

Unemployment and employment management in the context of digitalization of anti-crisis regulation

*Larysa Petrovna Ziankova*¹, *Sergey Nikolaevich Yashin*², *Vladislav Genrihovich Frolov*³, *Yuliya Aleksandrovna Popova*⁴ and *Yuliya Vladimirovna Chemodanova*³

¹Belarusian State University of Economics, Department of Economics and Management, Minsk, Belarus

²Lobachevsky State University, Department of Management and Public Administration, Nizhny Novgorod, Russia

³ Lobachevsky State University, Department of Economics of Enterprises and Organizations, Nizhny Novgorod, Russia

⁴Lobachevsky State University, Department of Science and Postgraduate Studies, Nizhny Novgorod, Russia

Abstract. The article is devoted to the study of the relationship between the level of employment, unemployment and the dynamics of GDP in the framework of cyclical nature studies of the Belarus national economy, the possibility of digitalization within economic cycle crisis phase anticipation and hence forecasting the unemployment dynamics. The study used a comparative analysis of the employment level statistical base and the dynamics of real GDP growth rates over the last 2 crises based on STATISTICA 10. The non-linear forecast of the employment level in Belarus for 2022 was also made using the Eviews 10 application software packages. The methodological basis for the choice of IT tools was the need to take into account cyclical, seasonal, delayed and prolonged reaction of the labor market to changes in the commodity market. Therefore, polynomial autoregression with distributed lag (PDL) was chosen from econometric methods. The comparative analysis of the employment level statistical base and the dynamics of real GDP growth rates over the last 2 crises showed that the dynamics of the employment level behaves as an acyclic indicator. As a result, an algorithm is proposed for setting a task for programmers when creating a management platform for the labor market and linking it with other parameters of public administration system digitization. The actions proposed will allow to plan the item of consolidated state budget expenditures for the payment of unemployment benefits more accurately and to form the targets of state employment assistance programs.

Keywords: economic cycle, unemployment, employment, forecasting, digitalization

¹ Corresponding author: Lovekak@mail.ru

1 Introduction

The level of employment and unemployment in the labor market is cyclical. Usually, the probing of the cycle phase in developed countries is carried out according to the dynamics of GDP volume. However, in the United States, the dating of the medium-term economic cycle, or the so-called business cycle (6-8 years) and the clarification of its turning points since the 60s of the twentieth century are based on a phase of recession lasting at least 5 months, recorded by the National Bureau of Economic Research, as well as on the duration of the entire cyclical wave of at least 15 months by 4 economic indicators, including the *level of employment* [1].

The management of employment and the unemployment contingent, as well as the planning of the corresponding expenditure item of the consolidated state budget (for unemployment benefits) depend on the corresponding phase of the economic cycle that the economic system is currently undergoing. Consequently, forecasting the time and depth of the next crisis is an important parameter for determining employment and unemployment.

However, our long-term studies of the Belarusian and Russian economies have shown that unemployment and employment levels, unlike developed countries or countries with emerging markets, cannot serve as reliable pro-cyclical leading indicators, and therefore cannot be recognized as indicators of early proactive crisis diagnosis [2].

Features of unemployment within the crisis and pandemic isolation are investigated by Graham & Ozbilgin (2021). The authors model the macroeconomic and distributional consequences of COVID-19 pandemic isolation shocks. The impact of a large-scale wage subsidy scheme during isolation is being studied [3].

The study of E.J. Choi, J. Choi, & Song (2020) analyzes the long-term consequences of entering the labor market in a recession: data from the Asian financial crisis. The results show that entering the labor market in a large-scale recession has a long-term impact on the employee even after the sanctions on the labor market stop [4].

The work of Polyzos, Samitas, & Kampaouris (2021) explores the issues of economic stimulation by banking regulation during the COVID-19 crisis. The article assesses the consequences of the COVID-19 pandemic for the banking system and the real economy and models potential government policy responses under budgetary constraints [5].

Congregado, Gafecka-Burdziak, Golpe & Pater (2021) analyze the long-term relationship between unemployment and labor force participation, taking into account potential non-linearities. The results indicate that there is a non-linearity in the studied relationship between labor force participation and unemployment and that the potential existence of gaps in the long-term relationship between these two variables should be taken into account [6].

The study by Abramova & Grishchenko (2020) examines the interrelationships of information and communication technologies, labor productivity and employment and their impact on the industries sustainability in Russia. The authors believe that information and communication technologies (ICT) are one of the key factors of fundamental industrial changes. There are some concerns about possible industrial unemployment along with the positively assessed impact of ICT on labor productivity growth. Cross-sectoral comparison of the link between ICT, labor productivity and employment shows heterogeneous effects depending on specific industries [7].

Nikitas, Vitel & Cotet (2021) as well as Chinoracký & Čorejová (2019) explore new threats related to digital technologies. The effects on employment are assessed as a forecasting tool, which can contribute to the fair planning of public policy. The authors believe that governments in general are not ready for the workplace transformations that

digital technologies bring and that additional measures should be widely applied to regulate employment [8, 9].

2 Materials and methods

The study used a comparative analysis of the employment level statistical base and the dynamics of real GDP growth rates over the last 2 crises (crises 2015–2016 and 2020 for the period of 2010–2020) based on STATISTICA 10. We have also conducted the non-linear forecast of the employment level in Belarus for 2022 was also made using the Eviews 10 application software packages. The methodological basis for the choice of IT tools was the need to take into account cyclical, seasonal, delayed and prolonged reaction of the labor market to changes in the commodity market. Therefore, polynomial autoregression with distributed lag (PDL) was chosen from econometric methods.

3 Results

The authors have conducted comparative analysis of the employment level statistical base and the dynamics of real GDP growth rates over the last 2 crises which showed that the dynamics of the employment level behaves as an acyclic indicator. Figure 1 shows periodograms based on the spectral analysis results of the real GDP dynamics in Belarus and the actual level of employment. The coincidence of frequencies with a value of 0.25 is obvious.

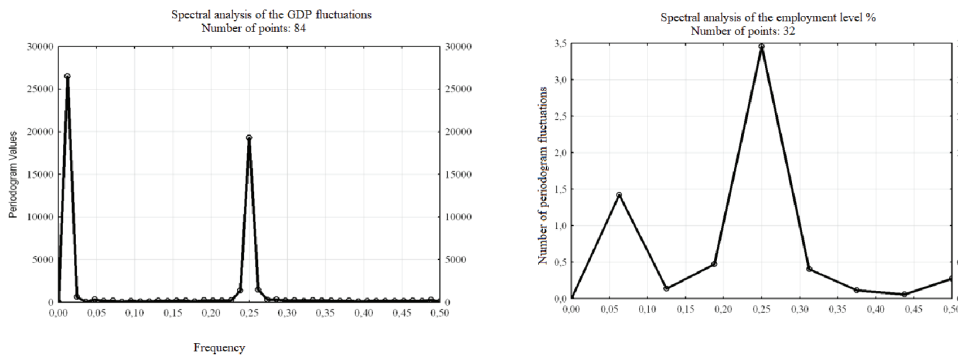


Fig. 1. The results of a comparative spectral analysis of the fluctuations frequencies in GDP dynamics and employment level in Belarus (STATISTICA 10 application software packages) for 2010–2020. Source: developed by the authors.

Over the past decades of the 20th and 21st centuries, highly developed countries have created and tested a set of counter-cyclical measures, so such a policy is actually detailed as a sequence of automatic algorithms counteracting instability in the labor market. However, the effectiveness of these packages depends on the application *timeliness* in the proactive mode of the expected (predicted) phase of the crisis. In conditions of transformational economies significant financial instability, this problem is particularly relevant and requires solving several tasks: forecasting the expected phase of the crisis and its depth; as a consequence, forecasting the expected level of employment and unemployment, the resulting state budget expenditures on unemployment benefits; forecasting the degree of tension in the labor market and the number of vacancies that will need to be created to ensure maximum employment.

We should not forget the dialectical interdependence of employment, unemployment and GDP. Scientific literature usually directly associates the unemployment rate above the natural level and the volume of lost GDP (Okun’s law). However, little attention is paid to the further sequence of economic events, when an income reduction as a result of the GDP curtailment will lead to a drop of entrepreneurial activity, which means a drop in demand for hired labor.

It should be borne in mind that the prolongation of the employment level response to the impulse from GDP reduction and entrepreneurs income reduction and hence their further demand for human resources, is not instantaneous, but takes a certain time interval (Figure 2), with its pronounced peak impact.

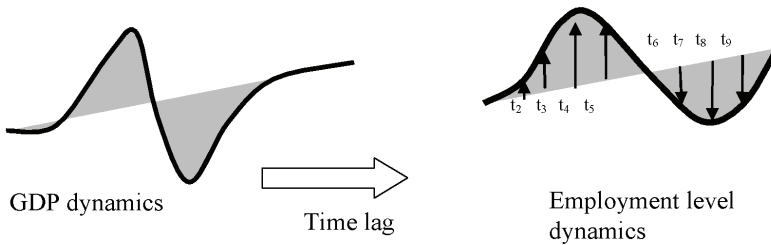


Fig. 2. Prolonged impact of GDP on job creation and unemployment.

The reaction of the labor market to changes in the scale of national production and income in Russia is longer, it takes 5-6 quarters, while in Belarus the peak of the impact occurs after only 1 quarter, and then quickly fades away. In our opinion, this is due to a large-scale system of state subsidies to unprofitable enterprises whose share currently stands at more than 15%, and in the construction industry at 38% [10]. Such a prolongation of the employment level reaction to GDP dynamics, as well as the fact of cyclical unemployment, should be taken into account when forecasting labor market indicators.

We have conducted a non-linear forecast of the employment level in Belarus for 2022 using the Eviews 10 application software packages. The methodological basis for the choice of IT tools was the need to take into account cyclical, seasonal, delayed and prolonged reaction of the labor market to changes in the commodity market. Therefore, polynomial autoregression with distributed lag (PDL) was chosen from econometric methods (Figure 3).

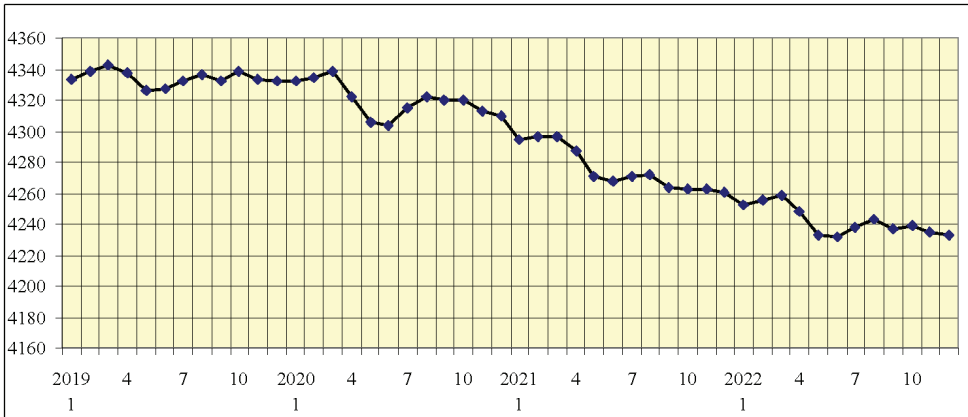


Fig. 3. Monthly employment forecast for 2022. Source: developed by the authors based on the following sources [11, 12].

The work we have carried out implies the following fundamental algorithm for setting a task for programmers when creating a management platform for the labor market and linking it with other public administration system digitization parameters (Figure 4).

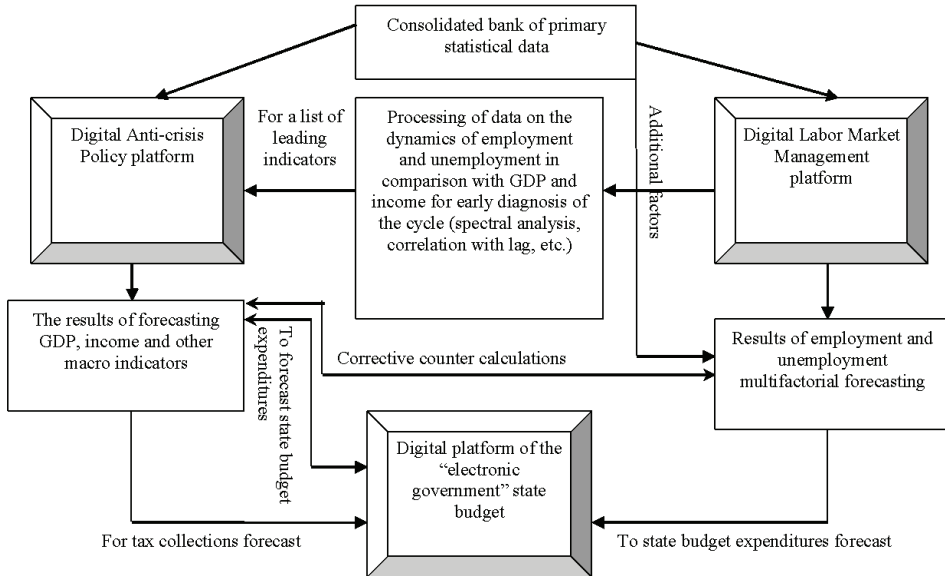


Fig. 4. Problem statement in the computer programs development for labor market management digitalization in the framework of anti-crisis policy. Source: developed by the authors.

4 Discussion

The results and conclusions obtained are comparable with the results of Matthes & Kunkel (2020) work, where the authors emphasize the differences between developed and developing countries in the ability to benefit from digitalization, including in aspects of employment [13]. In the works of Ballestar, Camiña, Díaz-Chao & Torrent-Sellens (2021) the existence of long-term effects of increasing productivity and reducing the labor force as a result of the introduction of robotics, digitization and innovation technologies is proved. The authors believe that companies have not been able to compensate in the long term for the effects of labor cuts that have arisen in the short term. Thus, an incomplete compensatory effect of employment was found. In this regard, strategic management and public policy should lead efforts to transform the models of business competitiveness, human capital and industrial relations [14]. Mitman & Rabinovich (2021) examines the issues of state policy on the regulation of unemployment benefits during the crisis, including in relation to COVID-19 [15].

5 Conclusion

Thus, according to the results of the research work, the need to make changes to the algorithm for setting the task of national economy digitalization becomes obvious: digital platforms of anti-crisis policy, budget policy within the framework of “electronic

government", etc. should be "tied" not only to a single bank of primary data (the creation of such bank and its problems we have already mentioned in the open press) [16] but also interconnected by corrective feedback routines. At the same time, the development of computer programs for data processing and their transmission to various digital platforms should be carried out according to a typical algorithm that ensures the correctness of data storage and mutual transmission, as well as the results of the processing. Therefore, such large-scale work should be carried out not by separate groups of developers, but by interconnected and periodically coordinating teams. Unfortunately, so far, the work in the direction of promoting and expanding the areas of digital labor platforms operation is going autonomously [17].

In our further scientific research, the predicted reaction of the labor market to changes in GDP and income should be adjusted for the influence of a number of factors by creating a multifactorial nonlinear model: rates of external labor migration; elasticity of prices and real wages; adaptive expectations; export growth (decline) rates. The latter factor is very significant for Belarus, since more than 60% of GDP is exported, which provides the subjects of the economy with an overwhelming share of income, and hence employment.

Acknowledgments

The study was carried out within the framework of the realization of the Strategic Academic Leadership Program "Priority 2030", project H-426-99_2022-2023 "Socio-economic models and technologies for the creative human capital development in the innovative society

References

1. Monthly report of the research organization Conference Board: Economic cycle indicators (composite for a number of indicators). Accessed on: March 01, 2022. [Online]. Available: <http://www.conferenceboard.org/data/bci.cfm>
2. L.P. Ziankova, Transformatsionnaya ekonomika: kratkosrochnye i srednesrochnye ekonomicheskie tsikly [Transformational Economies: Short- and medium-term economic cycles] (Misanta, Minsk, 2015)
3. J. Graham, M. Ozbilgin, *J. Econ., Dynam. Control*, **133**, 104233 (2021). <https://doi.org/10.1016/j.jedc.2021.104233>
4. E.J. Choi, J. Choi, H. Son, *Labor Econ.*, **67**, 101926 (2020). <https://doi.org/10.1016/j.labeco.2020.101926>
5. S. Polyzos, A. Samitas, I. Kampouris, *J. Int. Fin. Markets, Instit. Money*, **75**, 101444 (2021). <https://doi.org/10.1016/j.intfin.2021.101444>
6. E. Congregado, E. Gałecka-Burdziak, A.A. Golpe, R. Pater, *J. Econ. Asymmet.*, **24**, e00198 (2021). <https://doi.org/10.1016/j.jeca.2021.e00198>
7. N. Abramova, N. Grishchenko, *ICTs, Procedia Manuf.*, **43**, 299-305 (2020). <https://doi.org/10.1016/j.promfg.2020.02.161>
8. A. Nikitas, A. Vitel, C. Cotet, *Cities*, **114**, 103203 (2021). <https://doi.org/10.1016/j.cities.2021.103203>
9. R. Chinoracký, T. Čorejová, *Transp. Res. Procedia*, **40**, 994-1001 (2019). <https://doi.org/10.1016/j.trpro.2019.07.139>

10. Skolko v Belarusi ubytochnykh organizatsii [How many unprofitable organizations are there in Belarus]. Accessed on: March 01, 2022. [Online]. Available: <https://www.belnovosti.by/ekonomika/v-belarusi-za-2020-god-uvelichilos-kolichestvo-ubytochnyh-organizatsiy>
11. Sotsialno-ekonomicheskoe polozhenie Respubliki Belarus v yanvare-dekabre 2020 goda: ezheemesyachnyi byulleten Natsionalnogo statisticheskogo komiteta [Socio-economic situation of the Republic of Belarus in January-December 2020: monthly bulletin of the National Statistical Committee] (National Statistical Committee, Minsk, 2021)
12. Sotsialno-ekonomicheskoe polozhenie Respubliki Belarus v yanvare-dekabre 2019 goda: ezheemesyachnyi byulleten Natsionalnogo statisticheskogo komiteta [Socio-economic situation of the Republic of Belarus in January-December 2019: monthly bulletin of the National Statistical Committee] (National Statistical Committee, Minsk, 2020)
13. M. Matthes, S. Kunkel, *Techn. Soc.*, **63**, 101428 (2020). <https://doi.org/10.1016/j.techsoc.2020.101428>
14. M.T. Ballestar, E. Camiña, Á. Díaz-Chao, J. Torrent-Sellens, *J. Innov. Knowl.*, **6(3)**, 177-190 (2021). <https://doi.org/10.1016/j.jik.2020.10.006>
15. K. Mitman, S. Rabinovich, *J. Pub. Econ.*, **200**, 104447 (2021). <https://doi.org/10.1016/j.jpubeco.2021.104447>
16. L.P. Ziankova, O.V. Mashevskaya, *Econ. Manag. Innov.*, **2**, 33-38 (2020)
17. Platforma tsifrovoi zanyatosti [Digital Labour platforms]. Accessed on: March 01, 2022. [Online]. Available: <https://news.un.org/ru/story/2021/02/1397302/>