https://doi.org/10.21272/sec.4\(4\).175-182.2020](https://doi.org/10.21272/sec.4(4).175-182.2020)