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Table of Contents

Spis treści

Nierówności Społeczne a Wzrost Gospodarczy, nr 72 (4/2022)
Social Inequalities and Economic Growth, no. 72 (4/2022)
DOI: 10.15584/nsawg.2022.4.1 ISSN 1898-5084, eISSN 2658-0780

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Employee compensation as a function of the sectoral structure of the economy

Introduction

In the economy, a high level of employee compensation and productivity is a desirable phenomenon. Therefore, it is widely believed that in countries where employee compensation and productivity are relatively high, the economy is

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developing well. Work productivity influences the standard of living, determines real compensation, and also reduces disproportions between regions, especially in the long run (Filippetti, Peyrache, 2013; Krugman, 1994). Productivity is also considered to be one of the key measures that describe the competitiveness of countries (Porter, 1990). Therefore, it is worth noting which factors determine a certain level of compensation and productivity. No wonder that over the past twenty years, this subject has been of interest and research by scientists (Ahmad et al., 2019). Nowadays, more and more is said about the importance of artificial intelligence (AI) for the labour market. According to Hui and Jiang (2020), if AI develops an alternative relationship with the labour force, and when the degree of substitution of AI for the labour force is higher and higher, the compensation for employment will increase at first and then will decrease.

Typically, the literature uses the gross domestic product (GDP) per capita to measure the relationship with productivity. However, there are many other indices that have been used in research. For instance, some research has found relationships between labour productivity and variables such as: inflation (Fortune, 1987), unemployment (Weisskopf, 1987), foreign direct investment (Egger, Pfaffermayr, 2001), vocational training of employees (Sala, Silva, 2011), gross national income (Fuentes-Castro, 2012), labour flexibility (Ingason, 2013), human capital (Azorin, del Mar Sanchez de la Vega, 2015), technology development (Filippetti, Peyrache, 2015), resource productivity (Stocker et al., 2015), expenses, savings, reforms in the labour market (Choudhry et al., 2016), information and communication technology (Hagsten, 2016), exports of goods (Csordas, 2017), compensation, employment (Conti et al., 2019), production innovations (Woltjer et al., 2019), age of the active population (Milanez, 2020), customer life cycle (Lew, 2017; Lew et al., 2017a) and even high air temperature and physiological stress of employees (Ioannou et al., 2021). Today, modern technology plays an important role in employment opportunities and compensation levels. Employees need to adapt to the prevailing conditions and develop their knowledge of modern technologies (Asonitou, Kavoura, 2019). The use of new variables in research means that one knows more and more about what causes changes in labour productivity and employee compensation. This knowledge is very important as it is relevant to productivity. One of the factors related to productivity is the level of employee compensation. Therefore, the aim of the study was to find how the structure of the economy influences employee compensation.

The result variable in the performed models is compensation of employees. It is a variable of the level type. Compensation of employees is shown in the euro, thanks to which it was possible to include in one model also the countries where the currency is different from the euro.

The explanatory variable is the sectoral structure of the economy.

The data concern the period 2013–2020 and include all countries belonging to the European Union. They constitute a panel with two levels: the year level and the country level; therefore, multi-level modelling was chosen as the method of data analysis. The two-level structure for the problem under study is presented in Figure 1. The observations regarding the relationship between the outcome variable and the predictor are related (correlated), so adjustments must be made with respect to countries. It can be said that the information on the shaping of the values in subsequent years is concentrated or belongs to a given country. Therefore, the lower level is the *Year*, and the higher level is the *Country*.

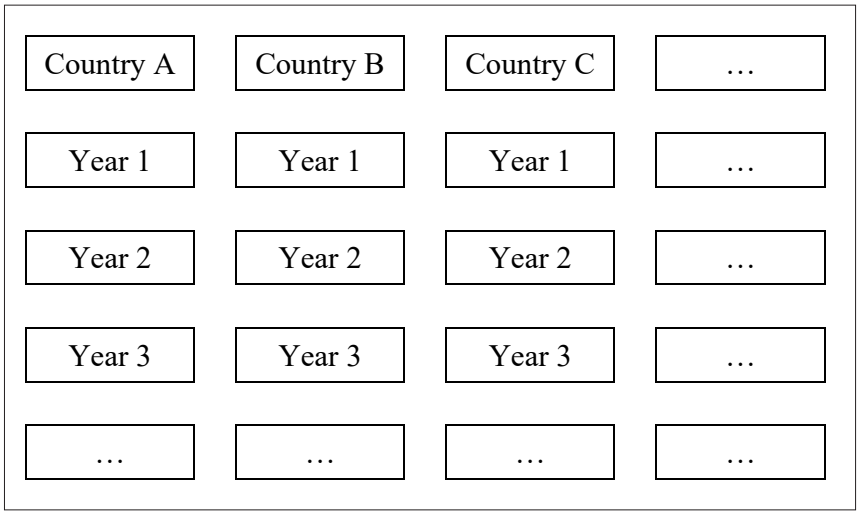

Figure 1. Two-level structure: years are concentrated around countries

Source: own study.

Multi-level modelling was originally used to analyze the educational process (Goldstein, Cuttance, 1988; Nutall et al., 1989), but is now more widely applied. The essence of multi-level modelling is data hierarchy. In this problem – determining the factors influencing the compensation of employees, one deals with a hierarchical structure. First, the behaviour of the outcome variables in the subsequent years of the analysis and by country can be assessed. If we assume that the year is level 1 and the country is level 2, then, in the case of the standard regression model, all countries should be included as independent variables. Meanwhile, when the multi-level analysis is used, not all intercepts and regression coefficients for each country are estimated, but only one intercept and one regression coefficient and their variances, as well as the variance between intercepts and regression coefficients.

The analyses were performed in the MlwiN 3.05 module.

Literature review

Employee compensation and productivity differ depending on the region or industry (Bernard, Jones, 1996). Researchers also found that increases in employee compensation, labour productivity and productivity levels were inversely proportional to different industries and regions (Abramovitz, 1986). It happened that when examining the dependence of variables at the level of the region, individual countries in the region, or dividing the region by industry, the results were different (Rodrik, 2012). Because of this, researchers often focus on factors that influence labour productivity in a given region, such as the EU, and then divide that area into sub-regions, such as the EU Member States. There is no shortage of research on labour productivity in EU countries. The subject of the research was the aspect of the level (an increase or a decrease) of productivity in the EU (Mitchell et al., 2006; Turner, Boulhol, 2011). Arnold and Wörgötter (2011) proposed a model that measured potential benefits of additional reforms and increased integration of EU service markets. In such a case, average employee compensation and labour productivity in the EU would increase by almost 10% in 10 years. The ageing of the EU population is also an important problem. Productivity was found to decline with increasing age of the economically active population (Calvo-Sotomayor et al., 2019). These results were confirmed in other studies (Cristea et al., 2020; Feyrer, 2007; Kelley, Schmidt, 2005; Sarel, 1995). Research on the impact of human capital on labour productivity in the EU showed that labour, allocation, diffusion and research effects of human capital increased the level of employee compensation and productivity (Cörvers, 1997).

Researchers also explored the employee compensation and productivity of the EU not as a whole, but for individual countries (Mihai, 2014; Piscitello, Rabbiosi, 2005; Polyzos, Arabatzis, 2006; Roberts, Thompson, 2009). Researchers from OECD (2001) showed that there were characteristics of individual EU Member States that prevented them from catching up with other countries in terms of labour productivity and, therefore, also in employee compensation. Focusing on advanced economies, Berg, Buffie and Zanna (2018) found that the more easily robots substitute for workers, the higher the increase in GDP per capita and the greater the decrease in labour share, leading to a richer economy, but with more inequality. During a long transition, real wages may fall. On the other hand, some argue that although technology indeed displaces some workers, there are countervailing forces which compensate for the displacements, notably increasing product demand, local demand spillovers, increasing demand for new complementary skills, or even new jobs required for new products and services (Acemoglu, Restrepo, 2018a). Moreover, that will increase compensation in modern economies.

The relationship between labour compensation and labour productivity is at the heart of macroeconomic analysis (Atkinson, 2009). According to the theory of economics, the dynamics of compensation should reflect changes in productivity, so both of these figures should grow together. The claim that compensation growth should reflect increase in labour productivity means that nominal unit labour costs should only be driven by the rate of inflation, so real unit labour costs should remain constant (Pasimeni, 2018). Compensation is a component of labour costs. Therefore, labour costs are a broader concept and include all costs related to the performance of work by employees. In addition to wages and salaries, they may include, for example, costs of employee training.

Researchers confirmed that increase in labour compensation is accompanied by a growth in labour productivity, while labour productivity is growing at a faster pace than labour compensation (Bivens, Mishel, 2015). Additionally, it was found that there was a significant and positive association between compensation and productivity, but not all productivity gain drove increases in compensation, so there was, in fact, a significant difference between labour productivity and labour compensation (Pasimeni, 2018). AI is important for compensation in modern economies. Regarding employment income, AI suggestively improves the labour income share of enterprises (Chen, Hu, 2020), as well as aggravates the income gap between high-skilled and low-skilled labour (Pan, 2019).

According to the authors, fewer people can produce more and more goods and services. During the last 150 years, labour productivity has grown more than 50 times. Nowadays, we can refer to the phenomenon of "growth without jobs" (Grishnova, Cherkasov, Brintseva, 2019). It is undoubtedly a result of several industrial revolutions, starting from the First Industrial Revolution, which brought mechanical innovations, like the steam engine and railroads. The Second Industrial Revolution brought the concept of mass production, while the Third Industrial Revolution brought computers and the internet. Now, we are witnessing the Fourth Industrial Revolution combining many different forces such as computing, wireless networks, Internet of Things (IoT), and artificial intelligence (AI) on the one hand, and smart materials, nanotechnology and 3D printing on the other hand (Kumar, 2018). In addition, new technologies and innovations can guarantee the viability of companies and organisations, indirectly affecting society as a whole (Makarona, Kavoura, 2019). The increasing presence of industrial robots and high-tech machines in industrial production has caused changes in compensation structures as well as skill changes. This phenomenon, referred to in the literature as wage polarisation, has created opportunities for highly skilled workers. The highest increase in average wages is seen in high-skilled job groups, while the lowest increase is seen in medium-skilled workers. This situation can also be explained as a natural consequence of the changes in demand for skills as a result of job polarisation (Dagli, Ozbay, 2021).

The simulation results reveal a refined interplay of effects of robotics in case of emergence of sectors and mobility of labour, inherent mechanisms of the labour market driving a wage-price spiral, and policy interventions to manipulate robotisation or consumption (Vermeulen, Pyka, Saviotti, 2020). Robotisation results in lower unit production costs and lower product prices, softens wage competition across sectors, and thus causes stagnation of wages and possibly an income gap between low- and high-skilled occupations. However, it is also found that the emergence of new sectors results in (sectoral) labour shortages and thus induces renewed price-wage spirals, effectively breaking away from wage stagnation, drawing in (un)employed workers across "vacancy chains" in which workers migrate stepwise to more advanced occupations/sectors. This is the case even if firms have strict requirements regarding skill distances or if workers' labour mobility across occupations/sectors is limited. In general, the (desirability of) effects of robotisation and the effects of policy interventions are to be differentiated between economies with labour surplus and economies with (nearly) full employment. Whenever employment levels are low, robotisation will exacerbate unemployment and cause wage stagnation, such that it is commended to have robot taxation to prevent robotization, a universal basic income (to stimulate product and labour demand), and to stimulate innovation to create new sectors. However, whenever employment levels are (again) high, robotisation will "free up" labour, resolve labour shortages, reduce vacancies in new sectors, and relieve firms from (fierce) wage competition. In this case, a universal basic income would exacerbate shortages, a robot tax would sustain fierce wage competition, while the creation of new sectors would increase labour demand, such that these interventions are discommended. From this, it may be conjectured that there is a basin of attraction of Schumpeterian creative destruction in which, on the one hand, high, escalating wages under labour scarcity (i) invites technological substitution and (ii) slows down sector emergence, both reducing wage competition and labour utilisation. On the other hand, labour surplus (i) invites a reduction of wages, which (ii) drives entrepreneurial activities and, thereby, the creation of (labour-intensive) opportunities, both restoring labour utilisation and, hence, wage competition.

Acemoglu and Restrepo (2020) demonstrated high and robust negative effects of robotisation on employment and wages, and Compagnucci *et al.* (2019) used IFR data to demonstrate that the introduction of robots plays a key role in slowing down human labour and compensation growth, while Cho and Kim (2018) used IFR data for the multiple regression considering the triangular relationship of employment-working-hours-wages, to show that job destruction due to robotisation is not yet very remarkable. In contrast, Cséfalvay (2020) claims that

"recent studies clearly show that robotisation is associated with economic growth and productivity gains."

One important area of research is the impact of structural changes in the economy on productivity and wages. A few studies seek to identify the role of entrepreneurship in inducing structural changes in economy (Neffke et al., 2017). Gajewski and Kutan (2018) argue that the emergence of new firms is determined by the specific conditions of the economic sector. Structural change is expressed in "the reallocation of labour and value added across sectors" (Ciarli, Valente, 2016, p. 40). This implies a continuous shift from sectors with lower productivity to those with higher productivity (Vu, 2017). Such a shift from agriculture to manufacturing is observed, followed by the predominance of the service sector (Gries, Naudé, 2008). This is supported by a subsequent increase in industrial productivity (Gurgul, Lach, 2015) and a decline in the share of agricultural labour (Cai, 2015). Projections show that we can expect a growth in the number of better-educated employees in the manufacturing sector, and a growth of labour productivity in the U.S. manufacturing sector (Rojko et al., 2020). Changes in the structure of the economy can therefore be expected to manifest themselves in a reduction in the importance of agriculture, an increase in productivity in industry and an increase in the importance of services. However, Acemoglu and Restrepo (2020) find that the increase in industrial robots in U.S. manufacturing had extensive negative effects on compensation and employment across commuting zones with the strongest wage effects on workers with high school education or less. The second perspective is more novel and relevant to current debates about automation reducing employment and its policy implications. Even though automation expands productivity, a force which always raises welfare, it also reduces employment, but compensation is higher (Acemoglu, Restrepo, 2018b).

Methods of multi-level analysis

The multi-level modeling approach was used to describe the relationships between the result and explanatory variables. This is a two-level modeling as the data is observed at the country level and in time. Appropriate types of multi-level models are used depending on the specific situation and the specificity of the relationship in the data. The details concern the number of levels and type of design (here these are a random intercept, random slopes and random coefficients regression model). In the paper, the random coefficients regression model was applied. The models of multi-level analysis also differ in the scale of the outcome variable and number of outcomes. There are univariate and continuous outcome variables.

There exist many procedures to estimate the parameters of multi-level models (Searle et al., 1992; Rao, 1971; Hox, 2002; Bryk, Raudenbush, 1992; Mass, Hox, 2003). The most popular are the minimum standards quadratic estimation (MINQUE), maximum likelihood method (ML and REML), expectation maximization (EM) and the iterative generalized least squares (IGLS), as well as its derivatives (RIGLS).

In the IGLS method applied in the paper, the model parameters estimation procedure is two-stage and includes the usual estimation of constant parameters using the least squares method (OLS), which is used to estimate the random part of the model (model covariance matrix). The resulting estimate of the random part of the model is applied to make an improved estimate of the part fixed, which is, in turn, used again to improve the estimate of the random part of the model. Thus, the constant and random parts of the model, until convergence is reached, are alternately estimated (Goldstein, 1986). The parameter estimates resulting from IGLS procedure are maximum likelihood estimates (Goldstein, 1995).

The procedure for estimating the parameters of multi-level models presented below comes from the work by El-Horbaty and Hanafy (2018).

Suppose the data set is divided into m groups, with a different number of n_j responses (j = 1,2, ..., m) in each group. The data includes the vector of the result variable Y_j, a set of explanatory variables W_j and another set of explanatory variables from the level of the Z_j group. To model this data, separate regression models are considered for each level. So the model at the general level is:

$$Y_j = W_j \alpha_j + \varepsilon_j \tag{1}$$

where:
Y_j – length vector n_j representing the response of group j;
W_j – matrix of size n_j x q independent variables;
$\varepsilon_j : N\left(0; \sigma_e^2 I_{n_j}\right)$ – vector of length n_j representing residues on the same level.

And the model on the group level is given by:

$$\alpha_j = Z_j \beta + \delta_j \tag{2}$$

where:
Z_j – matrix of size q x p second-level independent variables;
β – vector of size p x 1 representing the fixed effects;
$\delta_j : N\left(1; \Omega_g\right)$ – vector of size q x 1 representing random effects; where Ω_g is a symmetric covariance matrix:

$$\Omega_g = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \text{K} & \sigma_{1q} \\ \sigma_{21} & \sigma_{22} & \text{K} & \sigma_{2q} \\ \text{M} & \text{M} & \text{K} & \text{M} \\ \sigma_{q1} & \sigma_{q2} & \text{K} & \sigma_{qq} \end{bmatrix}. \tag{3}$$

The combined model for group *j* is expressed by the equation:

$$Y_j = X_j\beta + W_j\delta_j + \varepsilon_j . \tag{4}$$

By combining the data for all groups, we get:

$$Y = X\beta + W\delta + \varepsilon , \tag{5}$$

where:

$$Y = \left(Y_1^T, \text{K}, Y_m^T\right)^T ;\ X = \left(X_1^T, \text{K}, X_m^T\right)^T ;\ \varepsilon = \left(\varepsilon_1^T, \text{K}, \varepsilon_m^T\right)^T :\ N\left(0; \sigma_e^2 I\right);$$

W – matrix of a single block level with W_j in the corresponding block,

$\delta :\ N\left(0;\Omega\right);\ \Omega = diag\left(\Omega_g\right)$; with Ω_g of a covariance matrix at the group level.

The IGLS method estimates regression coefficients, variances and their random effects. Assuming that the residuals have a multivariate normal distribution, the method constructs an additional linear model whose unknown parameters are the intergroup covariances σ_{jk}, which represent the covariance between the *j*-th and *k*-th elements α (i.e. correlations between first-level parameter estimates); *j, k* = 1, .., *q* and within-group variance. The IGLS procedure is an iterative procedure and lasts until the model converges, as detailed in the literature on the subject (Lindquist et al., 2012). In practice, it happens that the models do not converge (negative variances), which may be caused by the use of e.g. small samples. This is especially true for estimating random regression coefficients, less frequently for intercepts.

All the models estimated are presented in Table 2. Each row of the table refers to one model. For each row there is the following:

1. The first line contains information about the intercept, and the second line contains the regression coefficient. For each model, the values of structural parameters were given along with their standard errors.
2. Then the confidence intervals for these parameters, the z-ratio statistic and the *p*-value significance level; *p*-values less than 0.05 were taken as indicative of the existence of a given structural parameter.
3. The next column contains the VIF values. In some models, they are very high, which is not preferred as described above. On the other hand, even at high

VIF values, the directions of the regression coefficients are consistent with the theory of economics.

4. Next columns concern the values of the variance of random structural parameters and their standard errors (according to the Ω_u matrix) as well as the covariance of the random intercept and the random regression coefficient. Some models failed to converge, therefore the random regression coefficient was turned off (this is shown by the ”-“ sign).
5. The last two columns are the residual variance (including standard error) and the IGLS statistics respectively.

It should be noted that correct models were obtained in the vast majority of cases, whereas problematic cases were in the minority. Due to the transparency of the assessment, the tables also include problematic models. This does not prevent one from drawing general conclusions, as each of the models can be interpreted individually.

Empirical results

Depending on the production resources available or the degree of modernity, economies differ in the shares of individual sectors in the gross domestic product. Frequently, economies are divided due to the participation of traditional manufacturing sectors such as agriculture, construction or industry, and modern manufacturing sectors such as trade, services, the financial and IT sectors. As a rule, traditional sectors are considered to have low requirements in terms of employee competences, and thus low compensation. The situation is different in the case of modern sectors where requirements for employee competences are much higher, and therefore salary expectations of employees are higher.

For compensation of employees, the following variables are operative, which have a significantly positive impact (Table 2):

- Information and communication/GDP (β_0=19986.2; β_1=2060.1);
- Prof., scientific, techn.; admin., support serv. activities/GDP (β_0=-6949.6; β_1=3903.4);
- Public admin.; compulsory s.s.; education; human health/GDP (β_0=19667.6; β_1=715.9).

Among these variables, the strongest positive influence on *Compensation of employees* has *Prof., scientific, techn.; admin., support serv. activities/GDP* (regression coefficient 3903.4) and *Information and communication*/*GDP* (regression coefficient 2060.1). Each increase in these activities causes an increase of employee compensation in the economy. The regression coefficient shows that a 1% higher share of a given activity allows for a higher salary per employee by the value of the regression coefficient.

The variables that have a significantly negative impact are the following:
- Agriculture, forestry and fishing/GDP (β_0=39366.0; β_1=-4614.3);
- Industry, including energy/GDP (β_0=56790.9; β_1=-1367.9);
- Distributive trade, repairs; transport; accommod., food serv./GDP (β_0=76808.4; β_1=-2215.0);
- Financial and insurance activities/GDP (β_0=37625.1; β_1=-1493.9);
- Other service activities/GDP (β_0=35160.7; β_1=-1349.0).

Agriculture, forestry and fishing/GDP had the strongest negative impact (regression coefficient -4614.3). Any limitation of the above-mentioned activities is beneficial for employee compensation. The regression coefficient shows how much employee compensation will decrease if the share of a given activity increases. But also the other way around, limiting the share of the above-mentioned activities is beneficial for employees' compensation.

The variables that have a non-significantly impact are the following:
- Construction/GDP (β_0=36536.7; β_1=-1047.7);
- Real estate activities/GDP (β_0=28146.4; β_1=323.9).

In all models, the covariance between the intercept and the regression coefficient is negative, so the higher the intercept, the weaker the compensation of employees' response to changes in predictors.

In addition, it is worth paying attention to the value of intercepts as they show what theoretically would happen in an economy that would give up a given branch of the economy. Thus, the highest value of the intercept 76.808,405 was obtained for *Distributive trade, repairs; transport; accommod., food serv./GDP* = 0. On the other hand, the lowest value of the intercept -6.949,636 was obtained for *Prof., scientific, techn.; admin., support serv. activities/GDP* = 0. Therefore, the comparison of the value of intercepts with regression coefficients allows to answer the question of what type of economy should be promoted. The lower the β_0 value, the more significant the activity, and the higher the β_0 value, the less significant the activity. The activities of the first group have low β_0 values, while the activities of the second group have high β_0 values. High β_0 values mean that giving up such an activity is beneficial for productivity and negative regression coefficients, which means that any restriction of such an activity is beneficial for productivity. Obviously, the question of resignation from a given activity should be considered only in purely theoretical matters.

Examples of a negative impact of *Agriculture/GDP* on *Compensation of employees* and a *Positive impact of prof., scientific, techn.; admin., support serv. activities/GDP* on *Compensation of employees* are shown in Figure 2. These are only selected variables concerning the structure of the economy among those described above, which have the strongest influence on compensation of employees.

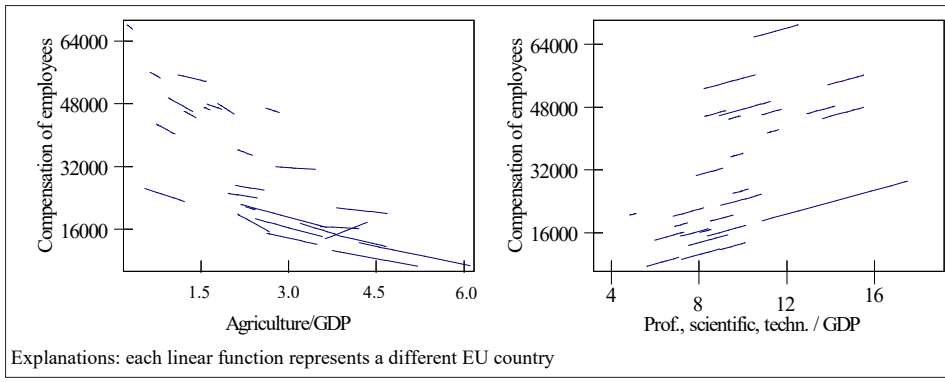

Figure 2. Examples of negative and positive impact of the economy structure on *Compensation of employees*

Source: own calculation.

The impact of two selected sections of the economy: negative impact of *Agriculture/GDP* and a positive impact of *Prof., scientific, techn.; admin., support serv. activities/GDP* on *Compensation of employees*, is shown by country (Table 1). It should be noted that the conclusions drawn from the country-by-country approach are subject to high uncertainty compared to the multi-level analysis presented above. The uncertainty results from short time series and hence from a small number of degrees of freedom.

Out of 27 analyzed countries, 19 had a negative impact of *Agriculture/GDP* on *Compensation of employees*, of which for 10 countries this impact turned out to be statistically significant at $p<0.05$ (Bulgaria, Czechia, Germany, Estonia, Hungary, Malta, the Netherlands, Portugal, Romania, Slovakia); for the remaining 9 countries, the impact is negative but statistically insignificant (Belgium, Ireland, Greece, Italy, Cyprus, Lithuania, Luxembourg, Austria, Poland). Meanwhile, for 8 countries, the impact of *Agriculture/GDP* on *Compensation of employees* is positive (Denmark, Spain, France, Croatia, Latvia, Slovenia, Finland, Sweden), but only for Latvia it turns out to be significant. Therefore, taking into account all countries, the result is consistent with the multi-level analysis and shows the negative impact of *Agriculture/GDP* on *Compensation of employees*.

Impact study of *Prof., scientific, techn.; admin., support serv. activities/GDP* on *Compensation of employees* allows for the conclusion that for 23 out of 27 countries this impact is positive. For 17 countries, a positive, statistically significant impact was found at $p<0.05$ (Belgium, Bulgaria, Denmark, Estonia, Spain, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Poland, Portugal, Romania, Finland) and for 6 countries, the impact turned out to be positive but statistically insignificant (Czechia, Germany, Greece, Austria, Slovenia, Slovakia). Only in 4 cases a negative link was obtained (Ireland,

Croatia, Cyprus, Sweden), and only for Croatia it was statistically significant. Therefore, as for the influence of *Prof., scientific, techn.; admin., support serv. activities/GDP* on *Compensation of employees*, it can be considered that the results are consistent with the above-obtained results for the multi-level analysis.

Table 1. The impact of selected sectors of the economy on *Compensation of employees*

Country	Agriculture, forestry and fishing/GDP		Prof., scientific, techn.; admin., support serv. activities/GDP	
	regression coefficient	*p*-value	regression coefficient	*p*-value
Belgium	-7317.92	0.5395	2253.32	0.0015
Bulgaria	-2448.03	0.0007	2616.05	0.0036
Czechia	-11107.61	0.0014	8745.87	0.0560
Denmark	1015.62	0.8069	2472.82	0.0000
Germany	-14961.26	0.0467	8625.53	0.0769
Estonia	-3985.56	0.0465	7262.40	0.0001
Ireland	-10484.08	0.1487	-1502.99	0.3513
Greece	-665.41	0.4184	2464.02	0.2004
Spain	1202.82	0.3018	1351.12	0.0052
France	6743.93	0.2504	2103.83	0.0042
Croatia	763.74	0.5175	-3460.81	0.0080
Italy	-5006.38	0.1050	3078.36	0.0018
Cyprus	-829.45	0.5204	-311.49	0.3544
Latvia	9852.02	0.0072	6046.88	0.0001
Lithuania	-4843.29	0.3090	4910.29	0.0036
Luxembourg	-67827.20	0.0598	4381.37	0.0000
Hungary	-2972.56	0.0002	1780.68	0.0026
Malta	-6556.89	0.0019	695.02	0.0000
Netherlands	-17046.60	0.0416	2356.78	0.0491
Austria	-21530.84	0.1151	6379.81	0.1389
Poland	-3188.50	0.0798	2571.98	0.0003
Portugal	-18657.91	0.0225	1738.93	0.0347
Romania	-2863.39	0.0384	3509.70	0.0039
Slovenia	557.78	0.9284	766.36	0.8336
Slovakia	-4055.18	0.0269	1002.06	0.4185
Finland	3501.35	0.3667	1536.58	0.0212
Sweden	5792.62	0.4571	-721.62	0.3838

Notes: regression coefficient estimated by LSM method, p-value < 0.05 – significant impact.

Source: own calculation.

Table 2. Outcome variable: compensation of employees

Independent variable	Coef.		S.E.	Conf Int 2.5%	Conf Int 97.5%	z-ratio	*p*-value	VIF	Var (βi)	S.E.	Covar (β_1/β_0)	S.E.	Var (residual)	S.E.	IGLS
Agriculture, forestry and fishing/GDP	β_0	39366.0	3894.7	31732.4	46999.5	10.107	0.000	2.859	3.52E+08	1.11E+08	-6.4E+07	2.63E+07	2.67E+06	2.90E+05	4001.747
	β_1	-4614.3	1033.8	-6640.6	-2588.1	-4.463	0.000		1.75E+07	7.27E+06					
Industry, including energy/GDP	β_0	56790.9	5201.6	46595.9	66985.9	10.918	0.000	3.419	5.08E+08	1.91E+08	-1.4E+07	7.33E+06	2.05E+06	2.23E+05	3959.292
	β_1	-1367.9	221.2	-1801.5	-934.3	-6.184	0.000		6.84E+05	3.26E+05					
Construction/GDP	β_0	36536.7	4415.9	27881.7	45191.7	8.274	0.000	15.785	0.000	0.000	0.000	0.000	2.67E+08	2.57E+07	4803.844
	β_1	-1047.7	785.9	-2588.1	492.7	-1.333	0.183		0.000	0.000					
Distributive trade, repairs; transport; accommod., food serv./GDP	β_0	76808.4	5008.4	66992.2	86624.6	15.336	0.000	28.282	0.000	0.000	0.000	0.000	1.92E+08	1.84E+07	4732.272
	β_1	-2215.0	237.0	-2679.5	-1750.4	-9.345	0.000		0.000	0.000					
Information and communication/GDP	β_0	19986.2	3247.8	13620.6	26351.7	6.154	0.000	8.962	0.000	0.000	0.000	0.000	2.54E+08	2.45E+07	4793.395
	β_1	2060.1	581.1	921.3	3199.0	3.545	0.000		0.000	0.000					
Financial and insurance activities/GDP	β_0	37625.1	4610.7	28588.2	46661.9	8.160	0.000	2.135	4.83E+08	1.55E+08	-4.9E+07	2.18E+07	2.31E+06	2.55E+05	4007.747
	β_1	-1493.9	746.9	-2957.9	-29.9	-2.000	0.045		1.09E+07	3.96E+06					
Real estate activities / GDP	β_0	28146.4	6424.0	15555.6	40737.2	4.381	0.000	4.633	8.81E+08	2.98E+08	-7.3E+07	2.74E+07	2.59E+06	2.86E+05	4024.348
	β_1	323.9	623.3	-897.8	1545.5	0.520	0.603		8.09E+06	2.81E+06					
Prof., scientific, techn.; admin., support serv. activities/GDP	β_0	-6949.6	3422.0	-13656.5	-242.7	-2.031	0.042	15.087	0.000	0.000	0.000	0.000	1.68E+08	1.61E+07	4703.462
	β_1	3903.4	341.6	3234.0	4572.9	11.428	0.000		0.000	0.000					
Public admin.; compulsory s.s.; education; human health/GDP	β_0	19667.6	7163.4	5627.6	33707.5	2.746	0.006	5.814	1.10E+09	3.70E+08	-4.1E+07	1.58E+07	2.26E+06	2.50E+05	3993.262
	β_1	715.9	320.5	87.9	1344.0	2.234	0.025		1.94E+06	7.36E+05					
Other service activities/ GDP	β_0	35160.7	3280.3	28731.4	41590.0	10.719	0.000	1.118	2.60E+08	7.07E+07	-	-	3.53E+06	3.64E+05	4041.912
	β_1	-1349.0	332.2	-2000.1	-698.0	-4.061	0.000		-	-					

Notes: Coef. β_0, β_1 – structural parameters of the model, S.E. – standard error; Conf Int 2.5% – Conf Int 97.5% – confidence interval for structural parameters; z-ratio – test statistic of significance of structural parameters; *p*-value – significance level; VIF – variance inflation factor; Var (β_i) – variance of random structural parameters, S.E. – standard error; Covar (β_1/β_0) – covariance of random structural parameters, S.E. – standard error; Var (residual) – residual variation of the model, S.E. – standard error; IGLS-statistic – 2 * loglikelihood

Source: own calculation.

The conducted collective research (multi-level analysis) has a methodological advantage over individual conclusions for countries. First of all, the analyzed data set is larger, which is advantageous due to the number of degrees of freedom. Moreover, the method of multi-level analysis allows one to draw more general conclusions. Of course, the specificity of countries may cause deviations from general regularities, but the theory should be general in principle.

Conclusions

Research into factors influencing compensation and productivity is extremely important. It provides valuable information for shaping the fiscal policy of the state and sets directions for the development and transformation of the economy. Obviously, there is competition between entrepreneurs and employers for added value and a question may be asked whether growing salaries will reduce the profits of enterprises. Entrepreneurs will depend more on productivity. These two important groups must reach a compromise together, yet from a macroeconomic point of view, i.e. the economy as a whole and the strength of the state, these two things – compensation and productivity – come together.

The present research focused primarily on the construction of the economy, i.e. the impact of the output approach or economy structure on the *Compensation of employees*. Conclusions can be divided into two groups: those concerning methodology and the cognitive ones concerning directions and strength of influence of selected predictors on *Compensation of employees*.

The choice of the dependency description method fell on a multi-level analysis. The unquestionable advantage of this method is a possibility of including many groups of objects observed at different levels in one model. Whether multi-level modeling is an appropriate method depends on the goal of the development. Multi-level modeling allows one to observe the general regularities governing a given system, without delving into the issues of differences between individual objects. The scale of the differences is known, but it is not specified which objects it applies to. Naturally, there are no problems with the identification of individual objects and their mutual evaluation. Here, it was done for two variables: *Agriculture/GDP* and *Prof., scientific, techn.; admin., support serv. activities/GDP*. In this individual approach, the LSM method was used, and the choice of a method depends only on the intention of the researcher. In this paper, thanks to the use of multi-level modeling, it was possible to determine the strength and direction of the impact of selected predictors on the outcome variable – employee compensation, but due to the fact that different countries were subject to the study, also the scale of differentiation of this impact was determined.

In the presented models, statistically significant regression coefficients were obtained, but they correlated with the intercept. In the case of standard modeling,

the correlation of structural parameters is a problem, but in the case of multi-level modeling, on the contrary, it is of particular interest and is described and interpreted using appropriate parameters. This is of great practical importance.

The practical interpretation of the results clearly shows the significance of using multi-level modeling. Looking from the output approach of GDP, it was found that the increase in the share of information and communication and prof., scientific, techn.; admin., support serv. activities leads to the fastest growth of compensation of employees. This is a very important observation as some literature notes that modern forms of production reduce wages. On the other hand, the increase in agriculture, forestry and fishing has a negative effect on *Compensation of employees*. What became evident at this point in the application of multi-level modeling is the finding that the strength of the influence of a given predictor depends significantly on the share of a given GDP section in the entire economy; the smaller this share, the stronger the reactions to changes in the production structure. Thus, it can be concluded that a transition from traditional sectors of the economy to modern sectors leads to an increase in compensation and productivity. It is obvious that on a global scale it is not, and even not advisable, that all economies undergo such a transformation. This process should be viewed as a process of sustainable development of traditional sectors of the economy, which are necessary for the proper functioning of society, as they satisfy basic human needs and the transition of human resources to modern production methods. On the other hand, in traditional sectors of the economy, their efficiency should be increased. As a result, basic human needs will continue to be met and compensation will increase at the same time.

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Summary

Employee compensation is the factor that determines the directions of economic development. Yet, at the same time, the structure of the economy influences employee compensation. Due to the importance of the structure of the economy, the purpose of the paper is to examine the structure factors that influence compensation in the EU Member States in the period 2013–2020. In particular, it investigates the importance of traditional and modern economic structures for employee compensation. In the paper, a multi-level analysis was applied. The research showed that the systematic transformation of the economy towards modern branches in favour of the traditional ones caused an increase of compensation. This is an alternative result in relation to some observations in the subject literature, where it is often emphasized that robotisation and AI cause an increase in unemployment and a decrease in employee compensation. On the other hand, it is impossible to completely replace the traditional sectors. Hence, the most appropriate direction seems to be a gradual increase in efficiency in underdeveloped sectors of the economy without abandoning them entirely.

Keywords: compensation of employees, economy, determinants, multi-level analysis.

Wynagrodzenia pracowników jako funkcja struktury sektorowej gospodarki

Streszczenie

Wynagrodzenia pracowników są czynnikiem, który wyznacza kierunki rozwoju gospodarczego. Jednocześnie można stwierdzić, że struktura gospodarki wpływa na wynagrodzenia pracowników. Ze względu na znaczenie struktury gospodarki, celem artykułu jest zbadanie czynników struktury wpływających na wynagrodzenia w krajach członkowskich UE w latach 2013–2020. W szczególności zbadano znaczenie tradycyjnych i nowoczesnych struktur gospodarczych dla wynagrodzeń. W pracy zastosowano analizę wielopoziomową. Badania wykazały, że systematyczna transformacja gospodarki w kierunku nowoczesnych gałęzi kosztem tradycyjnych spowodowała wzrost wynagrodzeń. Jest to wynik alternatywny w stosunku do niektórych obserwacji literaturowych, gdzie często podkreśla się, że wykorzystanie robotyzacji i sztucznej inteligencji powoduje wzrost bezrobocia i spadek wynagrodzeń pracowników. Z drugiej strony, całkowite zastąpienie tradycyjnych sektorów jest niemożliwe ze względu na ich znaczenie. Stąd najwłaściwszym kierunkiem wydaje się być stopniowe zwiększanie efektywności w słabo rozwiniętych sektorach gospodarki, bez ich całkowitego porzucania.

Słowa kluczowe: wynagrodzenia pracowników, gospodarka, determinanty, analiza wielopoziomowa.

JEL: E24, J30.

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The economic situation of households in Poland and the Czech Republic. Comparative analysis[3]

Introduction

The household is a central but underestimated participator in the economy. The economy could not develop without work, which is the most important production factor provided by households (Costantini, Seccareccia, 2020). At the same time, households and their members are consumers of goods and services produced in the economy. The measure for the efficiency of functioning of households is possibly a high level of satisfaction of needs – both individual and common to the entire household. This function is realised through the consumption of goods and services (Borowska et al., 2020; Bywalec, 2012). The condition for consumption is to have sufficient resources to purchase the goods and services mentioned (Canberra Group, 2011). The knowledge of the income distribution is the basis for assessing the material situation of socio-economic groups of households (Dolls et al., 2019; Trzcińska, 2020; Trzcińska, 2021; Kuznets, 2019; Bartošová, Bína, 2009). A lack of funds to meet the needs at the desired level implies a risk of

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poverty for households and may lead to social exclusion of its members due to the inability to participate in social life (Ledić, Rubil, 2019; Mysíková et al., 2019; Forster, Pearson, 2018; Salejko-Szyszczak, Szczepaniak, 2017; Wolf, 2009). In a broader sense, poverty is understood not only as an inadequate level of income, insufficient to purchase appropriate goods or services, but also a lack of prospects for changing the situation for the better in the near future (Liberati et al., 2022; Biernat-Jarka, Trębska, 2018). Multidimensional poverty is also associated with deprivation of higher needs, including living conditions in a broader perspective (Ulman, Ćwiek, 2014; Iftimoaei et al., 2021; Golinowska, Broda-Wysocki, 2005; Ferreira, Lugo, 2013). Thus, not only does the level and quality of life of their members depend on the financial condition of households, but indirectly also on the condition of the entire economy.

The aim of the paper is to compare the economic situation of households in Poland and the Czech Republic. The level and the dispersion of income distributions of households and the level of poverty due to selected socio-economic characteristics of a respondent or a household are analysed. All the conclusions are based on the results of European Quality of Life Surveys. Poland and the Czech Republic were selected for the analysis because, on the one hand, they are countries that share a similar geographic location and geopolitical conditions, and on the other hand, are characterised by different economic situations (Michálek, Výbošťok, 2019; Sompolska-Rzechuła, Kurdyś-Kujawska, 2022). The paper deals with the issue of the distribution of equivalent income, inequality, and poverty, which constitute an important and current socio-economic problem. The originality of the work is based on the use of microdata obtained from the Eurostat database to compare patterns in terms of disadvantaged groups of households in Poland and the Czech Republic due to the selected socio-economic characteristics.

The structure of the study is derived from the above-mentioned objective. The first part includes the methodology of the conducted research and the description of the data. The second part demonstrates the results of the conducted analysis. The paper is concluded with a summary, which contains the most important conclusions of the analyses, and identifies potential directions for further research.

Methodology and statistical data

To describe the economic situation of Czech and Polish households, statistical data from the European Quality of Life Survey (EQLS) was used. The survey conducted by Eurostat contains information about the living conditions and social situation of people in Europe. So far, four rounds of this survey have been carried out: in 2003, 2007, 2012 and 2016. In this paper, the latest data was used. The EQLS uses a statistical sample to examine a population of adults (aged 18 or

above) who live in private households. The sample size was 733 households in Poland and 686 households in the Czech Republic.

In this paper, all calculations are based on net equivalent income expressed in the Euro according to the purchasing power parity (PPP). Equivalent income is the total income of a household that is available for spending, divided by the number of household members converted into equivalised adults (Mysíková et al., 2021). Net equivalent income is after-tax income, enabling income comparisons in countries with different tax systems. Household members are equivalised or made equivalent by the following so-called modified OECD (Organisation for Economic Cooperation and Development) equivalence scale:

- the first household member aged 14 years or more counts as 1 person;
- each other household member aged 14 years or more counts as 0.5;
- each household member aged 13 years or less counts as 0.3.

All analyses are carried out for households in general including the following socio-economic characteristics: the size of the household's locality (large town or city, small or medium-sized town, rural area or village), age group of the reference person (18–24, 25–34, 35–49, 50–64, 65+), and education level of the reference person (lower secondary or below, upper secondary or post-secondary, tertiary).

Income distribution can be described empirically or using theoretical models, i.e. density functions. The Singh-Maddala model was introduced in economics in the context of modelling income distribution by Singh and Maddala (1976). In statistics, this distribution appeared first in the system of distributions of Burr (1942) and is known as the Burr XII distribution. The Singh-Maddala model is characterised by high flexibility. The Singh-Maddala distribution is described by the probability density function (Kleiber, Kotz, 2003):

$$f(x: a, b, q) = \frac{aqx^{a-1}}{b^a \left[1 + \left(\frac{x}{b}\right)^a\right]^{1+q}}, \qquad x > 0 \tag{1}$$

The cumulative distribution function takes the form:

$$F(x: a, b, q) = 1 - \left[1 + \left(\frac{x}{b}\right)^a\right]^{-q}, \qquad x > 0 \tag{2}$$

The theoretical properties of the Singh-Maddala are very well known (Kleiber, Kotz 2003).

The mean of the Singh-Maddala model takes the form:

$$E(X) = \frac{b\Gamma\left(1 + \frac{1}{a}\right)\Gamma\left(q - \frac{1}{a}\right)}{\Gamma(q)} \tag{3}$$

And the variance is equal:

$$\mathrm{var(X)} = \frac{b^2\{\Gamma(q)\Gamma\left(1+\frac{2}{a}\right)\Gamma\left(q-\frac{2}{a}\right) - \Gamma^2\left(1+\frac{1}{a}\right)\Gamma^2\left(q-\frac{1}{a}\right)\}}{\Gamma^2(q)} \tag{4}$$

The mode is described by the formula:

$$x_{\mathrm{mode}} = b\left(\frac{a-1}{aq+1}\right)^{1/a}, \qquad a > 1 \tag{5}$$

The Gini coefficient for a country is often displayed visually using a graph called the Lorenz curve (Lorenz, 1905). Higher values of the Gini coefficient indicate greater income inequalities in society. The Gini coefficient for the considered model can be expressed by the following formula:

$$G = 1 - \frac{\Gamma(q)\Gamma\left(2q-\frac{1}{a}\right)}{\Gamma\left(q-\frac{1}{a}\right)\Gamma(2q)} \tag{6}$$

The situation in which households have insufficient funds to meet their basic needs at an appropriate level is associated with poverty (Panek, 2011; Wolf, 2009). The broadest application in measuring poverty is aggregated poverty indices. Headcount Ratio (HR) determines the extent of poverty (poverty incidence), i.e., the percentage of households below the poverty line (Panek, 2011):

$$HR = \frac{n_p}{n} \tag{7}$$

n_p – number of households below the poverty line,
n – total number of households.

This index takes the value of 0 when there are no poor households and 1 when all households have an income equivalent below the poverty line. The poverty rate does not explain the depth of poverty in the poor population. It has the same value regardless of the difference between the equivalent income of households and the poverty line.

The primary measure for assessing the depth of poverty is the Poverty Gap Index (PGI). It measures the average distance between the equivalised income of the poor and the poverty line. It is calculated by the formula:

$$PGI = \frac{1}{n_p}\sum_{i=1}^{n_p}\frac{z - y_i}{z} \tag{8}$$

y_i – the income equivalent to the i-th household,
z – the value of the poverty line.

The Income Gap Index (IGI) is a primary measure of poverty intensity. Together with the Poverty Gap Index, it describes the scope and depth of poverty. The main difference from the Poverty Gap Index is that it applies to the entire surveyed population, not just poor households. It is calculated according to the formula:

$$IGI = \frac{1}{n}\sum_{i=1}^{n_p}\frac{z - y_i}{z} \tag{9}$$

The fourth group of measures, apart from the scope and depth of poverty, takes into account income inequalities among the poor. The Poverty Severity Index (PSI) is the most widely used. It is a measure in which a given household has the greater weight, the greater the distance of its equivalent income from the poverty line:

$$PSI = \frac{1}{n}\sum_{i=1}^{n_p}\left(\frac{z - y_i}{z}\right)^2 \tag{10}$$

Poverty analysis was carried out based on the relative poverty line (60% of the median estimated using the Singh-Maddala model).

RESULTS AND DISCUSSION

Tables 1 and 2 contain the estimates of the Singh-Maddala distribution parameters for the equivalent income of the Czech Republic and Poland, respectively (total and selected socio-economic breakdowns). Parameters *a* and *q* on the Singh-Maddala income model are the shape parameters, and *b* is the scale parameter (Kleiber, Kotz, 2003).

Table 1. Estimation results for income distributions in the Czech Republic based on EQLS data

Parameter	a	b	q
Total			
Czech Republic	3.4227	954.1190	0.7520
Size of the household's locality			
Large town or city	4.1177	905.6390	0.5031
Small or medium-sized town	2.9499	1059.2400	1.0058
Rural area or village	3.5044	951.5040	0.8825
Age group of the reference person			
18–24	20.2685	603.9851	0.0738
25–34	4.2546	1071.5000	0.5424
35–49	3.6194	1175.8800	0.8682
50–64	3.2273	1679.4500	2.3139
65+	6.6003	703.5520	0.4460
Education level of the reference person			
Lower secondary or below	4.0015	631.6290	0.5749
Upper secondary or post-secondary	4.0827	884.4330	0.6258
Tertiary	2.1949	2608.0200	2.7058

Source: own calculations.

Table 2. Estimation results for income distributions in Poland based on EQLS data

Parameters	a	b	q
Total			
Poland	2.3976	917.0210	1.0649
Size of the household's locality			
Large town or city	3.1562	567.6382	1.2129
Small or medium-sized town	2.3209	883.3600	0.9983
Rural area or village	2.4081	838.5190	1.1186
Age group of the reference person			
18–24	3.4849	614.8794	0.3670
25–34	2.0634	1589.1100	1.8714
35–49	2.0466	1262.8300	1.5484
50–64	2.1920	921.1010	1.1694
65+	4.2008	598.3070	0.5011
Education level of the reference person			
Lower secondary or below	4.3644	396.0777	0.3193
Upper secondary or post-secondary	2.3696	924.8460	1.0953
Tertiary	2.7560	1319.4000	1.1192

Source: own calculations.

Figure 1 shows the density functions of the Singh-Maddala distribution of equivalent incomes for the Czech Republic and Poland. Both distributions are characterised by a strong skewness to the right. The distribution of the incomes of Czech households is shifted to the right compared to Polish households. This means that Czech households have, on average, greater amounts at their disposal. Apart from this shift, the shape of both density functions is very similar.

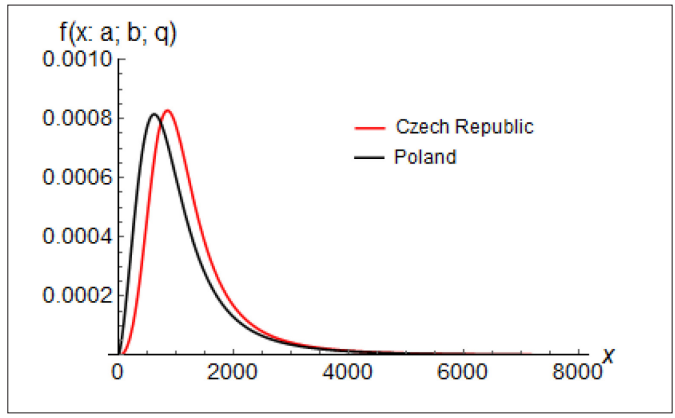


Figure 1. Density function for net equivalent income in Euro (PPP) for Poland and the Czech Republic

Source: own elaboration.

Tables 3 and 4 present the descriptive characteristics of net equivalent income in the Czech Republic and in Poland. The analyses show that the average income in the Czech Republic is over 15% higher than in Poland. An even greater disproportion concerns the median and the mode – in the Czech Republic, the median is higher by over 20% than in Poland, and the mode by as much as 37%. On the other hand, income in Poland is characterised by a greater standard deviation and a greater level of inequality.

Table 3. Descriptive statistics of net equivalent income for total households in the Czech Republic and in selected socio-economic groups

Specification	Mean	Median	Mode	Standard deviation	Gini coefficient
1	*2*	*3*	*4*	*5*	*6*
Czech Republic Total	1350.59	1076.98	851.68	1359.81	0.3445
Size of the household's locality					
Large town or city	1621.83	1179.30	908.92	1566.40	0.3854
Small or medium-sized town	1283.91	1056.36	832.58	1061.95	0.3380
Rural area or village	1182.31	1000.73	827.08	860.58	0.3048

1	*2*	*3*	*4*	*5*	*6*
Age group of the reference person					
18–24	1338.49	705.77	491.00	1541.70	0.5053
25–34	1735.69	1340.04	1067.45	2293.55	0.3475
35–49	1458.84	1242.85	1036.04	1026.80	0.2976
50–64	1280.88	1212.03	1110.16	554.39	0.2345
65+	1007.79	858.881	741.97	668.61	0.2502
Education level of the reference person					
Lower secondary or below	1016.15	781.03	616.81	1374.00	0.3547
Upper secondary or post-secondary	1306.74	1051.58	854.10	1276.83	0.3247
Tertiary	1686.50	1488.39	1170.14	1044.88	0.3228

Source: own calculations.

In the Czech Republic, households in large towns do best – their income is 26% higher than in small and medium-sized towns and 37% higher than in rural areas. Comparing the median incomes, households in cities have incomes higher by 12% as compared to small and medium-sized towns and by 18% as compared to households in rural areas. Lower average incomes in households in rural areas and in small and medium-sized towns are also accompanied by significantly lower dispersion. In rural areas, the standard deviation is as much as 45% lower than in large towns.

Taking into account the breakdown of households according to the age of the reference person, households of young people (25–34) in the Czech Republic are in the best situation. With the increase in the age of the reference person, the average equivalent income decreases. Compared to households of older people (65+), households of people aged 25–34 have an average income higher by 72%. The youngest households have a surprisingly high income – compared to households whose reference person is 25–34 years of age, their average income is 23% lower. The same trend is noticeable for the median income, but the median values for individual age groups are lower by an average of EUR 292 than the average value. On the other hand, the mode in the youngest group of households is the lowest, and it is the highest in households where the reference person is aged 50–64. It is 126% higher than the modal income of the youngest households and 50% higher than the modal equivalent income of older households.

All measures of central tendency calculated for the equivalent income show an increase with the increase of the reference person's education. Households whose reference person has upper secondary or post-secondary education have an equivalent income higher, on average, by less than 30% compared to households whose reference person has lower secondary education or below. In the case of

households of people with higher education, the disproportion is even greater – they have an income higher by 66% as compared to households of people with lower secondary education or below. On the other hand, the standard deviation is the highest in the households of people with the lowest education and decreases with the increase in the reference person's education.

Table 4. Descriptive statistics for net equivalent income for total households in Poland and in selected socio-economic groups

Specification	Mean	Median	Mode	Standard deviation	Gini coefficient
Total	1168.30	884.59	621.38	1366.21	0.4031
Size of the household's locality					
Large town or city	1226.79	884.28	439.69	1891.13	0.4313
Small or medium-sized town	1017.94	786.96	561.80	1071.98	0.3914
Rural area or village	595.28	522.73	439.70	363.70	0.2900
Age group of the reference person					
18–24	1298.75	486.90	305.10	1368.95	0.6738
25–34	1312.76	1077.19	760.79	1034.57	0.3715
35–49	1219.57	955.11	642.77	1133.19	0.3977
50–64	1124.47	836.47	558.92	1360.18	0.4195
65+	1056.53	778.41	602.66	1441.40	0.3779
Education level of the reference person					
Lower secondary or below	894.57	657.92	492.99	1602.41	0.3954
Upper secondary or post-secondary	1154.34	877.52	615.43	1312.13	0.4018
Tertiary	1513.95	1247.89	971.29	1228.46	0.3429

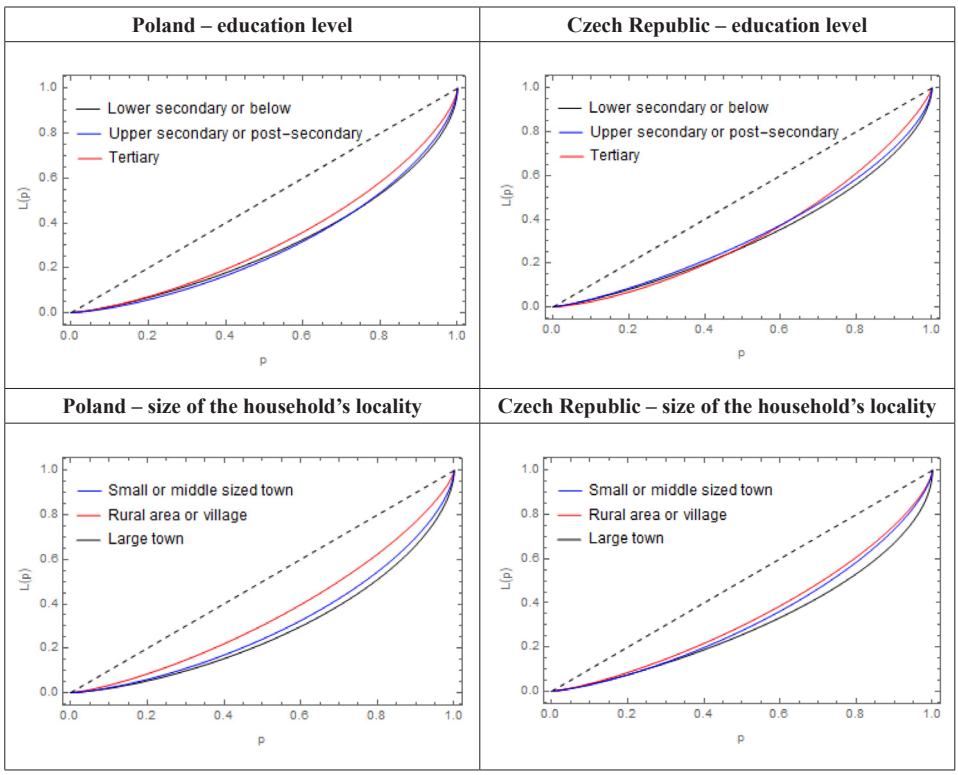
Source: own calculations.

In Poland, as in the Czech Republic, households in cities are in the best financial situation. Their average income is higher by over 20% than households in medium and small towns and by over 100% than households in rural areas. The median and mode also decrease as the size of the place of residence decreases. Ćwiek and Ulman (2019) present similar results.

Taking into account the division of households according to the age of the reference person, it should be noted that households of people aged 25–34 are in the best situation. However, with the increase in the age of the reference persons, the average equivalent income decreases. Households of older people have an average income lower by almost 20% as compared to households of people aged 25–34. Households of people aged 18–24 are also in a very good situation – their

average income is only 1% lower than that of the best-off households. However, when comparing the median and mode of both discussed groups of households, it should be noted that in the lowest age group, they are respectively 55% and 60% lower than for households aged 25–34. It is accompanied by a high value of the standard deviation in households of people aged 18–24 – it is higher than the average of the equivalent income.

The conducted research shows that the average equivalent income increases with the education level of the reference person. Households with tertiary education have an income that is 30% higher than those with an upper secondary or post-secondary education and 70% as compared to households with lower secondary education or below. In the case of the median, the variability is even greater – the median equivalent income for households with higher education is over 40% higher than the median equivalent income for households with upper secondary or post-secondary education, and 90% as compared to households where the reference person has lower secondary education or below. On the other hand, income inequality, measured by the standard deviation, decreases along with the increase in the level of education of the reference person. Similar results can be found in the work of Ulman and Ćwiek (2021).



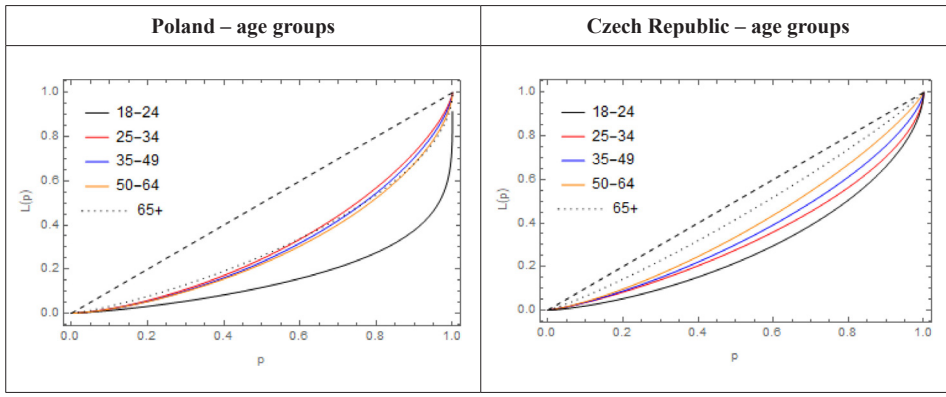


Figure 2. Lorenz curve *L(p)* for the Czech Republic and Poland in selected socio-economic groups

Source: own calculations.

Figure 2 shows graphs of the Lorenz curve *L(p)*. The values of Gini index estimators were obtained by means of the Singh-Maddala income model. Comparing the Czech Republic and Poland, it can be noted that there is a greater income inequality in Poland (Tables 3 and 4). These results are confirmed by (Bilan et al., 2020). Taking into account the size of a household's locality in the Czech Republic, the highest inequalities are in large towns, while the Gini coefficient in small or medium-sized towns and rural areas is similar. The situation is different in the case of Poland. The income inequality level is similar for large towns and small or medium-sized towns. Considering the age of the reference person in the Czech Republic, the highest inequalities occur for households with the reference person's age of 18–24 and the lowest for the 50–64 age group. In Poland, the situation is similar to the Czech Republic: the highest inequalities occur for the age of 18–24, while the lowest for ages 25–34 and 65+. Income inequalities for the ages of 35–49 and 50–64 are similar. Considering the education level of the reference person, the highest income inequalities in the Czech Republic are observable for people with lower secondary education or below. For Poland, the level of equivalent income inequality among people with lower secondary education or below, and upper secondary or post-secondary education are very similar. In the Czech Republic, people with upper secondary or post-secondary and tertiary education are on a very similar level. It should be noted that in Poland, the lowest income inequality is among people with tertiary education.

Tables 5 and 6 present the values of aggregate poverty measures, i.e. Headcount Ratio (HR), Poverty Gap Index (PGI), Income Gap Index (IGI) and Poverty Severity Index (PSI), which describe the range, depth, intensity, and severity of poverty in the examined countries, i.e. the Czech Republic and Poland.

Table 5. Poverty criteria in the Czech Republic in total and in selected socio-economic groups

Dimension	HR	PGI	IGI	PSI
Total	0.1166	0.2790	0.0325	0.0178
Size of the household's locality				
Large town or city	0.1000	0.2356	0.0236	0.0102
Small or medium-sized town	0.1191	0.2978	0.0355	0.0214
Rural area or village	0.1299	0.2932	0.0381	0.0213
Age group of the reference person				
18–24	0.1200	0.0749	0.0090	0.0010
25–34	0.0909	0.1533	0.0139	0.0040
35–49	0.0929	0.2484	0.0231	0.0090
50–64	0.1453	0.4303	0.0625	0.0424
65+	0.1256	0.2205	0.0277	0.0136
Education level of the reference person				
Lower secondary or below	0.3077	0.2517	0.0775	0.0365
Upper secondary	0.1047	0.2639	0.0276	0.0145
Tertiary	0.0571	0.5061	0.0289	0.0221

Source: own calculations.

Table 6. Poverty criteria in Poland in total and in selected socio-economic groups

Dimension	HR	PGI	IGI	PSI
Total	0.1937	0.3346	0.0648	0.0348
Size of the household's locality				
Large town or city	0.1298	0.3060	0.0397	0.0197
Small or medium-sized town	0.1914	0.3932	0.0753	0.0417
Rural area or village	0.2373	0.3137	0.0745	0.0402
Age group of the reference person				
18–24	0.1818	0.3104	0.0564	0.0256
25–34	0.1589	0.3656	0.0581	0.0323
35–49	0.1944	0.3950	0.0768	0.0440
50–64	0.2116	0.3768	0.0797	0.0456
65+	0.1939	0.2249	0.0436	0.0185
Education level of the reference person				
Lower secondary or below	0.3158	0.2989	0.0944	0.0429
Upper secondary	0.1861	0.3488	0.0649	0.0370
Tertiary	0.0811	0.3576	0.0290	0.0157

Source: own calculations.

The research shows that 12% of Czech households were at risk of poverty and the average equivalent income of households experiencing poverty was 28% below the poverty line. Taking into account the size of the place of residence, it can be noticed that the extent of poverty increases with the decrease in the size of the town. However, the difference between the extent of poverty in different types of localities is not large – in rural areas, the percentage of households at risk of poverty is only 3 percentage points (pp) higher than in cities. A greater difference is observed in terms of the depth of poverty. In the countryside, the average equivalent income of households experiencing poverty was 29% below the poverty line, and in large towns, the average equivalent income of households experiencing poverty was 24% below the poverty line. When it comes to small or medium-sized town households, they have a lower poverty incidence than rural households, but the depth and severity indicators of poverty are essentially the same.

The greatest extent of poverty is observed among households whose reference persons are aged 50–64 (15%). This age group is also characterised by the highest values of poverty depth and severity indicators. A slightly better situation was recorded for households of people aged 18–24 and 65+. For these age groups, the percentage of households at risk of poverty is very similar (approx. 12%), but in the 65+ age group, the depth and severity of poverty are much greater. The lowest percentage of poor households was observed in the 25–34 and 35–49 age groups, and these are the age groups for which the highest average income was observed. Poverty in various age groups in the Czech Republic was also studied, among others, by Sirovátka and Mareš (2006).

The analysis shows a very strong correlation between the education level of the reference person and the headcount ratio. In households of people with higher education, the at-risk-of-poverty rate is only 6%. In the case of households of people with upper secondary or post-secondary education, this rate is at 10%, and for households of people with lower secondary education or below, it amounts to 31%. The impact of the level of education on the risk of poverty is confirmed by research (among others Szymkowiak et al., 2014; Brzezińska, 2018; Sirovátka, Mareš, 2006). Liu *et al.* (2021) proved that education significantly reduces the level of poverty, and higher education seems to be a significant tool for alleviating poverty.

In Poland, the risk of poverty also decreases along with the size of the town in which the household is found, but the percentage of households with incomes below the poverty line is much higher. The difference increases with the decrease in the size of the town. In the case of large towns, the difference is 3 pp, for small and medium-sized towns, it is 7 pp, in the case of villages, as much as 11 pp. Similar results were obtained by Piwowar and Dzikuć (2020). Using the relative poverty indicator and the aggregate indicator proved that in many households in rural areas, the financial resources are insufficient to cover the basic needs in the

Visegrad Group countries. Poverty is often related to rural, peripheral areas with poor access to services of general interest. Sączkowska-Piotrowska (2016), using nonparametric estimators of hazard function and logit models to study poverty and non-poverty survival time of urban and rural households, concluded that rural households' survival is shorter in non-poverty and simultaneously longer in poverty than urban households. Besides, urban households have more chance of poverty exit and less risk of poverty entry than rural households. Analyses of Nordregio and of the James Hutton Institute proved that poverty is related to the situation in rural areas in the new Member States and in the east and south of Europe, as well as in urban districts in the old Member States (*The Territorial Dimension of Poverty*..., 2014). Living in a rural area with limited access to education and the labour market, as well as a lack of appropriate infrastructure combined with often poor or expensive public transport may be factors that can affect the feeling of social exclusion.

The lowest value of the HR indicator, similar to the Czech Republic, is found for households whose reference persons are aged 25–34, and it amounts to 16%, which is a value of 7 pp higher than for the Czech Republic. On the other hand, the lowest depth and severity of poverty concerns households of older people (65+). The greatest extent of poverty concerns households of people aged 50–64 (21%). The average equivalent income of households experiencing poverty was 38% below the poverty line.

As in the Czech Republic, in Poland too the risk of poverty decreases along with the increase in the education level of the reference person. For households of people with lower secondary education or below, the headcount ratio is over 30%; for households of people with upper secondary or post-secondary education, it is 19%; and for households of people with higher education – only 8%.

Conclusions

The analyses show that the distribution of equivalent income in the Czech Republic and Poland is characterised by a strong skewness to the right. The shape of the designated density functions based on the Singh-Maddala model is very similar. The biggest difference concerns the shift to the right of the distribution of equivalent income for the Czech Republic. This means that Czech households are characterised by a higher average, median and mode of equivalent income. In Poland, on the other hand, a higher level of inequality was observed. In both of the analysed countries, the highest income is achieved by households living in cities and those whose reference person has tertiary education and is aged 25–34. In both countries, the highest income inequalities are found in households of young people (18–24).

Czech households face a low risk of poverty. Monetary poverty concerns about 12% of the surveyed entities, and in Poland, this value is at 19%. In both surveyed countries, a higher risk of poverty was observed for rural households. Households whose reference person has lower secondary education or below, or is aged 50–64, are also more likely to earn below the poverty line.

The conducted research indicates a high similarity both to the distribution of income and the groups particularly exposed to monetary poverty. It should be remembered that the financial situation of households is a result of many variables, and therefore it should be constantly monitored to ensure complete and objective data for the conduct of social policy. The implementation of an effective social policy in order to reduce poverty requires not only monitoring its changes over time, but also in-depth analyses. Due to the ongoing demographic changes (related to an increase in life expectancy and ageing of society), particular attention should be paid to the living conditions of the elderly and disabled people.

The limitations of the paper should also be pointed out. Due to the available data, net equivalent income was used in the research, which may be a source of potential problems in assessing poverty criteria. Income does not take into account accumulated savings and wealth (with the exception of interest generated by them), which can be equally used to purchase goods and services (Ward, 2009). Furthermore, the value reported for any period does not consider any fluctuations that affect the level of income in the long term. When analysing the results of the conducted research, it is also worth remembering that they only concern monetary poverty and do not take into account housing deprivation, energy poverty, lack of access to education or health care, and many other aspects of multidimensional poverty.

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Summary

Income distribution can cause large-scale transformations in social structure, as well as in the quality of life. The aim of the paper is to compare the economic situation of households in Poland and the Czech Republic. The level and the dispersion of income distributions of households and the level of poverty due to the selected socio-economic characteristics of a respondent or a household are analysed. All the conclusions are based on the results of European Quality of Life Surveys. To describe the distribution of net equivalent income, the Singh-Maddala model is used. The estimation parameters are obtained by means of the maximum likelihood method. The descriptive statistics characterising the total situation in the Czech Republic and Poland, as well as in selected socio-economic groups, are calculated. To analyse the extent, depth and severity of poverty in the countries in question, the aggregate indices are obtained. The conducted research shows a high similarity for both distribution of equivalent income and the socio-economic groups particularly exposed to monetary poverty.

Keywords: income distribution, Singh-Maddala model, Gini index, poverty, measuring poverty.

Sytuacja ekonomiczna gospodarstw domowych w Polsce i Czechach. Analiza porównawcza

Streszczenie

Rozkłady dochodów mogą powodować zakrojone na szeroką skalę przemiany w strukturze społecznej, a także w jakości życia. Celem artykułu jest porównanie sytuacji ekonomicznej gospodarstw domowych w Polsce i Czechach. Analizie poddano poziom i zróżnicowanie rozkładów dochodów gospodarstw domowych oraz poziom ubóstwa ze względu na wybrane cechy społeczno-ekonomiczne respondenta lub gospodarstwa domowego. Wszystkie wnioski oparte są na wynikach European Quality of Life Surveys. Do opisu rozkładu dochodu ekwiwalentnego netto zastosowano model Singha-Maddali. Parametry estymacji uzyskano metodą największej wiarogodności. Obliczono statystyki opisowe charakteryzujące ogólną sytuację w Czechach i Polsce oraz w wybranych grupach społeczno-ekonomicznych. W celu przeanalizowania zasięgu, głębokości i nasilenia ubóstwa w rozważanych krajach obliczono wskaźniki zagregowane. Przeprowadzone badania wskazują na duże podobieństwo zarówno rozkładu dochodów ekwiwalentnych, jak i grup społeczno-ekonomicznych szczególnie narażonych na ubóstwo monetarne.

Słowa kluczowe: rozkład dochodów, model Singha-Maddali, indeks Giniego, ubóstwo, pomiar ubóstwa.

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Poverty in Polish regions in the light of European Union policy

Introduction

In the 1970s, cracks appeared in the "ideal image" of the economies of highly industrialised countries, i.e. the Keynesian-social-democratic compromise between labour and capital, and market and state. During the period in question, two unfavourable economic phenomena became apparent: a slowdown in economic growth and the deepening of inequality in both economic (income and property) and social (prestige and social position) dimensions. At this point, it should be mentioned that the slowdown in economic growth and the deterioration of economic and social relations followed two oil shocks (the first in 1973–1974 and the second in 1978–1979). Both shocks set in motion a mechanism for increased production costs, which forced a change in the relationship between capital and labour, and confirmed the weakness of economic policy in the Keynesian spirit.

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Both phenomena have an impact not only on the dynamics of economic life, i.e. on production/national income, employment and inflation, but also on the level of social life, i.e. on social relations and the growth of antagonisms (Autor, Levy, Murmane, 2003, pp. 1279–1333; Cameron, Neal, 2004, pp. 401–403; Dziewięcka-Bokun, 1999, pp. 70–73; Jones, 2002, pp. 597–599, 669–673; Morgenson, 2011, pp. 235–236; Raval, 2018, pp. 93–119; Skodlarski, 2014, pp. 363–368).

The final "bankruptcy" of economic policy in the Keynesian-social-democratic spirit forces the expansion of private capital, which in turn contributes to the reorientation of the economic system, as well as the gradual reduction of state activity in both the real and social spheres (budget spending on social purposes, i.e. on payment transfers and especially on education, was commonly reduced). The mechanisms set in motion at that time prepared the ground for the liberal revolution of the late 1980s and early 1990s (especially in the United States and the United Kingdom), which fostered the process of globalisation and the internationalisation of businesses. "The Keynesian revolution has collapsed. In the history of economics, the era of John Maynard Keynes has given way to the era of Milton Friedman." (Galbraith, 1991, p. 288). Supporters of the liberal outlook – including Milton Friedman, Friedrich Hayek, Arthur Laffer or Robert Lucas – speaking of freeing the market and marginalising the economic powers of the state, approve of the diversity in the economic and social dimensions and, therefore, glorify freedom in the economic sense and accept income and wealth differentiation of the economic society (Easterling, 2014, pp. 15–67; Gill, 2002, pp. 47–65; Godłów-Legiędź, 1992, pp. 25–29; Poverty, Shared, 2021, pp. 2–5).

One of the economic goals of the European Union is economic development. References to the issues of equalising disparities, promoting development and reducing poverty are found in many documents regulating the activities of the European Union, from the treaties to strategies and assumptions of EU policies. Successive enlargements of the EU have resulted in a considerable increase in development disparities in the EU and forced the creation of policies dedicated to reducing inequalities between countries and EU regions. The 21st century brought many new challenges and threats to the EU (the 2008+ global financial crisis, the COVID-19 pandemic, Russia's aggression against Ukraine and the related energy and food crisis, as well as the migrant/refugee crisis), which led to a further increase in disparities and forced the EU to take appropriate countermeasures.

The theoretical and cognitive aim of the paper is to present the differentiated perception of the problem of poverty in economic theory and EU policy decisions. The purpose of the empirical study is to identify and evaluate regional disparities in poverty using the example of Poland's regions (provinces).

The rationale for the differential wealth of their inhabitants is based on historical policy decisions, infrastructural backwardness, proximity to foreign markets, and current economic development conditions. The activities of businesses and the

attractiveness of the labour market in some regions are further enhanced by the existence of a large city with metropolitan ambitions, which attracts resources and concentrates competitive service activities.

Method

The research was conducted with the application of the following methods: literature studies, descriptive and comparative analysis, and critical thinking. Due to the complexity of the category of poverty and poverty conditions, the selected method of multivariate comparative analysis, i.e. TMD, introduced by Hellwig in 1968, was adopted. The application of TMD made it possible to make a hierarchy of the analysed subjects – i.e. Polish regions /voivodeships – in terms of poverty measured by the synthetic index, as well as in terms of poverty conditions measured by the synthetic index. For the purpose of taxonomic analysis, four diagnostic variables were used to determine the poverty level, and sixteen diagnostic variables were taken into consideration to determine the poverty conditions. As a result of the operationalisation, the decision was made to take into consideration the following indices in the research process:

1. Poverty:
   – Average monthly income from social benefits per capita (stimulant);
   – Average monthly available income per capita (stimulant);
   – Poverty coverage rate after including social transfers in % (destimulant);
   – Monetary social assistance per capita (destimulant);
2. Regional conditions:
   a) Economic conditions
      – GDP per capita (stimulant);
      – Province budget expenditure per capita (stimulant);
      – Gross value added per employed person (stimulant);
      – Entities of the national economy per 1000 population (stimulant);
      – Investment outlays per inhabitant (stimulant);
   b) Labour market conditions
      – Unemployment rate (in %) (destimulant);
      – Number of employed persons per 1000 population (stimulant);
      – Employed in agriculture as % of total employment (destimulant);
      – Natural persons conducting economic activity per 10,000 population (stimulant);
   c) Infrastructure conditions
      – Expressways and motorways per 1000 square kilometres (stimulant);
      – Share of hard surface public roads (stimulant);
      – Railway lines per 1000 square kilometres (stimulant);

– Digital subscriber lines per 1000 population (stimulant);
– Population per 1 bed in hospitals (stimulant)
– Outlays on fixed assets in environmental protection and water management per capita (stimulant);
– Higher education students per 10,000 population (stimulant).

After selecting the set of diagnostic variables, the character of each variable was determined. The majority of variables were considered stimulants. Four variables were treated as destimulants. Variables were standardised, and a development model was constructed – a model unit, where diagnostic variables were determined according to the rule where: $z_{0j} = \max_i (z_{ij})$ for stimulants or $z_{0j} = \min_i (z_{ij})$ for destimulants. The distance of i-unit from the development model was calculated using Euclid's measure:

$$d_{oi} = \sqrt{\sum_{j=1}^{m} (z_{ij} - z_{oj})^2}$$

TMD was calculated according to the formula (Hellwig, 1968; Pluta, 1986; Nowak, 1990):

$$\text{TMD}i = 1 - \frac{d_{oi}}{d_o}, \; i=1, 2, \ldots n, \text{ where: } d_0 = \bar{d}_o + 2S_0, \text{ and:}$$

$$\bar{d}_0 = \frac{1}{n}\sum_{i=1}^{n} d_{oi}, \quad S_0 = \sqrt{\frac{1}{n}\sum_{i-1}^{n} (d_{oi} - \bar{d}_o)^2}, \text{ while: TMD}i \in [0; 1], \text{ for i=1, 2, ... n.}$$

Poland's provinces were analysed according to the level of poverty expressed by a synthetic index TMD (P), and in regard to regional conditions TMD (R). When it comes to regional conditions, three sub-indices were identified and calculated: economic conditions (RE), labour market conditions (RLM) and infrastructure conditions (RI). Finally, the super-index combining the two synthetic indices was calculated as TMD (PR).

Moreover, the application of cluster analysis for the research resulted in the grouping of the analysed subjects – sixteen Polish provinces – in four clusters according to the level of the super-index combining the two synthetic indices. A selected method of grouping linearly ordered objects, namely the method of standard deviations, was used for this purpose. Sixteen Polish provinces were divided into four groups (classes), according to the following rules (Pawlas, 2018b):

$$G_1 : s_i < \bar{s} - S(s),$$
$$G_2 : \bar{s} > s_i \geq s_i - S(s),$$
$$G_3 : \bar{s} + S(s) > s_i \geq \bar{s},$$

$$G_4 : s_i \geq \bar{s} + S(s),$$

where: $\bar{s}$ – arithmetic mean of the synthetic variable (in this study: arithmetic mean of TMD), while *S(s)* – standard deviation of the synthetic variable (in this study: standard deviation of TMD), s_i – value of the synthetic variable of the object *i* (in this study: TMD value in *i* for Polish provinces).

A dual approach to poverty in modern economic theory – Literature review

The dual approach to the problem of poverty and inequality in modern economic theory stems from advocating either a demand- or supply-side view of the economic process, and thus from a different interpretation of the relationship between the state and the market, and thus between capital and labour, and the rich and the poor. The liberal revolution perpetuates neoliberal models of social and economic development (it carries over the neoclassical model of capital accumulation), and thus the assumptions of neoliberal economic policy, especially the principles of individualism, market self-regulation and innovation. The principle of individual benefit, while guaranteeing the conditions of economic optimisation and social mobility (widely opening the paths of economic and social advancement), automatically limits the state's activity in the field of tax and social policy, and thus rationalises access to socially desirable goods, i.e. public goods. In the new systemic realities, the role of the state in the economic sphere is limited to protecting the conditions of freedom of action, and in the social sphere to the sham of protecting the poor and those affected by misfortune, including the initiation of ineffective measures in education and health care. Economic policy in the liberal spirit, while preferring economic freedom, accepts, on the one hand, the desire of the rich to get richer – to increase the rate of profits earned, and, on the other hand, the deterioration of working conditions and wages, and the growth of income and property (capital) inequality in both national and international relations (Levy, Murmane, 2003, pp. 1279–1333; Cole, 2008, p. 247; Friedman, 1993, pp. 160–161, 182–183; Neal, Rick, 2014, pp. 1–54; Nielsen, 2018, pp. 175–197).

The liberal revolution sets in motion a mechanism to displace the state not only from the real and regulatory sphere, but also from the social sphere. Thanks to this, the effect of "hollow" public finances is revealed, which sets in motion a process of gradual privatisation of public services (especially in the United States) and contributes not only to an increase in their prices and a decrease in the wages of lower-level public sector employees, but also to a deterioration in the quality of goods offered and social services provided. Therefore, in domestic

relations, the gap between the rich and the poor, between capital and labour, between super-managers and employees is steadily widening, as the growing national income goes primarily to the richest, to the super-managers, and at the same time, the number of homeless and working people living in extreme poverty is growing: „… people having only their own labour often live in modest or even very modest conditions, … capital holders can, without working, appropriate a significant portion of the goods produced" (Piketty, 2015, p. 57).

Neoliberals reject the ideal of a fair (equal) distribution of national income – while approving the market mechanism of allocating scarce resources – in order to reduce the level of economic inequality and activate society to work. According to them, top-down imposed social insurance becomes a tool of random redistribution and thus threatens the natural creativity of the market system. Following this line of reasoning, they believe that physical capital combined with properly educated human capital, guarantees in parallel the expansion of the value of investments and high productivity of the economy, and thus reduces the level of poverty and inequality (Milanowic, 2018, pp. 269–294).

Proponents of the demand-populist view of the economic process (in the theoretical layer referring to Keynesianism, but in reality aiming to limit freedom to power and action), including Thomas Piketty[4] and Anthony B. Atkinson[5], rejecting the neoclassical model of capital accumulation and the assumption of market reliability, offer a different attitude to the problem of deepening economic inequality, and therefore of progressive economic and social insecurity. According to them, a higher rate of return on capital increases the rate of capitalisation of already existing wealth, and thus exacerbates not only primary wealth and income inequalities, but also disparities in the conditions of wealth distribution nationally and internationally (Piketty, 2015, pp. 36–37; Solow, 2018, pp. 67–78).

Analysing the economic inequality problem, they focus their attention primarily on the growing disparities in highly industrialised countries. The abovementioned problem is particularly acutely felt in the United States, where the ratio of wealth to annual national income is at a very high level. In this country, the fastest growing disparities are observed not only in the distribution of wealth, but especially in the distribution of national income between capital and labour; there

[4] In 2014, the French economist T. Piketty published a paper: "Capital in the 21st Century," which is a result of his longtime historical-economic and socio-political research into the causes of economic inequality, as confirmed by his previous publications, including: (Piketty, 2003; Piketty, Saez, 2003; Atkinson, Piketty (eds.), 2007; Atkinson, Piketty (eds.), 2010; Atkinson, Piketty, Saez, 2011).

[5] Anthony B. Atkinson has made a name for himself with his research into issues of inequality and poverty, as well as income distribution. His research has resulted in numerous book publications and papers in academic journals, including: (Atkinson, 1993; Atkinson, 1998; Atkinson, 2008; Atkinson, Piketty (eds.), 2010; Atkinson, 2014; Atkinson, 2017).

is even talk of an erosion of the minimum wage and the growth of income poverty among the employed: "Average wages in developed countries have been stagnant for three decades, a tendency that is likely to continue in the future" (Standing, 2021, p. 85). Similar trends are also revealed in other countries belonging to this group. However, in their case, the ratio of wealth to annual national income is at a correspondingly lower level, and therefore less disparity is observed in the distribution of wealth, and, therefore, national income (Goldhammer, 2018, pp. 49–56; Naidu, 2018, pp. 128–148; Nielsen, 2018, pp. 175–197; Piketty, 2015, pp. 202–289; Raczkowska, 2014, pp. 319–327).

Representatives of the demand-populist approach, following this line of reasoning further, state that the process of growing economic inequality is a consequence of the reduction of the effective rate of taxation of the richest, which contributes to the dominance of the share of capital in national income, because under conditions of predominance of the rate of return on capital over the rate of economic growth, there is not only a slowdown in the rate of economic growth, but also a systematic widening of the gap between the two rates, which inevitably leads to a growing disparity in labour income, even to the degradation of labour (except for very high-level managers, the effect of increasing inequality in the upper distribution of labour income distribution), and the transformation of both the labour market and the capital market (Atkinson, 2017, pp. 2–36, 123–137, 249–260; Atkinson, 1998, pp. 1–20; Piketty, 2012a, pp. 18–21; Piketty, 2012b, pp. 22–25; Piketty, 2013a, pp. 61–63; Piketty, 2013b, pp. 74–76; Piketty, 2014, pp. 95–97; Piketty, 2015, pp. 586–725). Deepening inequality results in accelerating the process of social polarisation and chaos, i.e. widening the gap between the rich (including the super-rich) and the ever-poor 'wage earners', i.e. between the top 1 percent of the richest and the rest of society, both nationally and internationally. "Before World War I, the top 1 percent of the richest received about one-fifth of the total income in both the UK and the US. By 1950, that percentage was more than half as much, but since 1980, the 1 percent's share of national income has begun to rise again. In the United States, the percentage has returned to the level of 100 years ago" (Krugman, 2018, p. 80).

According to representatives of the demand-populist approach, the inefficiency and failure of the market forces state interference both in the real sphere and, above all, in the social sphere, i.e. in the conditions for the operation of economic agents (in the conditions for the functioning of the economy), as well as in the conditions for the redistribution of the national income produced. Therefore, they propose new optics for looking at the state, referring to the 20th-century concept of the social state. According to this concept, the state, while pursuing an active economic and social policy, determines, on the one hand, the tax strategy and, on the other hand, the principles of redistribution of the produced national income

and thus reduces the level of economic inequality (in income as well as property/capital terms). Therefore, the state should initiate measures to regain control over the rate of wealth accumulation in the new economic and social, and political realities (the rate of concentration of capitalisation) through changes in the tax policy already implemented (through the introduction of simple and transparent taxes), especially in relation to the richest (1 percent and especially 0.1 percent), as well as income policy and redistributive policy (Atkinson, 2017, pp. 204–211, 297–352; Belka, 1986, pp. 42–48; Mazzucato, 2016, pp. 139–146; Piketty, 2013, pp. 74–76; Piketty, 2014, pp. 95–97; Piketty, 2015, pp. 681–689; 724–725).

Poverty as a socio-economic category

Poverty is a multidimensional phenomenon, extremely problematic to define as the literature uses such terms as poverty, deprivation, critical living situation or social disadvantage interchangeably. In the above context, the phenomenon of poverty has both quantitative and qualitative aspects, but also temporal and spatial ones. Therefore, the difficulty of clearly defining the criterion of poverty arises (Dziewięcka-Bokun, Mielecki, 1998, p. 112; Ravallion, Chen, 2003, pp. 93–99; Sen, 1976, pp. 219–231). In the broadly interpreted social sciences, poverty is defined as:

– "Income insufficient to pay for basic supplies of food, clothing, a roof over your head and other necessities" (Samuelsson, Nordhaus, 2014, p. 333);
– "A state of relatively permanent unsatisfaction of basic human needs" (Sztaba, ed., 2007, p. 483);
– "A phenomenon dysfunctional for the social system" (Sztumski, 1995, pp. 13–18);
– "A situation in which an individual (person, family, household) does not have sufficient resources – (both monetary resources in the form of current income and income from previous periods and in the form of accumulated material resources) to meet its needs" (Panek, 2001, p. 162).

To sum up, poverty definitions, from the point of view of the social sciences, are created taking into account the economic, as well as social, cultural and political dimensions of the phenomenon of poverty.

The European Union's approach to the problem of poverty and disparities

One of the economic objectives of the European Union is regionally balanced economic development. The issue of economic development was put at the centre of integration processes initiated by the European Communities in the 1950s

(Moussis, 2015; Olsen, 2021). Statements regarding economic development have been included in the Treaties. Article 2 of the Treaty of Rome establishing the European Economic Community stated: "The Community shall have as its task… to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, an accelerated raising of the standard of living…" (The Treaty of Rome (1957), Article 2). The Single European Act of 1986 focused on the problem of considerable disparities in socioeconomic development observed in the mid-1980s. In Title V, Economic and Social Cohesion, in Article 130 A, one can read: "In order to promote its overall harmonious development, the Community shall develop and pursue its actions leading to the strengthening of its economic and social cohesion. In particular, the Community shall aim at reducing disparities between the various regions and the backwardness of the least-favoured regions". Moreover, Article 130 B states: "The Community shall support the achievement of these objectives by the action it takes through the Structural Funds (European Agricultural Guidance and Guarantee Fund, Guidance Section, European Social Fund, European Regional Development Fund), the European Investment Bank and the other existing financial instruments", while in Article 130 C the importance of the European Regional Development Fund in the process of disparities reduction is stressed: "The European Regional Development fund is intended to help redress the principal regional imbalances in the Community through participating in the development and structural adjustment of regions whose development is lagging behind and in the conversion of declining industrial regions." The significance of "the economic and social development of the Community as a whole and the balanced development of its regions" is underlined again in Article 130 Q. (Single European Act, 1987). The Treaty on European Union concluded in Maastricht in 1992 and introduced a new version of Article 2, in which a stronger emphasis is put on economic development. One can read there: "The Community shall have as its task, by establishing a common market and an economic and monetary union and by implementing the common policies or activities referred to in Articles 3 and 3a, to promote throughout the Community a harmonious and balanced development of economic activities, sustainable and non-inflationary growth respecting the environment, a high degree of convergence of economic performance, a high level of employment and of social protection, the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among Member States " (Treaty on European Union, 1992). In addition to that, Article 103 states that "In order to ensure sustained convergence of the economic performances of the Member States, the Council shall, on the basis of reports submitted by the Commission, monitor economic developments in each of the Member States and in the Community as well as the consistency of

economic policies with the broad guidelines … and regularly carry out an overall assessment" (Treaty on European Union, 1992). The Amsterdam Treaty adopted in 1997 further strengthens the importance of balanced growth and development: Part 1 Substantive Amendments, Article 1, point 2 relates to the amendment of the Treaty on European Union, concerning the issue of development as an overall objective of the EU: "Determined to promote economic and social progress for their peoples, taking into account the principle of sustainable development and within the context of the accomplishment of the internal market and of reinforced cohesion and environmental protection, and to implement policies ensuring that advances in economic integration are accompanied by parallel progress in other fields"; what is more, point 5 formulates the following construction of an objective of the EU: "to promote economic and social progress and a high level of employment and to achieve balanced and sustainable development, in particular through the creation of an area without internal frontiers, through the strengthening of economic and social cohesion and through the establishment of economic and monetary union, ultimately including a single currency" (Treaty of Amsterdam, 1997). The Treaty of Lisbon, in Article 2 of the Treaty on European Union, states: "The EU… shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. It shall promote scientific and technological advances. It shall combat social exclusion and discrimination… It shall promote economic, social and territorial cohesion…". The Treaty of Lisbon also added an amendment to Article 163; according to the aforementioned amendment, Article 163 took the following form: "The Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary virtue of other Chapters of the Treaties" (Treaty of Lisbon, 2007).

The significance of the promotion and stimulation of regionally balanced economic development was strengthened with both Southern enlargements (of 1981 and 1986) and Eastern enlargements (of 2004, 2007, 2013). The enlargements mentioned above resulted in widening the gap between the rich and the poor Member States (Pawlas, 2018a). The European Union actively responded to the identified challenge of regionally balanced growth and development. One should mention the introduction of new policies, instruments and actions devoted to the promotion of regionally balanced economic development. The promotion of regionally balanced economic development was at the centre of the Common Regional Policy introduced in 1988 (Dall'Erba, 2003; Hübner, 2008), which was

later transformed into the EU Policy of Economic, Social and Territorial Cohesion (Rodokanakis 2006; McCann and Ortega-Argiles, 2013).

The first decade of the 21st century brought further strengthening of the development objective of the European Union. The Lisbon Strategy of 2000 was a development plan for the economy of the European Union for the 1st decade of the 21st century. With the adoption of the Lisbon Strategy, the European Union made an attempt to meet the challenges resulting from both globalisation processes and the emergence of a knowledge-driven economy. The main objective of the Lisbon Strategy was to transform the European Union into the most competitive and dynamic knowledge-based economy in the world, and to solve the problem of low productivity and stagnation of economic growth in the European Union. Initially, the Lisbon Strategy was based on two pillars: economic and social. In 2001, however, a decision was made to introduce the third pillar, i.e. the environmental dimension. Unfortunately, the ambitious goals of the Lisbon Strategy were not met (European Council, 2000; European Commission, 2007; Krcek, 2013).

The problem of rising disparities in development and uneven distribution of wealth was further strengthened by the global financial crisis. The European Union took it into consideration in the Europe 2020 Strategy, which was adopted in 2010 for the period 2010–2020. The Europe 2020 Strategy consisted of three priorities, namely: 1. Smart Growth, 2. Sustainable Growth, 3. Inclusive Growth. The Inclusive Growth priority fully corresponded with the issue of poverty and social exclusion. It aimed at promoting more balanced growth and development, which should eventually lead to the reduction of poverty and social exclusion. The EU listed three measurable targets within this priority: reducing the number of people living below the poverty line by 20 million, increasing the employment rate of people aged 20–64 years up to 75%, reducing the school drop-out rate to 10% and increasing tertiary education up to 40% by the year 2020. Hence, education and activity in the labour market were considered crucial determinants of poverty reduction and pro-inclusive factors of development by the EU (European Commission, 2010; European Commission, 2019). In 2019, the EU adopted further strategic documents stressing the need for a reduction in poverty and exclusion and further promotion of inclusion: A New Strategic Agenda 2019–2024 (European Council, 2019) and Sibiu Declaration (Council of the EU, 2019). EU leaders emphasised the vital need to prevent the further deepening of intergenerational, territorial and educational divisions, to ensure equal opportunities and adequate social protection, as well as to reduce poverty and social exclusion.

The COVID-19 pandemic resulted in new challenges for the EU and created new areas of poverty and exclusion in the EU Member States (Schramm, 2022). The first reaction of the EU was the document "A Roadmap for Recovery.

Towards a More Resilient, Sustainable and Fair Europe", adopted in April 2020. The European Council called for a coordinated exit strategy, a comprehensive recovery plan and unprecedented investment. The need for a recovery plan based on solidarity, cohesion and convergence was stressed. A fully functioning and revitalised Single Market was to be a key component of the EU's future prosperity and resilience. To achieve this goal, the Green Transition and the Digital Transformation would be prioritised as tools for the modernisation of the EU's economy. Moreover, the strategic autonomy of the EU would have to be achieved through a new industrial policy (European Council, 2020).

The next crucial step was the adoption of the Multiannual Financial Framework 2021–2027 (MFF 2021–2027) and the Next Generation EU (NGEU) (Alcidi, Gros, 2020; European Commission 2022). MFF 2021–2027 accounts for EUR 1074 billion (in 2018 prices), while the NGEU amounts to EUR 750 billion (in 2018 prices). The Next Generation EU is a temporary instrument planned for the period 2021–2026. The main objective of the NGEU is to speed up the post-pandemic recovery and to strengthen resilience to future crises. Its main element is the Recovery and Resilience Facility (RRF), amounting to EUR 672.5 billion (in 2018 prices), which consists of two separate items: grants (amounting to EUR 312.5 billion in 2018 prices) and loans (amounting to EUR 360 billion in 2018 prices). RRF came into operation in February 2021. Other NGEU financial sources are to be devoted to: REACT-EU (EUR 47.5 billion in 2018 prices), Rural areas development (EUR 7.5 billion in 2018 prices), Just Transition Fund (EUR 10.0 billion in 2018 prices), Invest EU (EUR 5.6 billion in 2018 prices), RescEU (EUR 1.9 billion in 2018 prices) and Horizon Europe (EUR 5.0 billion in 2018 prices) (European Commission 2020; European Commission, 2021).

The energy crisis, as well as the Russian military aggression on Ukraine, plus the EU sanctions, create yet another challenge for the EU. A confluence of interconnected factors may result in further expansion of poverty in the EU and a further rise in regional disparities (Popkostova, 2022). The European Commission proposed the introduction of a new action, namely REPowerEU: Joint European action for more affordable, secure and sustainable energy. This plan of the European Commission outlines a series of measures to respond to rising energy prices in Europe and to replenish gas stocks for next winter (European Commission, 2022). Obviously, it is far too soon to describe the details of this planned action or to analyse the likelihood of its adoption. Undoubtedly, the situation is that the world economy is becoming more and more unstable and dynamic. The EU will have to take further steps and actions to keep its role in Europe and in a global environment. The strength and position of the EU will determine its capability of counteracting poverty and disparities in development in the EU (European Central Bank, 2022).

Multidimensional analysis of poverty in Polish regions

Poverty in Poland is not an evenly distributed phenomenon. The administrative division of the country into 16 provinces is, in economic terms, a division into the generally poorer Eastern Poland, the agricultural areas of Central Poland with its dominant rich regional capitals, the wealth-differentiated Pomerania in northern Poland and the urbanised and industrialised Southern Poland. Differences in wealth are influenced by historical backgrounds dating back to the Partitions (1795–1918).

The Polish territories incorporated into the Kingdom of Prussia in the 19th century developed better primarily due to investments in infrastructure, including railroads, education and health care. The situation was somewhat worse in the regions administered by the Austro-Hungarian Empire authorities, which nevertheless had access to many of the amenities spreading in Western Europe. The situation was much worse in the areas under Russian control, whose population was treated by the authorities in Saint Petersburg as inferior subjects. The contemporary distribution of economic interests is in line with both economic ties with the European Union favouring Western regions and local conditions determining the advantages of territorial units for doing business (natural resources, entrepreneurship). This is further compounded by the location of large cities being concentrations of people, resources and markets. They attract investors and consumers with their potential, creating the largest part of the wealth of their regions (Warsaw, Krakow, Wroclaw, Poznan).

Regional variation of poverty in Poland can be studied using the context of regional development. This is because the formation of the level of this phenomenon is not only the result of direct influences arising from the characteristics of employment, the level of wages, the number of enterprises or the scale of social welfare benefits, but also regional conditions, which determine the opportunities to undertake profitable economic activity conducive to building the wealth of regional residents. They consist of economic realities, labour market characteristics and functioning technical and social infrastructure. Table 1 shows indicators describing Polish regions: synthetic poverty index, synthetic indicators of regional determinants (economic, labour market and infrastructure), as well as super-index and groups (classes), calculated for the years 2010 and 2020, further illustrated in Figure 1. The analysis was conducted with the application of statistical information supplied by the Central Statistical Office (Warsaw) and taken from Statistical Yearbook of the Regions – Poland 2021, Statistical Yearbook of the Regions – Poland 2011, as well as https://bdl.stat.gov.pl/bdl/dane/podgrup/temat.

Tab. 1. Poverty in Polish provinces

Province	2010							2020						
	P	R_E	R_{LM}	R_I	R	Super index (PR)	Class	P	R_E	R_{LM}	R_I	R	Super index (PR)	Class
Lower Silesia	0.587	0.595	0.445	0.485	0.599	0.613	C4	0.598	0.476	0.476	0.601	0.566	0.705	C4
Kuyavia-Pomerania	0.409	0.392	0.372	0.191	0.359	0.449	C2	0.514	0.345	0.345	0.293	0.340	0.480	C3
Lublin	0.094	0.166	0.284	0.143	0.180	0.151	C1	0.178	0.170	0.170	0.263	0.163	0.151	C1
Lubusz	0.308	0.531	0.407	0.194	0.436	0.430	C2	0.448	0.373	0.373	0.274	0.357	0.459	C3
Lodz	0.520	0.403	0.538	0.340	0.511	0.501	C3	0.457	0.369	0.369	0.434	0.415	0.508	C3
Lesser Poland	0.326	0.374	0.558	0.335	0.499	0.475	C2	0.457	0.417	0.417	0.426	0.460	0.540	C3
Mazovia	0.619	0.903	0.871	0.335	0.827	1.000	C4	0.518	0.873	0.873	0.465	0.804	0.741	C4
Opole	0.334	0.394	0.350	0.346	0.421	0.441	C2	0.225	0.371	0.371	0.411	0.410	0.343	C2
Subcarpathia	0.171	0.272	0.228	0.187	0.232	0.257	C1	0.165	0.250	0.250	0.341	0.268	0.213	C1
Podlasie	0.292	0.223	0.282	0.143	0.209	0.365	C2	0.273	0.305	0.305	0.163	0.244	0.270	C1
Pomerania	0.493	0.502	0.550	0.270	0.536	0.546	C3	0.327	0.423	0.423	0.322	0.424	0.427	C2
Silesian	0.619	0.475	0.553	0.487	0.592	0.584	C3	0.794	0.445	0.445	0.701	0.541	0.746	C4
Holy Cross	0.215	0.340	0.266	0.274	0.324	0.259	C1	0.306	0.223	0.223	0.281	0.220	0.272	C2
Warmia-Masuria	0.428	0.310	0.275	0.126	0.324	0.413	C2	0.398	0.299	0.299	0.162	0.239	0.339	C2
Greater Poland	0.415	0.473	0.567	0.313	0.551	0.581	C3	0.380	0.492	0.492	0.280	0.462	0.489	C3
West Pomerania	0.537	0.439	0.275	0.391	0.413	0.580	C3	0.506	0.449	0.449	0.331	0.451	0.564	C3
Correlation coefficient P-R	0.8150191							0.641819						

Key:
P – Synthetic index of poverty; R – Synthetic index of regional conditions; Rg – Synthetic sub-index of regional economic conditions; Rrp – Synthetic sub-index of regional labour market conditions; Ri – Synthetic sub-index of regional infrastructure conditions; Super-index – synthetic index of poverty and regional conditions
Names of Poland's provinces: Dolnośląskie – Lower Silesia Province, Kujawsko-pomorskie - Kuyavia-Pomerania Province, Łódzkie – Lodz Province, Lubelskie – Lublin Province, Lubuskie – Lubusz Province, Małopolskie - Lesser Poland Province, Mazowieckie – Mazovia Province, Opolskie – Opole Province, Podkarpackie – Subcarpathia Province, Podlaskie – Podlasie Province, Pomorskie – Pomerania Province, Śląskie – Silesian Province, Świętokrzyskie – Świętokrzyskie (Holy Cross) Province, Warmińsko-mazurskie – Warmia-Masuria Province, Wielkopolskie – Greater Poland Province, Zachodniopomorskie – West Pomerania Province.

Source: own calculations based on statistical data taken from the Central Statistical Office (2011, 2021).

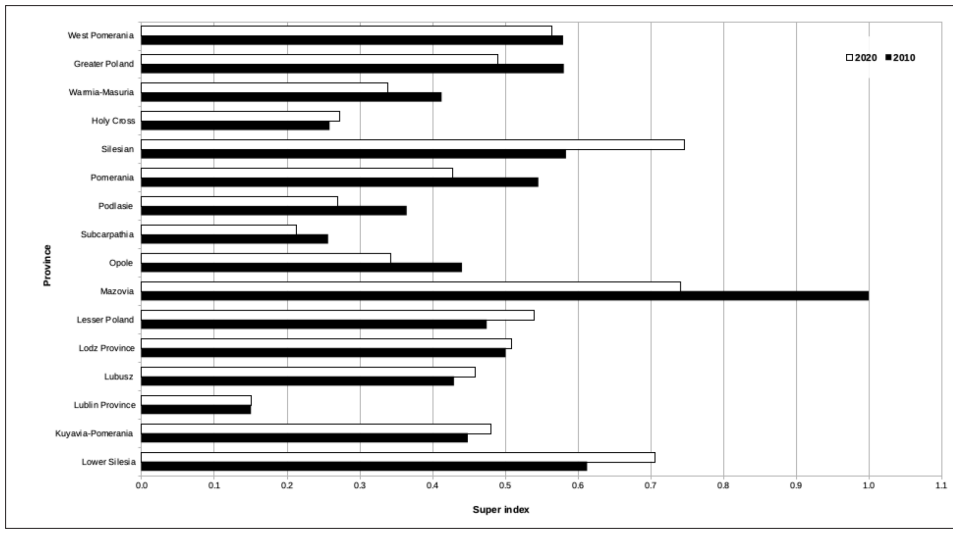

Figure 1. Poverty in Poland's provinces

Source: own calculations, own presentation.

The level of regional differentiation of the poverty phenomenon in Poland in terms of regional conditions makes it possible to distinguish four classes of regions. There were two provinces among the richest (class C4) in the years under study: Mazovia Province (Mazowieckie) and Lower Silesia Province (Dolnośląskie). They are characterised by the location of a large city (Warsaw in Mazovia Province and Wroclaw in Lower Silesia Province), which attracts people and companies, providing high wages for employees and profits for owners. They also offer many desirable jobs and good infrastructure facilities (e.g. motorways, universities, hospitals, cultural institutions). The innovative nature of the entities operating in these centres and their metropolitan aspirations are also conducive to building international investment attractiveness. The agricultural environment of the capital city of Warsaw does not hamper its economic vitality, while Wroclaw additionally benefits from the advantages of the Western region, taking advantage of its proximity to Germany. Silesian Province (Śląskie) – Poland's most urbanised region, heavily industrialised, though still struggling with difficulties of the coal mining transition – joined Class 4 in 2020. However, the area of Silesian Province is also home to a number of modern enterprises, and there are well-developed transportation networks and a newly created "Metropolis GZM".

The second class of regions (C3) included five provinces in 2010, i.e., Lodz Province (Łódzkie), Pomerania Province (Pomorskie), Silesian Province (Śląskie), Greater Poland Province (Wielkopolskie) and West Pomerania Province (Zachodniopomorskie). These are the provinces with many industrialised urban

centres, with fairly well-developed infrastructure. In the Lodz Province (Łódzkie), once a concentration of textile companies, modern industry is now being recreated, increasingly taking advantage of the area's central location in Poland. The functional integration of Lodz and Warsaw is also progressing, resulting in a gradual convergence of land use surrounding these cities, which is encouraging investor interest (in the Solidarity Transport Hub Poland plan). Pomerania Province creates a strong Gdansk–Gdynia–Sopot metropolitan area, oriented to attract residents, businesses and tourists, referring to the centuries-old harbour traditions of Gdansk. The surrounding agricultural areas provide a residential hinterland with great recreational potential. Greater Poland Province is a region with many industrial centres, led by Poznan, and well-developed agriculture. It is attractively located in relation to transportation routes (on the lines Berlin–Warsaw–Russia and Gdansk–Prague), taking advantage of this to build a network of economic cooperation with Western European countries (e.g. the Greater Poland Cluster 'Mebel Design'). The West Pomerania Province focuses its economic advantages primarily on the potential of Szczecin and the surrounding smaller cities. Agricultural activities are undertaken in other areas, while there are many tourist destinations along the coast. The region's western location fosters economic contacts with Germany and other Western European countries. Kuyavia-Pomerania Province (Kujawsko-Pomorskie), Lubusz Province (Lubuskie) and Lesser Poland Province (Małopolskie) joined the C3 class regions in 2020, while Silesian Province (Śląskie) and Pomerania Province (Pomorskie) left C3.

The third class of regions (C2) included six provinces in 2010: Kuyavia-Pomerania Province (Kujawsko-Pomorskie), Lubusz Province (Lubuskie), Lesser Poland Province (Małopolskie), Opole Province (Opolskie), Podlasie Province (Podlaskie) and Warmia-Masuria Province (Warmińsko-mazurskie). These are the regions with different characteristics. Kuyavia-Pomerania Province includes agricultural areas surrounding two large and industrialised cities of Bydgoszcz and Torun. Their economic potential is complemented by industrial activities carried out in several smaller cities. A peculiarity of Lubusz Province (Lubuskie) consists of its economic ties resulting from its direct proximity to Poland's western border. The region is the most forested area in Poland, which results in the features of agricultural activities and tourist advantages. Industry is concentrated in the region's two largest cities: Zielona Gora and Gorzow Wielkopolski. Lesser Poland Province (Małopolskie) is a region with a diverse economic situation. Its southern location has fostered economic contacts with Central and Southeastern European countries for centuries. The province's economic realities consist of a large number of service and industrial enterprises located in Krakow, the tourist potential of Podhale, companies operating in smaller towns, and a large number of small farms. Opole Province is the smallest region in Poland and is characterised

by well-developed agricultural activities and industry concentrated in Opole and several smaller cities. The same is true of Podlasie Province (Podlaskie), which is further enriched by economic ties with the Baltic States. Its area is also home to many unique environmental resources (Bialowieza National Park, The Augustowska Primeval Forest), which attract foreign tourists. They also flock to the facilities located in Warmia-Masuria Province (Warmińsko-Mazurskie), which offers the recreational advantages of the Masurian Lake District. Agriculture in the area is characterised by a large number of organic farms. Service and industrial companies are mainly concentrated in Olsztyn. Pomerania Province (Pomorskie) and Holy Cross Province (Świętokrzyskie) joined the C2 class regions in 2020, while Kuyavia-Pomerania, Lubusz, Lesser Poland, and Podlasie provinces left the C2 class.

The last class of regions (C1) included three provinces in 2010: Lublin Province (Lubelskie), Subcarpathia Province (Podkarpackie) and Holy Cross Province (Świętokrzyskie). These are the poorest Polish regions. Lublin Province has extensive land used for agriculture, while service and industrial activities are located in Lublin and several other smaller cities. The region is located on Poland's eastern border, but its proximity to Belarus and Ukraine is currently not conducive to developing economic cooperation. The situation is similar in the case of Subcarpathia Province (Podkarpackie); the province includes many mountainous areas where tourism is developing. However, farms in its area are highly fragmented, which makes it difficult to obtain satisfactory profits there. Rzeszow is building its position as a modern service and industrial centre (Aviation Valley). Holy Cross Province (Świętokrzyskie) benefits from its central location in the country. It is an agricultural area with several smaller centres for locating industrial companies. In turn, the region's most important service activities are concentrated in Kielce. Podlasie Province (Podlaskie) joined the C1-class regions in 2020, while Holy Cross Province (Świętokrzyskie) left the C1 class.

The distribution of the results of the study indicates a significant spread in the value of the super-index, from 0.151 for Lublin Province (Lubelskie) in both 2010 and 2020, to the benchmark level of 1.0 for Mazovia Province (Mazowieckie) in 2010. This indicates that the level of poverty in the Polish regions is highly differentiated, and the correlation coefficient generally confirms the significance of the impact of the analysed regional conditions on the formation of the characteristics of this phenomenon[6].

[6] It's worth mentioning here some research focusing on the problem of inequalities in Poland. Keane and Prasad (2001) studied inequalities in Poland during the first decade of transition. Sączewska-Piotrowska (2018) conducted research in the area of income inequalities among households in Poland. Moreover, Brzezinski and Najsztub (2020) re-examined the evolution of income inequality in Poland in the process of the post-socialist transition.

Conclusion

The problem of poverty divides economists, generating lively discussions that contribute to the development of economic theory on the one hand, and attempts to empirically address the phenomenon on the other. However, despite the many actions taken at local, regional, national and international levels by public institutions, private institutions, NGOs and supranational organisations, reducing global poverty in all its manifestations remains a challenge.

Integration implemented by the European Union should result in a more even economic development, and reduction of development disparities, higher standards of living, reduction of poverty. Such goals have already been set in the treaty documents on which the EU (formerly the European Communities) is based. Achieving these goals has proven very difficult in practice. On the one hand, the successive enlargements of the European Communities / European Union led to an increase in development disparities (the so-called Eastern enlargement of the EU of 2004, 2007, and 2013 should be mentioned in particular); on the other hand, the European Union was facing external challenges and threats, which also resulted in increased inequality and increased poverty. The 21st century has brought a number of new challenges and threats to the European Union:

– The 2008+ global financial crisis significantly increased the level of development disparities in the EU, to which the EU responded with the Europe 2020 Strategy;
– The pandemic crisis triggered by COVID-19 provided the impetus for deepening disparities and increasing poverty levels. In response to the pandemic, the EU introduced Next Generation EU and reformulated the financial assumptions for 2021–2027 accordingly;
– Russia's aggression against Ukraine, coupled with the energy, migration and food crises and mounting inflationary pressures, are further threats to the European Union that could result in a further increase in disparities and a growing poverty problem.

The conducted research allows us to conclude that there is an increasing number and intensity of actions taken at the European Union level directed at promoting even development, bridging development disparities and reducing poverty. It is important to increase the consistency of EU action in response to the growing instability of the external environment, despite the obvious national differences. The peculiarities of poverty in Polish regions are influenced by different development conditions. Their identification made it possible to determine the hierarchy of the intensity of this phenomenon in different parts of Poland. The richest regions are those with strong urbanised areas (Warsaw, Wroclaw, Metropolis GZM), taking advantage of the economic and infrastructural potential, the foundations of which were created by pre-war investments. The poorest, on the other hand, are the agricultural regions of eastern Poland, with a small number of

modern industrial enterprises, but slowly enriching their investment attractiveness since the 1990s.

Limitations of the research included limited access to data – to statistical information (not all diagnostic variables connected with the issue of poverty could be used in the research due to the fact they were not available). Moreover, the limitations of the research were due to the ongoing pandemic, which was compounded by a full-scale military conflict in Ukraine and the imposition of sanctions on Russia, which were associated with growing energy, migration/refugee and food crises and rising inflationary pressures. Undeniably, these factors should be viewed as a source of growing disparities and deepening poverty. Unfortunately, it is too early to fully assess and analyse their impact on the situation of Poland's regions. Further studies should focus on a detailed analysis of the implications of the COVID-19 pandemic and the military aggression of the Russian Federation against Ukraine on the situation of Poland's regions. They should also include a comparative analysis and evaluation of poverty in Poland's regions against the background of other European Union Member States' regions.

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Summary

Poverty is a multidimensional phenomenon, hard to define but of interest to many experts in social sciences. When it comes to economic sciences, the economic dimension of poverty and its consequences are underlined. The European Union pays attention to the problem of developmental disparities as well as the need to reduce poverty and disparities. It is reflected both in the EU treaties and in the EU activities undertaken within both the Economic, Social and Territorial Cohesion Policy and the Lisbon Strategy, the Europe 2020 Strategy, as well as the EU reaction to the numerous challenges facing the EU in the 21st century (the COVID-19 pandemic, Russian aggression against Ukraine). The main theoretical and cognitive aim of the research is to present the differentiated perception of the problem of poverty in economic theory and EU policy decisions. The main aim of the empirical part of the research is to identify and evaluate regional disparities in poverty using the example of Poland's regions (provinces). The research was conducted with the application of several scientific methods, including literature studies, descriptive and comparative analysis, and critical thinking. Because of the complexity of the category of poverty and poverty conditions, the selected method of multivariate comparative analysis, i.e. the TMD introduced by Hellwig, was adopted. The conducted research indicated that poverty in Poland's regions is unequally distributed, which results from their location in relation to richer markets, infrastructure conditions, and economic situation.

Keywords: poverty, region, EU policy, disparities, Poland.

Ubóstwo w polskich regionach w świetle polityki Unii Europejskiej

Streszczenie

Ubóstwo jest zjawiskiem wielowymiarowym, trudnym do zdefiniowania, ale będącym przedmiotem zainteresowania wielu specjalistów z zakresu nauk społecznych. W przypadku nauk ekonomicznych podkreśla się ekonomiczny wymiar ubóstwa i jego konsekwencje. Unia Europejska zwraca uwagę na problem nierówności rozwojowych, a także na potrzebę ograniczania ubóstwa i nierówności. Znajduje to wyraz zarówno w traktatach unijnych, jak i w działaniach UE podejmowanych zarówno w ramach polityki spójności gospodarczej, społecznej i terytorialnej, jak i Strategii Lizbońskiej, Strategii Europa 2020, a także w reakcji UE na liczne wyzwania stojące przed nią w XXI wieku (pandemia COVID-19, agresja Rosji na Ukrainę). Głównym celem teoretycznym i poznawczym badań jest przedstawienie zróżnicowanego postrzegania problemu ubóstwa w teorii ekonomii i decyzjach politycznych UE. Głównym celem empirycznej części badań jest identyfikacja i ocena regionalnych zróżnicowań ubóstwa na przykładzie regionów (województw) Polski. Badania zostały przeprowadzone z zastosowaniem kilku metod naukowych, w tym: studiów literaturowych, analizy opisowej i porównawczej, krytycznego myślenia. Ze względu na złożoność kategorii ubóstwa i warunków ubóstwa badania prowadzono z zastosowaniem wybranej metody wielowymiarowej analizy porównawczej, tj. taksonomicznej miary rozwoju Hellwiga. Przeprowadzone badania wskazały, że ubóstwo w regionach Polski jest nierównomierne, co wynika z ich położenia względem bogatszych rynków, warunków infrastrukturalnych, sytuacji gospodarczej.

Słowa kluczowe: ubóstwo, region, polityka UE, nierówności, Polska.

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Economic divergence between Poland and Ukraine from the perspective of their balances of payments

Introduction

The history of the economic divergence of two neighbouring countries, Poland and Ukraine, is the subject of many studies, especially since Poland and Ukraine had seen similar economic performances before starting their transition (Hartwell, 2014). In 1991, both countries had comparable economic potential, measured in GDP at current prices (USD 85.5 bln in Poland vs USD 77.4 bln in Ukraine), and at purchasing power parity (PPP), Ukraine's GDP was even higher than the Polish GDP (Fig. 1).

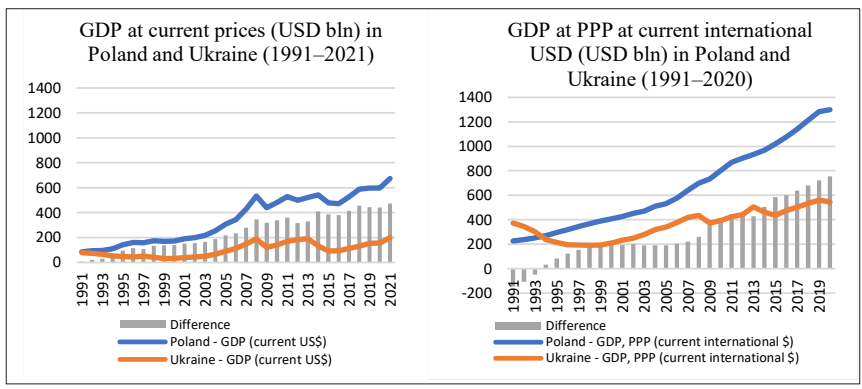

Figure 1. Dynamics of GDP at current prices and PPP in Poland and Ukraine

Source: own elaboration based on WDI (http).

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After 30 years, in 2021, final goods and services worth USD 674.1 bln were produced in Poland, while in Ukraine it was only USD 198.3 bln. This roughly corresponded to the GDP measured in current prices in Poland twenty years ago, that is, in 2002. The Polish economy has grown to be three times larger than the Ukrainian economy. Taking into account the purchasing power parity does not fundamentally change the picture, although the gap between the Polish and Ukrainian economies is narrowing. The Ukrainian GDP at PPP was lower than the Polish GDP at PPP by 58% in 2020, not over 70% as in the case of the GDP in current US dollars.

In simple terms, the strength of economies translates into the well-being of the citizens, especially since the populations of Poland and Ukraine are in general comparable[2]. Assuming that the ratio of GDP to the average population in a specific year translates roughly into the average income of the citizens, one can see rising income inequalities between the average inhabitants of the two countries. The GDP per capita in Poland, measured in current dollars, which in 1991 amounted to USD 2,235.50, had increased sevenfold by 2020 to USD 15,742.50. In Ukraine, the GDP per capita in 2020 was USD 3,523.30 (slightly less than in Poland in 1995) amounting to only 22% of the GDP per capita in Poland, while in 1991 this indicator was over 2/3 of the Polish one (Fig. 2).

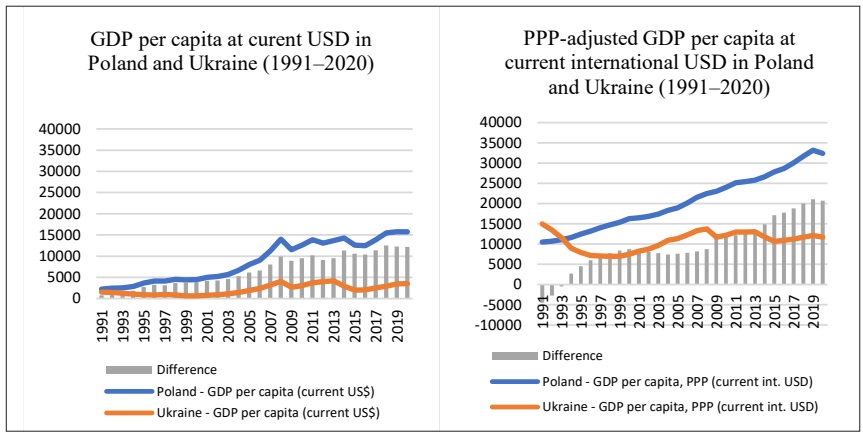

Figure 2. Dynamics of GDP per capita at current prices and PPP in Poland and Ukraine

Source: own elaboration based on WDI (http).

The GDP per capita in current prices shows, in simplified terms, the purchasing power of the population in the international arena and does not necessarily

[2] Although in 1991 there were almost 14 million more citizens of Ukraine than Polish citizens (52 million vs 38.2 million), this difference is constantly decreasing, and in mid-2021, it amounted to about 3 million (41.4 million vs 38.2 million). Data for 1991: WDI, for 2021: Eurostat and GUS (Central Statistical Office).

reflect the quality of life in a given country. The PPP-adjusted GDP per capita shows the increasing inequality between Poles and Ukrainians in income that can be spent in the local markets. Although until 1993, the GDP per capita at PPP in Ukraine was higher than in Poland, since 1994, the scissors have begun to spread to the disadvantage of Ukraine. In 2020 in Poland, the GDP per capita at PPP was 277% of this indicator in Ukraine, which meant that the Ukrainian GDP per capita in US dollars calculated based on PPP was only 36% of that in Poland.

The causes of the divergence in the economic development of Poland and Ukraine have been analysed in the literature from various perspectives. It is emphasised that the pace of restructuring of the economy and delays in institutional changes are the main reasons for the economic divergence between Poland and Ukraine (Åslund, 2013; Hartwell, 2016; Smits et al., 2019; IMF, 2021). Low investments are also a factor contributing to this divergence. Arii and Pula (2021) underline that investment in Ukraine is held back not only by the lack of strong, independent institutions but by regulated and often state or oligarch monopolised markets. Other factors that influenced the divergence of Poland and Ukraine's economic development are differences in (i) efficiency and effectiveness of financial systems (Rushchyshyn et al., 2021), (ii) R&D expenditures (Baszczak, 2020), (iii) economic, political, and geopolitical stability (Sutela, 2012; Wisła et al., 2020), and (iv) demographic trends (Smits et al., 2019; Vakhitova, Fihel, 2020). Another perspective in the literature emphasises the role of Poland's accession to the EU in the accelerated economic development of Poland (Belka, 2013; Bartz, 2015).

The paper aims to analyse the phenomenon of economic divergence between Poland and Ukraine from the perspective of the dynamics of the balances of payments. It is assumed that the differences in the paths of economic development will be reflected in current and financial flows, which are recorded in the balance of payments of both countries. The hypothesis, which is examined with the use of the econometric method, assumes a greater external openness of the Polish economy that significantly contributed to the increasing economic divergence between the two countries. The model for testing the potential determinants of the economic divergence between Poland and Ukraine resulting from their balances of payments was based on univariate linear regressions. The study was carried out based on the annual data collected from the World Bank (WDI, http) for the period 1995–2021.

The structure of the paper is as follows: After the introduction, Section 2 reviews the literature on the determinants of the economic divergence between Poland and Ukraine, then an analysis of the balances of payments of both countries is presented in the context of their different development paths, while Section 4 presents the results of the econometric studies, and Section 5 provides conclusions.

Causes of economic divergence between Poland and Ukraine – literature review

The reasons for the divergence between Poland's and Ukraine's economic activities have been the subject of many analyses. At the time of the collapse of centrally planned economy, Poland and Ukraine were characterised by a similar level of economic development, measured by GDP or GDP per capita, but there were **significant differences between Poland and Ukraine**. Ukraine is more richly endowed in terms of natural resources, climate, and soil. It had a better industrial base and far lesser foreign debt. However, Ukraine was directly under Soviet rule for much longer than Poland, which helped maintain Poland's individuality and some economic and political independence (Baszczak, 2020). For example, agriculture in Poland was less collectivised than in Ukraine, and Polish foreign trade was less dependent on the Russian market. In 1992, only 7 percent of Polish trade was related to Russia compared to over 40 percent in the case of Ukraine in 1994 (Tilford, 2019). An energy-inefficient economy was also a legacy of the past. Ukraine grew dependent on oil and gas imports from Russia[3] and remained one of the most energy-inefficient economies in the world (Sutela, 2012). Unlike Poland, Ukraine did not have its own currency or central bank. The heritage of the Soviet system also included the destruction of social capital (Kowalski, Shahmurove, 2018). Although the countries differed in many aspects at the beginning of the collapse of the Soviet system, these differences do not explain the later economic divergence between Poland and Ukraine.

The pace of restructuring the economy from centrally planned to a market economy in Poland and Ukraine is often presented as an example of the two extremes (Åslund, 2013). Poland introduced its market reforms very quickly at the end of 1989 through the beginning of 1990. Their goal was to increase the competitiveness (marketisation) of the economy through, inter alia, acceleration of privatisation, deregulation of economic activities, and opening to foreign goods and investors. Despite the economic downturn in the initial period, Poland had already returned to economic growth by the third year of its transition, i.e. in 1992. In contrast, Ukraine avoided radical reforms in the early years in favour of "fire fighting" against continuous political and macroeconomic crises (Hartwell, 2014). The reforms in Ukraine have been delayed (Smits et al., 2019), beginning on a larger scale in 1994/1995 when Ukraine managed, e.g., to cut state subsidies and liberalise prices, exchange rates, and trade. Gradual reforms were accompanied by ten years of economic decline. The reforms accelerated after 1998 when the economic imbalances were reinforced by the Russian financial crisis. Ukraine and

[3] On the other hand, Ukraine's strong position in gas transit to Europe could provide some bargaining power regarding transit fees (Sutela, 2012).

other former Soviet republics had to complete economic reforms in the neoliberal spirit (Åslund, 2009).

The economic divergence between Poland and Ukraine is often analysed from the perspective of their **institutions**. Economic liberalisation in Poland, unlike in Ukraine, was accompanied by the creation of new, effective market institutions (Bilenko, 2013). However, the economic model in Ukraine has made it possible for several regional oligarch groups to accumulate business, mass media, and political power (Lukanienko, 2013). This had some consequences in creating a poor institutional environment in the economy. Hartwell (2016) emphasises that institutions, and, more specifically, the evolution or neglect of particular institutions needed for a market economy, explain the economic divergence between Ukraine and Poland. For example, Ukrainian problems with the protection of property rights are undermined by a high level of corruption and a weak judicial system (Arii, Pula, 2001; Sutela, 2012). Even though the institutional reforms were enforced in recent years, according to the IMF (2021), they still lacked independent, transparent, and accountable institutions to contribute to the sustainability of Ukraine's advancements in anti-corruption and rule of law.

The lack of strong and independent institutions was accompanied by **low investment rates**[4]. In the 1995–2020 period, Ukraine's investment to GDP rates averaged at 20.0% and were below the average of Poland (21.3%). Arii and Pula (2021) underline that investment in Ukraine is held back by the lack of strong, independent institutions, lack of competition, and regulated and frequently monopolised markets by the state or oligarchs. This contributes to the misallocation of resources, does not create incentives to accumulate capital or attract foreign investment, and reorients exports away from commodities. According to EBA (2020), the top-five most important impediments to foreign investment are: (i) lack of trust in the judiciary, (ii) widespread corruption, (iii) monopolisation of markets and state capture by oligarchs, (iv) cumbersome and frequently changing legislation, and (v) oppressive law enforcement agencies. An effective fight against corruption was viewed as a top priority for improving the investment climate by all investors, followed by a relaunch of the judiciary and the appointment of credible reformers to top positions. According to Smits *et al*. (2019), the reasons for low investments in Ukraine are (i) low levels of FDIs, (ii) debt overhang discouraging capital formation, and (iii) large public sector imbalances that crowd out and divert limited resources.

Another factor that contributed to the divergence between the Polish and the Ukrainian economies was the **higher stability of the Polish economy**. Mykhenko

[4] Part of the difference between the investment rates in Poland and Ukraine, and the other countries of the region, can also be explained by the sectorial structure of these economies (Wisła et al., 2020).

(2007) notices greater success in achieving relatively low fluctuations in the level of prices and the exchange rate in Poland. Along with the **political and geopolitical instability** that often happened in Ukraine, it was a factor holding back domestic and foreign investment in Ukraine (Setula, 2012).

An important condition influencing economic growth, apart from access to capital accumulation, is productivity. The innovative potential of the economy in Ukraine, as measured by **R&D investment expenditure**, is deteriorating. Research and development expenditure (% of GDP) in Ukraine was higher than 1% until 2005 but it successively decreased to just 0.47% in 2018. Poland saw the opposite trend. Polish R&D investment expenditure increased from 0.5–0.6% to 1.2% in that period. Based on this data, some researchers see the fading potential of technological progress and growth in productivity as one of the factors contributing to the weaker development of the Ukrainian economy (Sutela, 2012; Wisła et al., 2020; Baszczak, 2020).

Rushchyshyn *et al.* (2021) show that Ukrainian economic convergence also depends on the **efficiency and effectiveness of its financial system**, in particular the banking sector. The results obtained in their research confirmed the large discrepancy in the development of Ukraine's banking sector and that of Poland. Chugaievska *et al.* (2020) emphasise the role of the capital market to mobilise savings and channel them into investments. The capital market was also significantly more involved in the process of the ownership transformation of the economy in Poland. Research by Mykhnenko (2007) confirms that the level of development of the financial system in Ukraine, as measured e.g. by the sum of domestic assets of commercial banks to GDP, and stock market capitalisation to GDP, was lower as compared to Poland.

Bartz (2015) highlights that Poland owes a significant portion of its economic success to its process of approaching the EU. Greater stability in Poland was achieved through costly reforms that preceded **Poland's accession to the EU** on May 1, 2004. Poland has also achieved considerable financial flows that stabilised the currency market and changed the infrastructure. The Polish EU accession also meant access to the labour, capital, and goods markets. This contributed to the inflow of FDI to Poland and a significant increase in trade with the European Union. Unlike Poland, Ukraine has faced an anti-dumping policy and protectionism from the European Union. Western European countries were afraid to enter into competition with cheaper products from Ukraine, which was a big producer of agricultural products and steel (Bartz, 2015). As a result, while Poland increased its political and economic ties with Western Europe, Ukraine was still doomed to cooperate on a larger scale with the countries of the former Soviet Union. Apart from EU membership, Poland is also a member of the North Atlantic Treaty Organization, which to a large extent frees Poland from problems related to **military security**. Over the last 25 years, Poland has spent 2% of GDP

on defence per annum, on average. Ukraine maintained a similar level of spending until 2014, but along with Russia's annexation of Crimea and the fight against pro-Russian separatists in eastern Ukraine was forced to divert its resources towards the military and enlarged its military spending up to almost 4% in recent years.

The **worsening demographics**, i.e. the shrinking of population and population ageing, has a profound impact on economic growth in Ukraine (World Bank, 2019). A sharp decline in the birth rate and a huge net migration outflow have also decreased the domestic labour supply. Similar demographic processes could also be observed in Poland, especially at the time of Poland's accession to the European Union when extreme immigration liberalisation occurred. However, in recent years, we could see a transition from the trend of emigration to immigration to Poland, with Ukraine being the largest country of immigrants to Poland (Vakhitova, Fihel, 2020). The declining population results in a decline in the human capital wealth of Ukraine. One must remember, however, that human capital wealth, apart from the population size, is also a function of a population's skills, knowledge, experience, habits, and health. Human capital understood in this way is the most important resource for sustainable economic growth (Smits et al., 2019). Ukraine is worse than Poland in the statistics in many fields here, e.g. in health care and patent applications.

Poland's and Ukraine's development paths in their balances of payments

A balance of payments is a record of all current and financial transactions carried out between residents of a given country and non-residents. Current transactions include foreign trade transactions (in goods – TB, and services – SB), income associated with the production process and property income (primary income – PI), and current transfers between residents and non-residents (secondary income – SI). A capital account records transfers detailing acquisition or disposal of an asset, in which the ownership of an asset is transferred or liability is forgiven to the creditor. A financial account shows the acquisition and disposal of financial assets and liabilities. Two categories of financial transactions are classified by type of investment: foreign direct investment (cross-border investment associated with control or significant influence over the enterprise) and portfolio investment (cross-border transactions involving debt and equity securities which are not classified as FDI). Financial instruments aimed at risk transfer are included in financial derivatives and employee stock options. Foreign reserves record central bank transactions and other investments and comprise all financial transactions other than those included in FDI, portfolio investment, financial derivatives, and foreign reserves.

The concept of the balance of payments is based on accounting principles, according to which each credit entry has an opposite debit entry. Consequently, the balance of payments must always be balanced:

$$CA + CPA + EO = FA \tag{1}$$

where CA is the current account, CPA – capital account, EO – errors and omissions, and FA – financial account.

In turn, the current account and the financial account are expressed as:

$$CA = TB + SB + PI + SI \tag{2}$$

$$FA = FDI + POI + OI + DER + RES \tag{3}$$

where TB denotes the trade account, SB – service account, PI – primary income, SI – secondary income, FDI – foreign direct investment, POI – portfolio investment, OI – other investment, DER – derivatives, and R – foreign reserves[5].

Table 1 shows the development of the balances of payments of Poland and Ukraine in 1995–2021[6] and four sub-periods: (i) 1995–2000, (ii) 2001–2008, (iii) 2009–2014, and (iv) 2015–2021. The values for the individual periods are cumulative and measured in billions of current US dollars.

Table 1. Balances of payments of Poland and Ukraine in 1995–2021 (USD bln)

	UKRAINE					POLAND				
	1995–2000	2001–2008	2009–2014	2015–2021	1995–2021	1995–2000	2001–2008	2009–2014	2015–2021	1995–2021
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
CA	-2.0	-2.8	-50.4	-8.2	**-63.4**	-37.9	-121.4	-117.4	-2.1	**-278.8**
TB	-14.3	-35.4	-84.1	-60.4	**-194.1**	-59.1	-110.7	-71.7	11.1	**-230.4**
SB	12.5	19.2	33.4	14.3	**79.4**	24.0	26.3	54.5	157.6	**262.4**
PI	-4.3	-7.4	-15.8	8.1	**-19.4**	-13.9	-47.1	-98.6	-157.8	**-317.4**
SI	4.2	20.8	16.0	29.7	**70.7**	11.1	10.1	-1.7	-12.9	**6.6**
CAP	0.0	0.1	1.3	0.6	**2.0**	0.6	15.2	61.9	71.7	**149.4**
EO	-2.5	-1.5	4.0	4.7	**4.7**	3.4	-2.5	-47.1	-38.3	**-84.5**
X+M	203.0	558.2	725.9	673.1	**2,160.2**	457.3	1,549.3	2,190.1	3,454.7	**7,651.4**

[5] Detailed definitions of the individual components of the balance of payments are included in IMF (2009).

[6] The choice of the analysis period is determined by the availability of data for both countries. Although WDI has provided data for both countries since 1994, the year 1994 was omitted from further analysis due to debt forgiveness in Poland, which made it difficult to compare the balance of payments in both countries this year.

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
	UKRAINE					POLAND				
	1995–2000	2001–2008	2009–2014	2015–2021	1995–2021	1995–2000	2001–2008	2009–2014	2015–2021	1995–2021
FA	-4.4	-4.2	-45.2	-2.9	**-56.7**	-33.9	-108.7	-102.6	31.3	**-213.9**
FDI	-3.2	-37.0	-29.0	-23.9	**-93.1**	-35.5	-70.6	-53.8	-87.2	**-247.2**
FDIA	0.1	1.9	3.0	2.0	**6.9**	0.7	30.5	25.0	43.5	**99.7**
FDIL	3.2	38.9	32.0	25.9	**100.0**	36.2	101.1	78.9	130.7	**346.9**
POI	-1.9	-14.0	-15.2	-9.9	**-41.0**	-8.8	-15.8	-79.1	29.4	**-74.2**
OI+	6.2	19.6	23.5	12.1	**61.5**	-13.0	-46.2	-18.2	18.0	**-59.4**
RES	-5.6	27.2	-24.6	18.8	**15.8**	23.4	23.9	48.5	71.1	**166.9**

OI+ – other investment plus derivatives

Source: own elaboration based on WDI (http).

The analysis of the data contained in Table 1 shows that there are some significant differences in the balances of payments of Poland and Ukraine, which say a lot about their paths of economic development.

Exports and imports. The foreign trade turnover in Poland (USD 7,651 bln) proves greater openness of Poland's economy and its ability to compete on international markets, especially in the European Union. In the case of Ukraine, the values of exports and imports were lower (USD 2,160 bln) and more volatile due to its structure, greater share of the former Soviet Union countries, and greater sensitivity to price changes on world markets.

Two periods are of great importance in the comparative analysis of the foreign trade between Poland and Ukraine. First, the period in which Poland's accession to the European Union took place was characterised by a sharp increase in Polish foreign trade. In 2001–2008, Polish exports and imports were three times higher than the exports and imports of Ukraine. Second, in the period of increased geopolitical risk as a result of Russia's annexation of Crimea and the beginning of an armed conflict in the Donbas, Ukraine's foreign trade turnover decreased, while in Poland, foreign trade was developing very fast. As a result, in 2015–2021, the foreign trade turnover in Poland was five times higher than in Ukraine.

When analysing the dynamics of foreign trade in Poland and Ukraine, attention should also be paid to their balances of goods and services. Despite some similarities in the aggregate values for 1995–2021 (surpluses in the services accounts and deficits in the trade accounts in both countries), it is worth paying attention to (i) improving foreign trade balances in Poland after the outbreak of

the global financial crisis, and (ii) cumulative surplus in the balance of goods and services in Poland for the whole period (USD 42 bln) as opposed to Ukraine (USD -114.7 bln). These trends are clearly visible in Figure 3, where the dynamics of all components of the Polish and Ukrainian current accounts in relation to their GDPs are presented.

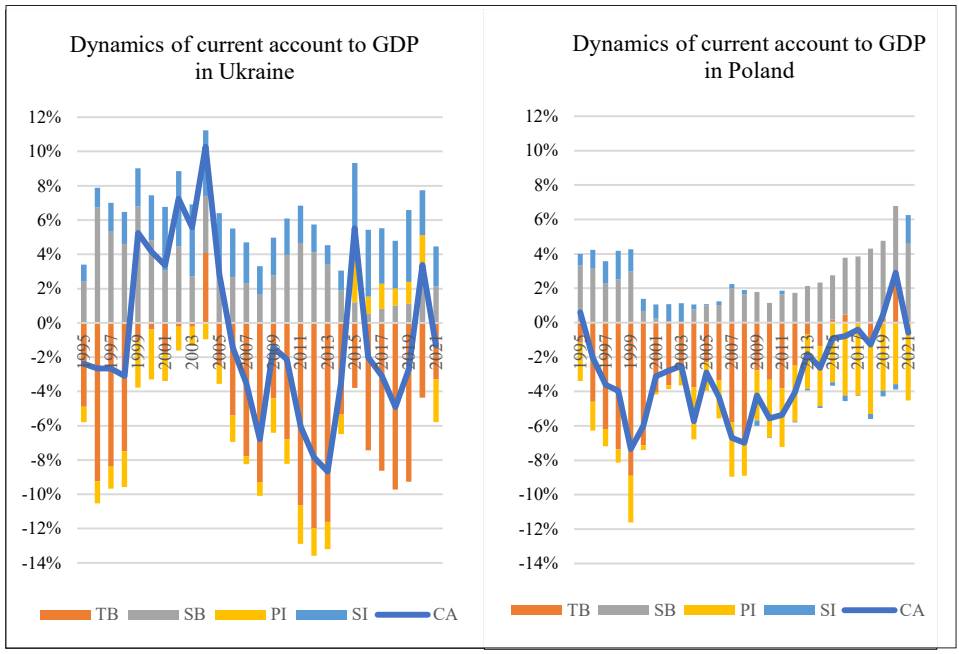

Figure 3. Dynamics of current accounts in relation to GDP in Poland and Ukraine in 1995–2021

Source: own elaboration based on WDI (http).

Primary account. Poland's primary income was negative and was decreasing throughout the entire period. Net income paid to non-residents amounted to USD -317.4 bln and was more than 16 times higher than in Ukraine. What is more, the primary income in Ukraine shifted even to a surplus in 2015–2021. This was largely due to a significant decrease in dividend and interest outflows as a result of a ban on dividend repatriation and the currency crises starting in late 2014 (Balabushko et al., 2017). The primary income is largely a function of the international investment position (IIP) which reflects the accumulated value of resident-owned foreign assets and residents' liabilities to residents of other countries. Table 2 shows the IIPs of Poland and Ukraine at the end of 2021. The net international investment position of Poland was negative at USD -257 bln, whereas in Ukraine, it was only USD -24.6 bln.

Table 2. International investment positions of Poland and Ukraine at the end of 2021 (USD bln)

2021	Poland	Ukraine
Net foreign assets	**378.860**	**159.099**
FDI – Assets	79.922	3.885
Reserves	166.049	30.941
Net foreign liabilities	**636.308**	**183.710**
FDI – Liabilities	322.682	68.343
Net International Investment Position	**-257.448**	**-24.611**

Source: own elaboration based on WDI (http).

Secondary account. For Ukraine, transfers from abroad have become the primary source of external capital, especially since the beginning of the Russian aggression against Ukraine in 2014. The cumulative inflows of transfers in 1995–2021 was USD 70.7 bln but only in 2015–2021 it was USD 29.7 bln. In the case of Poland, although the accumulated value of secondary accounts is positive, this account shows a constant deficit in recent years. Higher current transfers of the government sector related to settlements with the European Union are mainly responsible for the change in the trend.

Capital account. The aggregate balances of the capital account in Poland amounted to USD 149.4 bln against only USD 2 bln in Ukraine. The capital account in Poland was dominated by transfers of funds from the EU related to the acquisition and disposal of non-produced and non-financial assets (Andrzejczak, 2019). The EU funds recorded in the capital account finance investments into roads, highways, bridges, schools, hospitals, etc. (NBP, 2018).

Financial flows. Foreign capital was flowing into Poland in greater amounts than into Ukraine, especially until 2014. The cumulative balance of the financial accounts in 1995–2014 in Poland amounted to USD -245.2 bln, while in Ukraine it was USD -59.6 bln. The lower inflow of investments into Ukraine in 2015–2021 was related mainly to the increased geopolitical risk and a weaker economic situation in that country. In Poland, in turn, as a result of a significant improvement in the current account balances in parallel with the inflows of EU funds, the financial account switched to a positive balance (a total of USD 31.3 bln). However, the main Polish investor investing abroad was the National Bank of Poland (NBP), which invested its foreign currency reserves. The dynamics and directions of the financial flows in Ukraine and Poland versus the behaviour of their current accounts are shown in Figure 4.

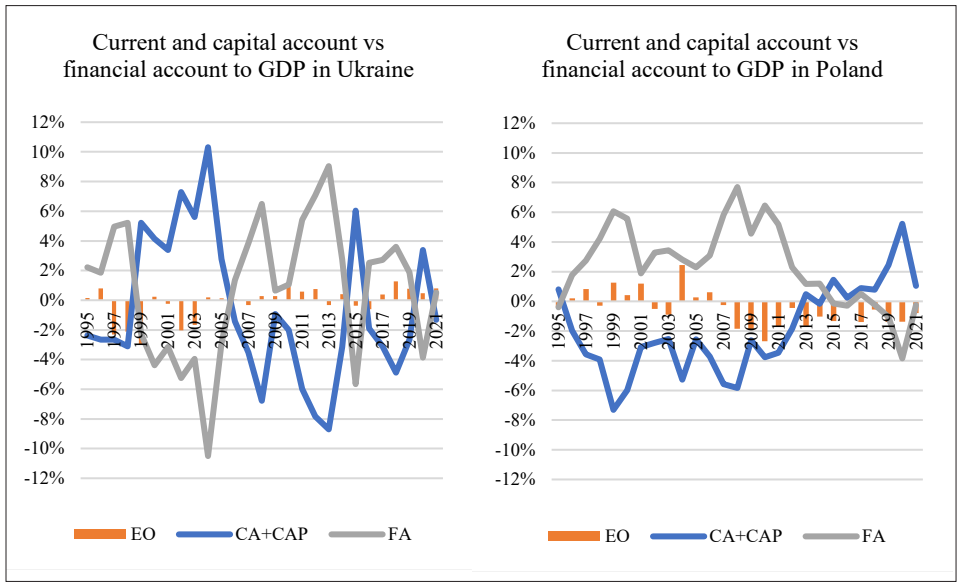

Figure 4. Dynamics of current and capital account vs financial account in Poland and Ukraine in 1995–2021

Source: own elaboration based on WDI (http).

Foreign direct investments. FDIs played a greater role in Poland than in Ukraine. The FDI account prevailed in the structure of the Polish financial account. The net balance of FDI cumulated in 1995–2021 amounted to USD 247.2 bln in Poland, compared to USD -93.1 bln in Ukraine. The cumulative value of FDI liabilities (a proxy for FDI inflows) in Poland reached USD 346.9 bln, whereas in Ukraine it was USD 100 bln; more than three times less. While the investments of Ukrainian residents were insignificant (the cumulative balance of FDI assets – a proxy for FDI outflows, was USD 6.9 bln in 1995–2021), Polish residents invested USD 99.7 bln abroad in the same period. The differences in the scale of FDI investments in both countries are confirmed by the data from the International Investment Position presented in Table 2.

In the analysis of the FDI dynamics, the phase of the transformation process (1995–2000) is particularly noteworthy, where the cumulative FDI inflows to Ukraine amounted to only USD 3.2 bln. In Poland, it was nearly 12 times more (USD 36.2 bln). Capital in the form of FDI began to flow into Ukraine in a wider stream in the years 2001–2008. However, most FDI went to closed-sector services such as retail trade and finance, and real estate, which suffered heavy losses during the Global Financial Crises[7]. A higher geopolitical risk

[7] In 2009, there was a sharp recession in Ukraine. GDP fell then by nearly 15%.

and economic slowdown[8] further enhanced by the depreciation of the hryvnia (UAH) chilled foreign investments in 2015–2020. In Poland at that time, investments were flowing in a wide stream. In 2015–2020, the inflow of direct investments to Poland amounted to USD 130.7 bln, while in Ukraine it was only USD 25.9 bln.

Portfolio investments and other investments, in which debt investments predominate, are often called "hot money" due to their often short-term nature and greater volatility. They played a smaller, but also different role than FDI in the financial account in both countries. In Poland, the accumulated portfolio investments and other investment accounts totalled USD -133.6 bln. In 2015–2021, both portfolio investments and other investment accounts had surpluses related to a large extent to non-resident divestments in Poland. In Ukraine, non-resident portfolio investments flowed generally throughout the entire period (except for periods of increased tensions in the Ukrainian economy, such as in 2008 and 2014), largely financing state budget deficits. Other investments, mostly including deposits, loans, and credits, behaved in the opposite way, outflowing from Ukraine practically throughout the entire analysed period (exceptions are 2007–2008, 2013, and 2017–2018). Table 2 confirms that for Poland net foreign liabilities consist mainly of FDI (USD 322.7 bn). In Ukraine, however, most of them are less stable portfolio and other investments. As a result, Ukraine's economy is much more vulnerable to changes in market sentiment.

Foreign reserves. At the end of 2021, Poland's foreign reserves amounted to USD 166 bln, while in Ukraine it was USD 30.9 bln. As a result of the stable inflows of capital to Poland, largely in the form of EU transfers and FDI, the Polish central bank was gradually increasing its foreign reserves, which stabilised the economy and, in particular, made it possible to control the exchange rate risk. This could be seen at times of greater pressure on the depreciation of the zloty (e.g. in 2001 and 2008), when the NBP was forced to intervene in the exchange market for a short time, resulting in a reduction in its foreign reserves.

In Ukraine, the balance of foreign exchange reserves was unstable. The largest value of Ukraine's foreign exchange reserves was in August 2008 (USD 37.3 bln). In 2021, it was USD 6.4 bln less. Given the frequent UAH crises, foreign exchange reserves were used more often and on a larger scale by the Ukrainian Central Bank than by the NBP to intervene in the forex market. For example, in 2008–2009, the hryvnia weakened by 60%, and, due to high external indebtedness, the National Bank of Ukraine spent 36% of its foreign reserves to support its currency. Against the depletion of its foreign reserves, Ukraine was forced to request exceptional access to financing from the IMF.

[8] GDP in Ukraine fell cumulative by 16% in 2014–2015.

Economic divergence between Poland and Ukraine and the dynamics of their balances of payments – econometric research

This part of the paper presents the results of econometric research, the aim of which was to identify the correlation between the dynamics of the balances of payments and the economic divergence between Poland and Ukraine. The study was carried out based on the annual data collected from the World Bank (WDI) for the period 1995–2001.

The model for testing the potential determinants of economic divergence between Poland and Ukraine resulting from their balances of payments is based on univariate linear regressions measuring the relationship between a dependent variable representing differences in GDP measured in current USD between Poland and Ukraine, and one independent variable taken from a set of components of the balance of payments. Given the dataset of dependent variables, y_i, and the explanatory variables, x_i, the model applied is a simple linear regression.

$$y_i = \alpha + \beta x_i + \varepsilon_i \tag{4}$$

where ε_i is the random component of the regression and x_i represents a dataset of *i* independent variables which are the components of the balance of payments according to Formulas (2–3). The ordinary least squares method (OLS) was taken to estimate the parameters α (the constant term) and β (the coefficient term). The regression results are presented in Table 3. First, the estimated coefficients are depicted, second, *T*-statistic to test that a coefficient is equal to zero is shown in brackets, and next, *P*-values which are evidence to reject the hypothesis of a zero coefficient are marked with asterisks depending on the significance level (*** – $p<0.01$, ** – $p<0.05$, * – $p<0.10$).

Table 3. Regression results

Independent variables	β Coefficients
1	*2*
CA/PL – CA/UKR	**2.716 (1.073)**
X+M/PL – X+M/UKR	**0.839 (21.580)** ***
TB/PL – TB/UKR	**7.293 (3.819)** ***
SB/PL – SB/UKR	**10.957 (6.462)** ***
PI/PL – PI/UKR	**-12.983 (-16.494)** ***
SI/PL – SI/UKR	**-38.304 (-9.967)** ***
CAP/PL – CA/PUKR	**22.345 (11.361)** ***

1	*2*
FA/PL – FA/UKR	2.839 (1.319)
FDI/PL – FDI/UKR	-7.073 (-1.603)
FDIA/PL – FDIA/UKR	**16.584 (3.05)** ***
FDIL/PL – FDIL/UKR	**10.575 (3.379)*** **
POI/PL – POI/UKR	2.642 (1.001)
OI+PL – OI+UKR	0.031 (0.013)
RES/PL – RES/UKR	4.637 (1.649)
n	27

Source: own elaboration.

The regression analysis generally confirms the observations made in the third section. There is a significant relationship between the size of the economic divergence between Poland and Ukraine and the openness of the economy described by the sum of exports and imports. All components of the current account are also highly significant at 1%. The increasing differences in the trade and services balances between Poland and Ukraine favoured the increasing economic divergence between these countries. In turn, the differences in primary and secondary accounts between both countries were negatively correlated with the level of divergence between Poland and Ukraine. This confirms previous observations that the greater differences between the GDP of Poland and Ukraine occurred despite the deteriorating primary account in Poland and despite the large inflows of current transfers recorded in the secondary account in Ukraine. The inflow of EU transfers into Poland recorded on the capital account is also statistically significant. It accompanies the increasing economic divergence between Poland and Ukraine. As for the inflow of foreign capital, which is recorded in the financial account of the balance of payments, attention should be paid to the statistical significance of the direct investment flows and, in general, the insignificance of other financial account balances. The higher economic divergence between Poland and Ukraine is accompanied by a higher difference in FDI flowing to these countries, but also by a growing disproportion in FDI by Polish and Ukrainian residents abroad.

CONCLUSION

Since the collapse of the Soviet Union, the two neighbouring countries have been developing in two different ways. The Polish economy has become more export- and foreign investment-oriented. Foreign capital was used as leverage for

development, supplementing insufficient domestic savings with foreign savings, which resulted in an increase in domestic investments. The majority of FDI was directed to export-oriented industries and Poland has become a kind of production platform for exports. As a consequence, Poland achieved more sustainable development, but at the cost of a higher dependence on foreign investors. The Polish development path is presented in Figure 5 and is very visible in the balance of payments. It is characterised by (i) an increasing value of exports and imports (X+M), (ii) an improving balance of trade in goods and services (TB, SB), (iii) relatively large capital account surpluses in which EU transfers allocated to infrastructure are recorded (CAP), (iv) a growing inflow of foreign capital mainly in the form of FDIs (FDI), and (v) practically constantly growing foreign exchange reserves (RES). A consequence of the adopted development path is an increase in foreign liabilities and the deteriorating primary account (PI). However, this is not a significant problem concerning the external stability of the Polish economy, as long as the primary income is largely related to dividends and retained profits of foreign FDI companies that have invested in Poland, of which a very large number are export-oriented.

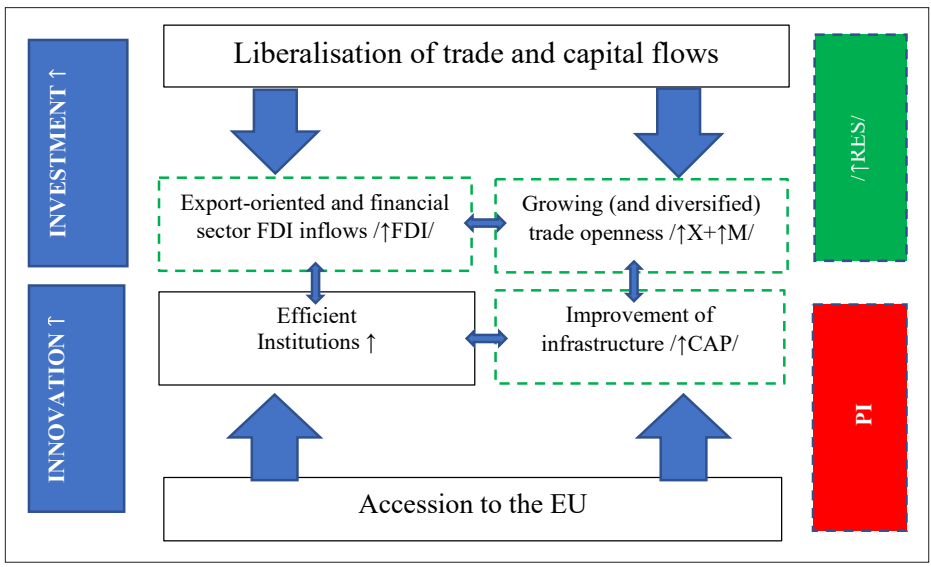

Figure 5. Poland's development strategy

Source: own elaboration.

The shock that hit Ukraine with the escalation of the war in 2022 offers an opportunity for political and social consent to broad reforms and greater ties with foreign capital. There is no need to invent a new recipe for success. Ukraine can, in principle, follow the Polish economic path.

First, the strategy for development in Ukraine should be based more on FDIs which should facilitate modernisation of its economy[9]. Unlike Poland, in the past, Ukraine relied more on short-term capital flows (POI) which were increasing the frequently unsustainable public and private consumption. FDIs should improve access to capital, supplementing limited domestic savings and leading to increasing investment[10]. The oligarchic- and state-favoured non-market structure of the economy can also be counterbalanced by an economy more exposed to foreign competition and investment.

Second, sustainable growth, which has seen a high growth rate over a long period, also needs an institutional umbrella and preparation for accession to the EU. The European Union should be a particularly important economic partner for Ukraine. Previous attempts to strengthen ties with the EU led to a Russian-Ukrainian trade and energy war, and then military aggression against Ukraine. Let us hope that this time, after the war with Russia, Ukraine will take advantage of the geopolitical situation and the sympathy of the entire democratic world, and will strengthen ties with the European Union[11], and then repeat Poland's economic success which took place with the significant support of foreign capital.

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[9] Apart from external factors on which Ukraine has a limited influence, i.e. geopolitical situations, an increase in capital and trade flows is also only possible if certain internal conditions are met. With the exception of the media, foreign capital in Ukraine is more restricted than in Poland (Smits et al., 2019). Lowering the restrictions on foreign capital would contribute to a greater opening of the large consumer market in Ukraine, and also to an increase in competitiveness.

[10] More on the potential economic impact of FDI on Ukraine: (Saha et al., 2018).

[11] Ukraine's integration with the EU has many advocates both in Ukraine and abroad. A few days after Russia invaded Ukraine in 2022, Ukraine applied for EU membership. In June, 2022, the European Council granted Ukraine the status of a candidate for the European Union accession.

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Summary

The paper aims to look at the phenomenon of the economic divergence between Poland and Ukraine from the perspective of the dynamics of the balances of payments in both countries. It is assumed that the differences in the paths of economic development are reflected in the current and financial flows, which are recorded in their balances of payments.

The model for testing the potential determinants of economic divergence between Poland and Ukraine resulting from their balances of payments was based on univariate linear regressions. The study was carried out based on the annual data collected from the World Bank (WDI) for the period 1995–2001.

A significant positive relationship between the dynamics of the economic divergence between Poland and Ukraine was found in the dynamics of (i) trade openness, (ii) trade and services balances, (iii) capital transfers, (iv) FDI liabilities – a proxy for FDI inflows, and (v) FDI assets – a proxy for direct investments carried out by residents. The dynamics of the differences in the primary and

secondary accounts between both countries were negatively correlated with the level of divergence between Poland and Ukraine. The larger differences between the GDPs of Poland and Ukraine occurred despite the deteriorating primary account in Poland and despite the large inflows of current transfers recorded in the secondary account in Ukraine.

Keywords: Poland-Ukraine economic divergence, economic growth of Poland and Ukraine, balance of payments, FDI.

Dywergencja gospodarcza Polski i Ukrainy z perspektywy ich bilansów płatniczych

Streszczenie

Artykuł ma na celu analizę zjawiska dywergencji gospodarczej Polski i Ukrainy z perspektywy dynamiki bilansów płatniczych obu krajów. W artykule zakłada się, że różnice w ścieżkach rozwoju gospodarczego znajdują odzwierciedlenie w przepływach bieżących i finansowych, które są rejestrowane w bilansach płatniczych.

Testowanie potencjalnych determinant dywergencji gospodarczej pomiędzy Polską a Ukrainą wynikających z ich bilansów płatniczych zostało oparte na jednowymiarowych regresjach liniowych. Badanie przeprowadzono na podstawie rocznych danych pozyskanych z Banku Światowego (WDI) za lata 1995–2001.

Stwierdzono istotny pozytywny związek między dynamiką dywergencji gospodarczej między Polską a Ukrainą a dynamiką (i) otwartości handlowej, (ii) sald handlu i usług, (iii) transferów kapitałowych, (iv) zobowiązań z tytułu bezpośrednich inwestycji zagranicznych oraz (v) aktywów z tytułu bezpośrednich inwestycji zagranicznych. Dynamika różnic w rachunkach pierwotnych i wtórnych między obydwoma krajami była z kolei ujemnie skorelowana z poziomem dywergencji między Polską a Ukrainą. Większe różnice między PKB Polski i Ukrainy wystąpiły pomimo pogarszającego się stanu rachunku pierwotnego w Polsce i pomimo dużego napływu transferów bieżących odnotowanych na rachunku wtórnym na Ukrainie.

Słowa kluczowe: dywergencja ekonomiczna pomiędzy Polską i Ukrainą, wzrost gospodarczy Polski i Ukrainy, bilans płatniczy, inwestycje bezpośrednie.

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Russian military aggression as a challenge for Ukraine's agriculture

Introduction

The purpose of this paper is to present the main results of the conducted research on identified challenges to the agriculture of Ukraine caused by the aggressive military Russian invasion, and the economic assessment of the possibilities of overcoming them. As the main hypothesis of the conducted research, there is an assumption that the scale of the challenges and real consequences of the mentioned aggression are staggering and unique in size and significance, but the actions that are foreseen and already aimed at overcoming them are fully justified and have an appropriate financial support. The main motive for writing this paper is the difficult state of agriculture in Ukraine, caused by the military actions of the Russian invaders pursuing geopolitical and economic goals, and objectively high relevance of these issues, which are caused by the reality and scale of military actions taking place in Ukraine and have objectively vitally important consequences for the whole world.

The research methodology was based on the implementation of a dialectical approach, in which the method of historical-logical unity was used in the study of socio-economic phenomena in combination with the methods of analysis and synthesis, scientific abstraction, induction, systematisation and generalisation.

The results of expert assessments by relevant specialists and the author's own observations made during the war were used as sources of information. The results of the assessment of the damages and losses caused to Ukraine by Russia and of the corresponding needs of Ukraine to deal with the consequences, obtained by the World Bank, the Government of Ukraine and the European Commission based

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on the use of the Damage and Loss Assessment (DaLA) methodology, were also processed.

The study includes an introduction with the justification of the expediency of its publication, a short review of the literature in the context of the study with a theoretical justification of its topic, the research methods, the main results, their interpretation and conclusions, as well as the summary.

Literature review

The issues of the challenges and threats facing Ukraine at the beginning of the 21st century are discussed in the literature, and at numerous forums at the intergovernmental, diplomatic, and scientific levels. Understanding their depth and acuteness requires an awareness of the fundamental theoretical developments that relate to the functioning of civilisations, their changes, and the challenges they face as discussed, in particular, in the publications of Arnold J. Toynbee (1889–1975), a British historian, philosopher, cultural scientist and sociologist, and specifically, in his 12-volume work "A Study of History", (1934–1961). A. Toynbee believes that any society is a complex and dynamic formation of an evolutionary type. Its development is conditioned by internal factors and external conditions. The development of a society depends on a combination of factors and conditions that act as a "challenge" ordering an appropriate "response". If the response is successful, the society acquires a new quality. If it is inadequate, the society stops developing and may perish (Toynbee, 2019). By "challenge", Toynbee meant some unpredictable factor or event that posed a threat to the ways in which a group of people had made their livelihood in the past. A challenge could arise as the result of many things – population growth, exhaustion of a vital resource, or climate change (Schmandt, Ward, 2000). That is, we are talking about the fact that by responding to the challenge, the society solves the task set before it and thereby transforms itself into a higher, more perfect state (Brylo, 2014, pp. 397–398). This is especially relevant in the case of the present day challenge of war waged by Russia on Ukraine. The Ukrainian society, with the support of the civilised world community, gives a worthy rebuff to the aggressors. As is written in the Bible: 'Then Jesus said to him, "Put your sword back into its place. For all who take the sword will perish by the sword"' (From Matthew 26:52).

In this regard, there are reasons to categorically disagree with the interpretation of the essence of the challenge by L. Kalashnikova (2017, pp. 19–20) or A. Kravchuk (2016, p. 71), according to which the challenge is a certain set of factors that do not pose a threat, and the challenge represents a minimal risk and is characterised by an imaginary readiness to harm a security object (Kalashnikova, 2017,

pp. 19–20). The real state of affairs testifies an extremely high degree of threat and danger of a modern military challenge for Ukraine, up to the complete destruction of the country. For the same reason, the legitimacy of the interpretation of the challenge in the approach of I. Boyko (2017, p. 96), according to whom challenges do not create factors that can affect the state of economic security, is questionable. Reasoning in this way, "uncertainty", "challenge", "threat", "danger", and "risk" are different things (Kalashnikova, 2017; Boyko, 2017; Kravchuk, 2016), and may take place at the level of security theory, but the practice of today's war shows that we are dealing with a situation where both "uncertainty" and "challenge", and "threat", "danger" and "risk" appear simultaneously, on the basis of "all in one". For more than 10 months, Ukrainians have constantly felt the danger of this challenge directly, as well as of the threats it contains, and are almost constantly at risk of being killed by Russian missiles or drones at any time, regardless of whether it is about "uncertainty" or "threat", etc. Therefore, V. Kravchenko's point of view of makes a certain amount of sense, where a challenge is a problematic situation, the solution of which depends on further functioning, the very existence of the society and of the state (Kravchenko, 2016).

In the context of modern challenges in Ukraine, the provisions on the peaceful coexistence of various political and economic systems, substantiated by the famous American economist J.K. Galbraith (1908–2006), are also relevant (Galbraith, 2003). Assessments of challenges and threats to Ukraine are contained in many publications by V. Horbulin, who emphasises the danger of such a global challenge to the whole world due to Russia's new geostrategic course, which he calls a "geopolitical revenge" (Horbulin, 2009). The analysis of the nature of hybrid wars and the hybrid war in Ukraine by O. Neklessa, presented in September 2015 at the XXV Economic Forum in Poland, is useful in this regard (Neklessa, 2015).

The most complex and concise characteristic of a challenge is contained in definitions that can be found in dictionaries and texts of publishers. In particular, IGI Global interprets a challenge as "Something that by its nature or character serves as a call to make a special effort, a demand to explain, justify, or difficulty in an undertaking that is stimulating to one engaged in it" (IGIGlobal, 2022). According to the Collins English Dictionary, "a challenge is something new and difficult which requires great effort and determination" (Collins Dictionary, 2022). The authors of the Oxford dictionary interpret "challenge" as a task or situation that tests one's abilities (English Oxford Living Dictionaries, 2017).

At the same time, a challenge by its very nature creates threats to a person, to a community of people, to society as a whole, which can be implemented in various spheres, in particular: economic, financial, military, socio-political, territorial, national, informational, etc. (Kravchenko, 2016). Therefore, for example, M. Baidak considers a challenge both as a threat and as an opportunity (Baidak, 2021).

Based on the approach to the interpretation of the concept of "challenge" presented here, and many other existing interpretations, there are reasons to understand it as a situation that contains a real potential for the emergence of prerequisites for the formation of a real threat and the occurrence of fatal consequences, which does not exclude the presence, in this situation, of the possibility of the presence of stimulating effects and potentials for its positive change. Moreover, a challenge can have both a general character when it concerns the entire society, and a purely individual character, if it is a challenge for someone personally. In this regard, the Russian-Ukrainian war by its nature is a challenge not only for Ukraine and its population, but also for humanity as a whole. Publications on the topic of such a challenge, which is a large-scale Russian military aggression against Ukraine, especially affecting its agriculture, which deserve attention given the "freshness" of the events and their dynamism, are currently not observed in available sources, therefore this paper claims high relevance and importance in contributing to the formation of the necessary scientific context for studying the situation and predicting its outcomes.

Research methodology

Methodologically, challenges to the agriculture of Ukraine caused by Russia's military aggression are studied from the standpoint of their interpretation as a socio-economic phenomenon. The methodology of the conducted research involved the implementation of a dialectical approach to the identification and study of the main challenges to the agriculture of Ukraine, which are taking place as a result of the military aggression of the Russians. Within the framework of this approach, the method of historical and logical unity is used in the study of socio-economic phenomena in combination with methods of analysis and synthesis, scientific abstraction, induction, systematisation, and generalisation.

The study uses data obtained by the World Bank, the Government of Ukraine and the European Commission to assess the damages and losses caused by Russia, and the corresponding needs of Ukraine to deal with their consequences, based on application of the internationally recognised Damage and Loss Assessment (DaLA) methodology (GFDRR. *Damage*…, 2022), which provides a comprehensive assessment of the specified damages and needs for restoration, and which were published in the report "Rapid assessment of damage and needs for restoration of Ukraine" (GFDRR. *Assessment* …, 2022). Expert assessments of relevant specialists and the author's own observations are also used, which relate to changes closer to the current situation, since the war is ongoing and the damage caused to Ukraine and the need for both budgetary funding and rapid reconstruction of the destroyed infrastructure is constantly increasing.

Analysis results, their interpretation and conclusions from the research

The essence of Russian military aggression as a challenge for Ukrainian agriculture is that this aggression has dealt a powerful blow to the country's economy in general, but especially to its agriculture, since this industry is unique in its spatial dispersion over the surface of the land territories, on a significant part of which military actions are taking place. About 30% of agricultural lands have been under occupation or in the zone of active hostilities (*How did the war…*, 2022).

Ukraine has suffered a large-scale destruction, as a result of which direct losses amounted to $97 billion as of June 1, 2022, while losses caused by the disruption of economic flows and production chains are estimated at $252 billion. According to forecasts, by the end of 2022, poverty in Ukraine will increase tenfold, and one out of five Ukrainians will live in poverty. By the end of 2023, 55% of the country's population will live in poverty (The World Bank: *the level*…, 2022). Under conditions of military aggression carried out by Russia, Ukraine's direct expenses for comprehensive defence and support of the economy currently amount to more than $500 million every day, and this is without taking into account the cost of the damage caused (Havunka, 2022).

According to the Kyiv School of Economics (KSE), the total amount of losses caused directly to the agricultural branch of Ukraine as a result of the full-scale Russian invasion on the country's territory has already reached $4.29 billion, which is almost 15% of the country's capital (*Ukraine Invest…,* 2022).

The direct damage caused to the agriculture of Ukraine includes granaries, greenhouses, farms and agricultural machinery damaged or completely destroyed by the enemy, killed animals, burned fields and stolen grain. According to the FAO's calculations (Food and Agriculture Organization of the United Nations), Ukrainian farmers have lost four to six billion dollars in this way (Yashchyshen, http; *Ukraine Invest*…, 2022). On the other hand, indirect losses concern even enterprises which do not come under Russian fire. For example, it concerns a decrease in production and of income due to war-disrupted logistics. Such losses are even greater.

According to the results of the analysis "Overview of Indirect Losses from the War in the Agriculture of Ukraine" by the Centre for Food and Land Use Research of the KSE Institute together with the Ministry of Agrarian Policy and Food, as of mid-September 2022, the potential direct damage to the agricultural sector of Ukraine amounted to more than six billion US dollars, and indirect (as a result of the drop in production due to the destruction or damage of agricultural land and lack of harvesting, blockade of ports and rising prices) – more than $23 billion (Korzh, 2022). Add to this more than $22 billion in lost potential income from unallocated food stocks (Lysa, 2022). Naturally, investments in agriculture

stopped with the beginning of the war, and the development of the industry was pushed back for years (*Laws regulating…*, 2022). The decrease in the income of agriculture and related sectors as a result of the war is expected to amount to 10 to 30% (Korzh, 2022).

In terms of its functioning, agriculture is strategically important for the maintenance of Ukraine's economy. According to the results of 2021, the share of the agro-industrial complex was 10.6% of the national GDP (Korzh, 2022). The share of agricultural products and food in the total volume of Ukrainian exports in 2020 was 45% or $22.2 billion (*In 2020*…, http). In addition, Ukrainian agriculture plays a significant role in solving the problem of food security in the world, since Ukraine is the world leader in the export of grain, sunflower oil, honey, chicken and other food products. Every fifth ton of Ukrainian wheat is used for baking bread and bread products in the countries of the Middle East, Africa and Southeast Asia. Twenty percent of the exported corn feeds livestock and poultry in Italy, Spain, and Portugal (BRDO, 2022). The problems will lie not only in an increase in the price of food but also in its physical shortage, which can lead to catastrophic social problems. The US Secretary of State A. Blinken warned that Russia's attack on Ukraine could add 70 million more people who are in acute food insecurity to more than 190 million people in the world already in such a situation (Blinken…, 2022). As reported by the UN, due to the war in Ukraine and the actions of the Russian invaders, hunger will threaten 323 million people (*Since the beginning*…, 2022).

More than 30% of the territory of Ukraine has suffered losses from war-related pollution, destruction, bombings, etc. (*Pollution*…, 2022). About half of the destruction caused by the war is recorded as a result of the destruction or partial damage of agricultural lands and failure to harvest – $2,135 million. Explosives from mines and munitions contaminate the earth and soil with heavy metals, the damage from which is estimated at the equivalent of $20 billion. According to the information of the State Service of Ukraine for Emergency Situations, it is currently necessary to demine approximately 270,000 square kilometres, which may take five to ten years (Yashchyshen, 2022). Taking into account the experience of demining the territory in Croatia, according to FAO calculations, the cost of a demining campaign in Ukraine could reach $10 billion (Kravchenko, 2022). Just the cost of surveying lands with a high risk of mine contamination and demining the affected territories is estimated at $436 million (*What damages…,* 2022).

In addition to the direct damage to land, occupation, military action and mine contamination limit farmers' access to fields and harvesting opportunities. Approximately 2.4 million hectares of winter crops with a total value of $1,435 million remained unharvested (*What damages…,* 2022).

The estimated cost of replacing and repairing machinery damaged as a result of shelling, airstrikes, and military operations is 926.1 million US dollars. There

is evidence that the Russian Federation is purposefully destroying grain elevator capacities in order to weaken the Ukrainian agricultural sector (*Ukraine Invest…,* 2022). Fourteen percent of grain elevators have been damaged or destroyed, 10% are located in Russian-occupied territory, so access amounts to only 65% of the existing storage facilities (*The losses…*, 2022). The total amount of losses due to the damage or destruction of granaries is estimated at $272 million. The estimated value of killed animals is more than $136 million. The estimated number of animals that are killed in the affected areas is 42,000 sheep and goats, 92,000 cattle, 258,000 pigs and over 5,700,000 poultry (*What damages*…, 2022). The Ministry of Agrarian Policy and Food of Ukraine says that the country as a whole has lost up to 15% of its meat and dairy production capacity (Yashchyshen, 2022).

The occupiers simply steal whatever they can. They have already exported grain worth about $600 million from the occupied territories (Ministry…, http). According to the estimates of the investigation department of the German broadcaster NDR, by the end of 2022, Russia could export a total of 1.8 million tons of grain from the occupied territories of Ukraine. Most of the cargo is sent to Russia, Syria and Turkey (Venkina, 2022).

The indicated amounts of damage do not mean that there will be a food crisis in Ukraine. The structure of consumption, of course, as a result of the action of various factors caused by the conditions of a real war and the implementation of military operations, has a tendency to change. In particular, in 2023, the production of eggs in Ukraine may stop if the producers fail to restore the chicken population. As it is ageing, the number of eggs will decrease as a result, and the prices will rise accordingly (ROMANK, *There will be* …).

This also applies to problems with milk and milk products. Dairy factories are in a difficult situation and need support in uninterrupted energy supply, since milk processing is a systematic and non-stop production process. The purchase of generators will inevitably affect the cost of dairy products. Still, despite the change in logistics routes, the work of enterprises in dangerous conditions is demonstrated in the Ukrainian dairy sector by the growth of exports in 2022. The sale of Ukrainian dairy products for 9 months amounted to 72.43 thousand tons in natural terms and $186.2 million in value terms, which is 11% and 41% more than in 2021, respectively (*Milk…*, 2022). In addition, the market under modern conditions is capable of covering local product shortages, so there is no reason to fear a “dairy famine” today.

Despite the occupation of part of the south, there will be no shortage of fruit and vegetables. Areas in which there are no active hostilities have increased the area under vegetable cultivation, and there has always been overproduction of fruit and berry crops in Ukraine (Yashchyshen, 2022).

No problems are expected with grain in Ukraine, even taking into account all the negative aspects caused by the war. According to the final estimates, the wheat

harvest in 2022 is expected to be at the level of 18–20 million tons, which is five times higher than the country's needs, and there are still stocks left from 2021. Also, much more buckwheat was sown in 2022, which will saturate the market and equalise prices. At the same time, it is possible that a significant part of the fields will be used for spring crops.

The blockade of Ukrainian ports was another manifestation of the general military challenge for Ukraine, as it practically stopped foreign currency receipts, because, for obvious reasons, the land export of grain turned out to be much less productive than the sea export. Before the start of the full-scale war, about 80% of Ukrainian exports of agricultural products were carried out by sea. The situation has created a challenge for the whole world, as it has put a significant number of the population of other countries at risk of starvation. The grain agreement between Ukraine and Russia, concluded with the mediation of Turkey and the UN, led to the resumption of grain exports by sea. The countries to which Ukrainian grain ships have been heading since the opening of the grain corridor are Egypt, Yemen, Israel, Iran, India, China, South Korea, Libya, Somalia, Sudan, Djibouti, Turkey, as well as EU countries. During the three months of the corridor operation, Ukraine sent 10.1 million tons of grain to the world from the ports of Great Odessa.

On October 29, 2022, Russia announced that it had suspended its participation in the "grain agreement" due to the attack in Sevastopol; however, on the morning of November 2, 2022, Russia returned to the agreement after Turkey, Ukraine and the UN agreed to the continued passage of grain trucks despite the Kremlin's demarche, effectively ignoring it. Currently, Russia is deliberately inhibiting the productivity of joint inspections – an average of only 12 inspections per day are planned, of which 8–9 are actually completed, against 35–40 per day while Russia was not taking part in this agreement (*Russia* …, http). Such uncertainty with the grain corridor has forced Ukraine to significantly improve transportation logistics. Yet, rail transportation is much more expensive than sea freight. Ukrainian track gauges are wider than European gauges, so it is necessary to transship grain, which requires both time and money. Due to insufficient port capacity, the European infrastructure is not able to accept more Ukrainian products to transport them by sea to other continents. Romanian and Polish ports can handle 33 million tons of grain per year, while 50–60 million tons are needed (Harkhalis, 2022).

The blockade of ports showed the disadvantages of exporting a large volume of these goods, therefore the demand for niche, high-margin crops (peas, berries, mustard, etc.) is growing, the transportation of which is more variable. There is reason to believe that this will not harm the cultivation of wheat, sunflower and corn as the main crops. Ukrainian farmers are now inclined to choose oil crops as alternative to grains, which have a higher added value and, accordingly, are higher-priced. Ukraine possesses sufficient capacity to process sunflower seeds into oil for later export. There is a tendency to increase the cultivated area of rapeseed,

which can be processed both for edible oil and for biofuel. As a ton of Ukrainian rapeseed for export currently costs $600, and a ton of rapeseed oil costs $1,700, and it is very problematic to export rapeseed and soy as raw materials, increasingly, many producers are looking towards its processing and the reorientation of their activities to the export of finished products. This will be facilitated by the signed agreement with the Polish government on the construction of a unique pipeline for the transportation of Ukrainian vegetable oil to the port of the city of Gdansk for its export to third countries.

However, the assessment of the consequences of the hostilities for the agricultural industry is complicated by the lack of an analogy, where a country with such a large-scale and globally important agricultural sector as Ukraine is embroiled in a war. Based on the latest assessments of the extent of damage caused by the Russian military aggression against Ukraine, carried out by the team of K. Tymoshenko in the Office of the President, the Kyiv School of Economics, Advanter Group, and the Ministry of Finance and Economy, $750 billion will be needed to rebuild and compensate for the direct and indirect losses suffered as a result of the armed aggression by Russia (Sukov, 2022). More than $30 billion will be needed to compensate for the losses in the agricultural sector (Nedogybchenko, 2022). Funds necessary for the restoration of critical infrastructure are included in the budget. Funds of the Russian Federation seized on the territory of Ukraine can also be used for recovery (ROMANK, *The Cabinet…*). This is also taken into account in the developed Ukraine Renewal Plan for 2022–2032, which was presented to Western partners on July 4, 2022 and provides for the implementation of 850 projects in various areas of the economy.

Another source of funding for the reconstruction of Ukraine is hundreds of millions of dollars in international donor aid. The finance ministers of the EU countries were instructed to develop a mechanism for allocating at least €18 billion to Ukraine in 2023, that is, about €1.5 billion per month (€3–4 billion, if needed) (ROMANK, *The EU…*).

After the outbreak of war, the FAO developed a rapid response plan and is calling for $115.4 million to support nearly a million rural residents by providing agricultural assistance and ensuring food security for those most affected by the war. Within the framework of this program, the FAO has already provided assistance to 80,000 people in 13 regions of Ukraine (Gromov, 2022).

The target audience of international donor organisations is rural households and farmers, who are rightly considered as the most important factor in the fight against unemployment and a guarantee of inclusive economic growth in rural areas. The programs already implemented in Ukraine by the FAO and other donors provide land bank for the maximum size of the recipient at the level of 250–1,000 hectares. This discrimination will intensify the processes of semi-disintegration of agrarian holdings, which have already begun, and a new leader will increase

its presence on the market – a state that will receive maximum benefits from the integration of Ukraine and the agrarian sector into the European Union.

Currently, it is critical for Ukraine to restore exports to ensure global food security, and to support internal currency reserves and a stable exchange rate of the hryvnia. Before the war, agriculture accounted for more than 40% of the country's total exports (Lysa, 2022). From a macro-financial point of view, the export of agricultural products supports currency reserves and the exchange rate of the hryvnia. From a macroeconomic point of view, Ukraine's inability to sell goods means a drop in GDP, in wages, and demand among suppliers for fertilisers, seeds, and other agriculture-related products.

Final remarks

Ukraine faces numerous challenges and threats as a result of Russia's military aggression which has caused enormous damage and losses to the country, both economic and social – the lost lives of Ukrainian heroes in the war against the Russian aggressors cannot be estimated. Ukraine has temporarily lost significant territories and their economic potential as a result of its occupation by the Russian invaders and the conduct of military operations within them. The living standard of the people has decreased significantly. Ukraine suddenly faced the question of how to respond to these challenges and threats, how to ensure rapid economic growth, and create a powerful national security system, army, and defence-industrial complex, how to strengthen and diversify international ties, and how to find a model for a victorious resolution of the war with Russia.

The situation is such that appropriate solutions must be found both in Ukraine directly, through its fundamental strengthening and modernisation, and in the international arena, through the creation of a new international legal format for solving the so called Ukrainian crisis, supporting the country with the participation of the United States, Great Britain, China and the European Union. In this situation, Ukraine objectively deserves such support, because at the cost of the lives of its citizens, it is resisting, on behalf of all civilised humanity, the challenge which Russia and its invading military aggression turned out to be.

At the same time, any challenges provide new opportunities. Russia's military aggression against Ukraine has showed that, as Toynbee's concept of "challenge-response" predicts, the challenge in the form of war shook the entire civilised world, and especially Ukraine directly. Ukraine's response to this challenge will have the character of the rebirth of the country at a new level. Ukraine will rise with renewed quality and will turn from a country of raw materials into a country of innovations, becoming a country of inventors, entrepreneurs, and people who challenge established practices and are able to achieve economic breakthroughs.

Ukraine's agriculture has suffered as a result of the war, perhaps the most of all branches, since a large part of the country's territory is either under temporary occupation or under direct military clashes. Nevertheless, in the near future, the development of industry will become an economic engine for the recovery of Ukraine and beyond. Agriculture will increase its value in the national GDP. The processing of agricultural raw materials will improve the agricultural productivity and energy independence of the country. Despite the war, the large-scale destruction, and the reduction in production volumes, agriculture is unlikely to be threatened with losing its status as one of the leading branches of the Ukrainian economy, which also has a corresponding positive international effect.

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Summary

The purpose of this paper is to present the main results of the conducted research on the identified challenges to the agriculture of Ukraine caused by the aggressive Russian military invasion, and the economic assessment of the possibilities of overcoming them. It was assumed that the scale of challenges and the real consequences of the mentioned aggression are astonishing and unique in terms of size and importance, but the actions envisaged and already aimed at overcoming them are fully justified and have adequate financial support.

The research methodology was based on the use of a dialectic approach to identify and study the main challenges for agriculture in Ukraine, which are present as a result of the military aggression of the Russians. Within this approach, the method of historical and logical unity was used in the study of socio-economic phenomena in combination with methods of analysis and synthesis, scientific abstraction, induction, systematisation, and generalisation.

Studies have shown that Ukraine faces numerous challenges and threats as a result of Russia's military aggression which has caused enormous damage and losses to the country, both economic and social. Russia's military aggression against Ukraine shocked the entire civilised world. At the same time, any challenges provide new opportunities. Ukraine will rise with renewed quality and will turn from a country of raw materials into a country of innovations, becoming a country of inventors, entrepreneurs, and people who are able to achieve economic breakthroughs. Ukrainian agriculture was perhaps the worst affected by the war, as a large part of the country's territory is either under temporary occupation or under direct military clashes. However, in the near future, the development of this industry will become the economic engine for the revival of Ukraine and beyond, which will also have a positive international effect.

Keywords: Ukraine, agriculture, war, challenge.

Rosyjska agresja militarna wyzwaniem dla rolnictwa Ukrainy

Streszczenie

Celem artykułu jest przedstawienie głównych wyników przeprowadzonych badań nad zidentyfikowanymi wyzwaniami dla rolnictwa Ukrainy spowodowanymi agresywną inwazją militarną Rosji oraz ekonomiczną oceną możliwości ich przezwyciężenia. Przyjęto założenie, że skala wyzwań

i realne konsekwencje wspomnianej agresji są zdumiewające i niepowtarzalne pod względem wielkości i znaczenia, jednak działania przewidziane i już zmierzające do ich przezwyciężenia są w pełni uzasadnione i mają odpowiednie wsparcie finansowe.

Metodyka badań polegała na zastosowaniu dialektycznego podejścia do identyfikacji i badania głównych wyzwań dla rolnictwa Ukrainy, jakie mają miejsce w wyniku agresji militarnej Rosjan w tym kraju. W ramach tego podejścia zastosowano metodę jedności historycznej i logicznej w badaniu zjawisk społeczno-ekonomicznych w połączeniu z metodami analizy i syntezy, abstrakcji naukowej, indukcji, systematyzacji i uogólnienia.

Badania wykazały, że Ukraina stoi przed licznymi wyzwaniami i zagrożeniami w wyniku agresji militarnej Rosji, która spowodowała ogromne szkody i straty dla kraju, zarówno gospodarcze, jak i społeczne. Agresja militarna Rosji na Ukrainę wstrząsnęła całym cywilizowanym światem. Jednocześnie, wszelkie wyzwania dają nowe możliwości. Ukraina może z kraju surowców zmienić się w kraj innowacji, stać się krajem wynalazców, przedsiębiorców, ludzi, którzy zdołali dokonać gospodarczego przełomu. Ukraińskie rolnictwo ucierpiało w wyniku wojny bodaj najbardziej ze wszystkich gałęzi, gdyż znaczna część terytorium kraju znajduje się albo pod czasową okupacją, albo pod bezpośrednimi starciami zbrojnymi. Jednak w niedalekiej przyszłości rozwój tej branży stanie się ekonomiczną lokomotywą ożywienia Ukrainy i poza nią, co będzie miało również pozytywny efekt międzynarodowy.

Słowa kluczowe: Ukraina, rolnictwo, wojna, wyzwanie.

JEL: Q18, Q38, D62, H53, H56.

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Wheat supply logistics in wartime in Ukraine

Introduction

The Russian invasion on Ukraine on February 24, 2022 has caused much turbulence not only in the Ukrainian economy but also worldwide. In particular, the production of agricultural products, especially in the grain sector, was severely affected.

According to statistical data, Ukraine, with 33 million tons, was the seventh most important producer and, with 19 million tons, the fifth largest exporter of wheat in the world in the 2021/2022 marketing year.

Thus, following the events of 2022, the logistics of grain supply has become a crucial and urgent issue worldwide, as wheat is the principal staple food in many countries (especially in Africa) and disruptions in its supply can lead to a food crisis in underdeveloped countries.

The purpose of the research is to develop a model of the Ukrainian wheat supply chain in conditions of war in the context of groups of importing countries based on the volume and stability of supplies. The model aims to present the best supply chain for ensuring food security in countries most dependent on Ukrainian wheat.

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In the research, the countries importing Ukrainian wheat were divided into groups using the ABC-XYZ analysis method according to the volume of wheat imports and the level of stability of the orders.

Considering the strategy of Ukrainian grain supplies, it is possible to forecast supply chains to satisfy the needs of the most Ukrainian-dependent importer countries in order to prevent a food crisis in those countries.

The study was conducted concerning the dynamic geopolitical situation in Ukraine in 2022 and was based on the data from analytical reports as of the end of August 2022.

The Ukrainian wheat market, and the share of Ukrainian wheat in the total demand of importing countries, were analysed based on data from 2010 to 2021, obtained from the State Statistics Service of Ukraine and the Food and Agriculture Organisation of the United Nations. Analytical reports of financial and agricultural organisations were also used in this paper.

Literature review and research methodology

Problems with providing high-quality supply logistics, including export logistics of wheat, have been observed in the grain industry of Ukraine. During the wartime, resolving these challenges have become more acute and, therefore, urgent due to the increased risk to global food security. Therefore, the security of wheat supply chains has become the object of research and analysis by scientists and experts.

I.I. Savenko and D.V. Sedikov are the authors of scientific works in which the issues of grain logistics (Sedikov, 2018) and food security as a priority of the agro-industrial policy of Ukraine (Savenko, Sedikov, 2019) are considered.

Yu. M. Makhanyova (Makhanyova, 2015) considers the issue of the export of grain crops from Ukraine, the European Union, and the countries of the world in the conditions of modern integration processes.

The main source of statistical information for writing the paper was the data of the State Statistics Service of Ukraine (State Statistics, 2010–2020), in particular, its express releases with data and analytics on Ukraine's foreign trade in 2022.

The authors also used publications posted on the website of the Ministry of Agrarian Policy and Food of Ukraine (Ministry of Agrarian, 2022). Data regarding the global grain market is covered in the "Agro international" section. To analyse the volume of exports and imports of Ukrainian wheat, data from the Food and Agriculture Organization of the United Nations (Food and Agriculture, 2010–2020) were used.

The authors analysed Ukraine's export potential on the world wheat market, and identified the main importers of Ukrainian grain. According to the methodology

developed by the authors, the share of Ukrainian wheat in the total demand of importing countries, and the share of Ukrainian wheat exports to these countries in the total Ukrainian export of wheat E(%) were compared. A comparison of these indicators provides information on Ukraine's external activities as a wheat exporter.

Since Ukraine exports wheat to over 50 countries around the world, the logistic method of ABC-XYZ-analysis was used to group these countries and justify the selection of the most strategically important groups of countries for further cooperation.

According to S.V. Koryagina (Koryagina et al., 2014), the ABC analysis method "means identifying and evaluating a small number of quantitative values, which are the most valuable and have the largest share in the total set of cost indicators". The authors adopted this method to the issue of wheat export and the grouping of importing countries, and the importing countries with which Ukraine cooperates in the supply of wheat were divided into groups A, B, and C:

– group A includes the countries that create the greatest demand for Ukrainian wheat and provide the greatest revenue. The cumulative demand share of such countries in the total volume of exports is up to 85%;
– group B includes the countries that produce average demand; their cumulative demand share in total exports is up to 5–10%;
– group C includes the countries that make up only 5% or less of orders for Ukrainian wheat.

E.V. Krykavskyi (Krykavskyi, 2004, p. 163) adds that "along with quantitative-qualitative method of ABC analysis, continuity or discreteness of consumption, assessment of sustainability is important for planning… supply and transportation… Such an understanding… forms the basis of the XYZ analysis".

The XYZ-analysis divides the importing countries into groups based on the stability of their demand for wheat. The basis of this analysis is the calculation of the variation coefficient, the essence of which is the assessment of the percentage deviation of the volume of deliveries to the average value for the analysed period.

The number of values in the statistical series, that is, the number of years on which the XYZ analysis is based, must be equal to "at least three periods for which the report is made. If the product has a turnover of more than a year, then it is necessary to take a period that is at least three times higher than the turnover" (Kolomin, 2022). The period 2017–2021, i.e. five years, was chosen for the study.

The greater the coefficient of variation, the less stable the volume of deliveries to a certain country:

– group X – countries with the most stable demand (coefficient of variation up to 10%);

– group Y – countries with medium variability of demand for wheat (coefficient of variation from 10% to 25%);
– group Z – countries with unstable demand (coefficient of variation over 25%).

The combination of ABC-analysis and XYZ-analysis makes it possible to divide the importing countries into nine groups, each of which is characterised based on indicators of the volume of Ukrainian wheat imports and the stability of demand for grain (Figure 1).

	A	B	C
X	**AX** greatest demand + stable demand	**BX** average demand + stable demand	**CX** low demand + stable demand
Y	**AY** greatest demand + medium variability of demand	**BY** average demand + medium variability of demand	**CY** low demand + medium variability of demand
Z	**AZ** greatest demand + unstable demand	**BZ** average demand + unstable demand	**CZ** low demand + unstable demand

Figure 1. Matrix of combinations of ABC and XYZ analyses

Source: based on: (Krykavskyi, 2004, p. 166).

According to Yu.V. Tyuleneva (Tyuleneva, 2017, p. 602), "the ABC-XYZ-analysis method is used to… classify consumers and suppliers of resources, distinguishing among them the main players to whom should be given the most attention". This advantage of the method was used by the authors to develop the model of the Ukrainian wheat supply chain in conditions of war for the purpose of ensuring food security in the most Ukrainian wheat-dependent countries.

Research results

Russia's invasion on Ukraine, which is one of the world's largest producers of wheat, maize, and barley, has caused damage to the grain sector worldwide. Therefore, disruptions in grain supplies caused by the seaport blockade forced importing countries to consider alternative supply options, in particular for wheat, which in terms of consumption is in third place after rice and maize.

We should emphasise that Russia also plays an important role in the grain market and is the third-largest wheat producer. In 2021, it exported approximately 13.1% of the total world export of wheat (*World Economic Forum, 2022. These are the top…*, http).

In Ukraine, more than 40 million hectares of fertile land is used for agricultural production. In 2000–2020, the country ranked 10th among wheat producers. In 2021, the total export of Ukrainian wheat amounted to 5.1 billion dollars (1,900,000 metric tons). In the structure of global wheat exports, Ukraine has 9% and ranks 5th among global exporters (Figure 2) (*World Economic Forum, 2022. Ukraine's food exports…*, http).

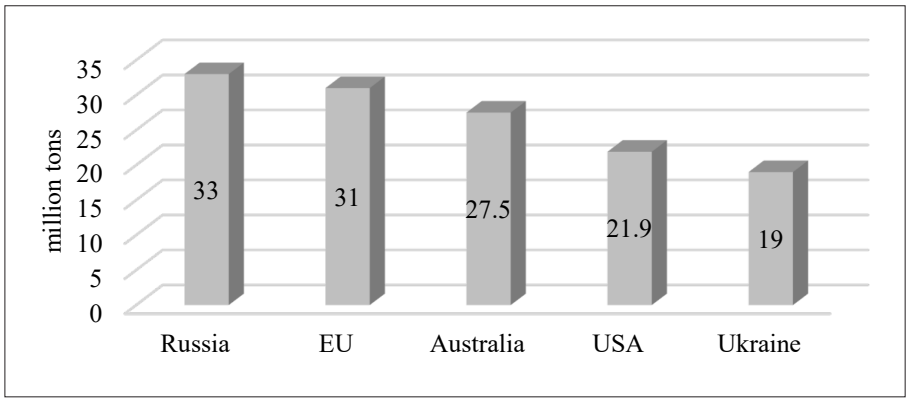

Figure 2. TOP-5 wheat exporting countries in 2021/2022 marketing year

Source: based on: (*World Economic Forum,2022 …*, http).

Over 2010–2021, the harvesting area ranged from 5 to 7 million hectares and tended to increase, especially in 2019–2021. However, in conditions of war, significant losses of cultivated areas are predicted in such regions as Chernihiv, Sumy, Kyiv, Kharkiv, Luhansk, Donetsk, Zaporizhzhya, Kherson, and Mykolaiv. Crops in the Zhytomyr, Poltava, and Dnipropetrovsk regions are also threatened (*State Statistics Service of Ukraine…*, http).

The volume of wheat production during the analysed period doubled from 16 to 32 million tons per year. This was facilitated by the use of proven growing technologies, thereby achieving an increase in the yield from 2.6 to 4.5 tons per hectare.

In Ukraine, 20–35% of wheat was used for domestic consumption in 2018–2021 (data for previous years are not available), and up to 20% of the produced wheat was used for food purposes. In 2021, this percentage decreased to 13%, which was associated with a decrease in its processing into flour due to low profitability of production, a change in taste preferences of Ukrainians, and a decrease in the population (*APK INFORM, 2022…*, http).

The key factor in maintaining demand for Ukrainian wheat is the price. Such a price should cover the growing production costs in war conditions and be acceptable to the importing countries, considering their purchasing power.

During 2010–2021, the export price of Ukrainian wheat increased from 186 to 250 dollars per ton, which was a 34.5% increase. Figure 3 shows the factors that determine both the increase and the decrease in the export price.

Beyond the economic aspect of the Ukrainian wheat supply system, the factor of food security should not be forgotten. In the conditions of the war, supplies should be directed to those countries where the problem of poverty and hunger is acute today. The Kyiv School of Economics conducted research and found that more than 400 million people around the world depend on grain supplies from Ukraine alone.

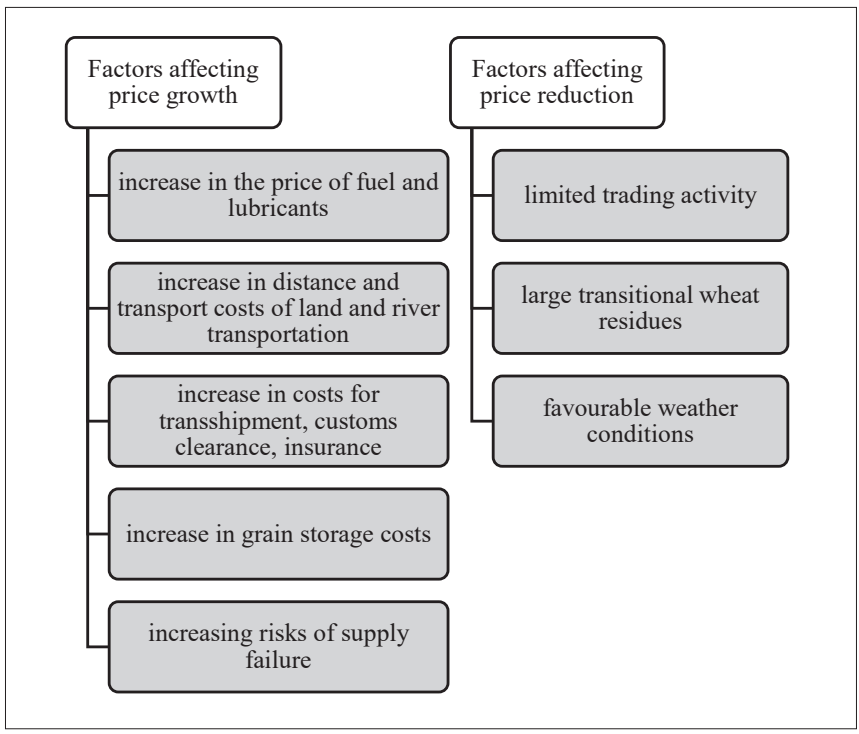

Figure 3. Factors of wheat export price formation

Source: based on own research.

The main importing countries of Ukrainian wheat, their ability to produce wheat on their own and their need for imported wheat, including from Ukraine, were considered (Table 1). Such countries as Bangladesh, Pakistan, Egypt, and Indonesia have remained the main importers of Ukrainian wheat for a long time.

Yet, Indonesia, Lebanon, and Libya are the most dependent on imported Ukrainian wheat: their share in the total wheat demand of the countries ranges from 15 to 90%.

Table 1. Share of Ukrainian wheat in the total demand of importing countries (D (%) and the share of Ukrainian wheat imports in the total Ukrainian export of wheat E (%) in 2010–2020

Importing country / Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
BANGLADESH D (%)	10.1	2.9	–	7.4	10.1	16.2	27.3	24.7	15.4	40.8	21.5
BANGLADESH E (%)	8.6	2.9	–	4.4	4.2	6.3	10.5	11.4	5.6	11.4	8.4
EGYPT D (%)	4.4	2.0	12.5	9.9	14.2	8.9	11.8	12.5	6.7	18.6	17.0
EGYPT E (%)	16.1	9.0	29.1	25.2	27.0	13.4	13.4	15.4	8.5	17.7	17.0
ISRAEL D (%)	27.0	22.0	39.6	18.5	21.6	35.3	28.6	29.7	28.5	25.7	16.4
ISRAEL E (%)	10.1	9.1	8.9	3.8	3.7	4.3	3.0	3.0	3.4	2.3	1.6
INDONESIA D (%)	–	–	–	4.0	4.2	13.1	20.1	19.7	25.8	27.6	26.4
INDONESIA E (%)	–	–	–	3.5	3.0	7.2	11.8	11.9	15.9	14.8	15.1
LEBANON D (%)	22.8	-	29.4	14.5	25.8	31.0	61.8	51.8	40.7	65.7	86.9
LEBANON E (%)	2.8	-	2.3	1.4	1.8	1.8	2.3	2.3	1.8	2.2	3.7
THAILAND D (%)	–	–	–	21.9	28.1	37.2	43.4	29.4	20.1	31.5	18.2
THAILAND E (%)	–	–	–	5.0	4.1	12.6	11.1	4.6	3.5	4.3	3.1
PHILIPPINES D (%)	7.1	–	–	9.6	9.7	19.0	20.4	15.9	26.2	14.2	10.3
PHILIPPINES E (%)	2.7	–	–	3.0	2.6	4.8	5.3	5.1	10.7	5.1	3.5

Source: based on (*State Statistics Service, 2022…* http*; Food, and agriculture, 2022…* http).

According to Table 1, the considered countries had different dynamics of wheat consumption in terms of domestically produced and imported wheat. All of the countries except the Philippines and Israel, for the period from 2010 to 2019, increased supplies of Ukrainian wheat while simultaneously reducing their own production and imports from other countries.

Israel and the Philippines, in contrast, reduced the consumption of Ukrainian wheat, especially in 2020. In Israel, the share of Ukrainian wheat in the country's total imports during the years 2010–2020 decreased from 25–35% to 16.4%. In 2020, the share of Ukrainian wheat exports to this country in the total of its exports decreased from 10% to 1.6%. Such dynamics relate to the use of alternative sources of wheat supply and the formation of the country's own grain stores.

The Ukrainian wheat import to the Philippines is also characterised by a decrease in the share of Ukrainian wheat in the total demand of this country from 20–26% to 10.3%. In the structure of Ukrainian wheat exports, the country's share decreased from 5–10% to 3.5%. According to 2021 data, the Philippines also increased purchases from Australia, as Australia had high production volumes and Ukraine was not competitive on the wheat market.

Other countries, such as Bangladesh, Egypt, Indonesia, Lebanon, and Thailand, increased the volume of purchases of Ukrainian wheat during 2010–2019. Those most dependent on Ukrainian wheat were Bangladesh, Indonesia, and Lebanon: the share of Ukrainian wheat in the countries' total demand in 2019 were, respectively, 40.8%, 27.6% and 65.7%.

In 2020, the situation changed, the countries reduced supplies of Ukrainian wheat because of the formation of sufficient temporary wheat stores and the expectation of good harvests.

To identify the most strategically important importing countries of Ukrainian wheat, an ABC-XYZ analysis was carried out.

According to the results of the ABC-analysis, such countries as Egypt, Indonesia and others have the largest share in Ukrainian wheat exports (16.5% and 15%, respectively) (Table 2). All countries whose cumulative share was up to 85% were included into group A.

Table 2. Results of ABC analysis of wheat imports in 2021, tons

Importing country	Amount of import, tons	Share on the total Ukrainian export, %	Cumulative share, %	Group of ABC-analysis
1	*2*	*3*	*4*	*5*
Egypt	3,314,424.69	16.513	16.513	A
Indonesia	3,059,797.85	15.245	31.758	A
Turkey	1,766,344.00	8.800	40.558	A
Pakistan	1,343,948.36	6.696	47.254	A

1	*2*	*3*	*4*	*5*
Bangladesh	849,373.40	4.232	51.486	A
Morocco	846,533.02	4.218	55.704	A
Yemen	796,808.37	3.970	59.674	A
Saudi Arabia	712,164.15	3.548	63.222	A
Tunisia	645,894.10	3.218	66.440	A
Lebanon	636,737.39	3.172	69.612	A
Ethiopia	607,029.16	3.024	72.636	A
Libya	569,509.43	2.837	75.474	A
Philippines	412,881.74	2.057	77.531	A
Republic of Korea	396,011.37	1.973	79.504	A
Israel	361,878.10	1.803	81.307	A
Kenya	355,497.66	1.771	83.078	A
Thailand	354,543.00	1.766	84.845	A
Nigeria	348,119.00	1.734	86.579	B
Vietnam	278,564.18	1.388	87.967	B
Iran (Islamic Republic)	264,189.00	1.316	89.283	B
Oman	207,108.62	1.032	90.315	B
Djibouti	193,749.47	0.965	91.280	B
Mexico	190,408.27	0.949	92.229	B
Mauritania	177,822.63	0.886	93.115	B
Algeria	167,890.31	0.836	93.951	B
Italy	126,500.40	0.630	95.372	C
Tanzania, United Republic	113,594.84	0.566	95.938	C
Sri Lanka	104,520.55	0.521	96.459	C
Jordan	63,051.50	0.314	96.773	C
Mozambique	63,008.17	0.314	97.087	C
Sudan	53,237.37	0.265	97.352	C
Uganda	46,808.00	0.233	97.585	C
Somalia	43,992.06	0.219	97.805	C
The Netherlands	43,879.56	0.219	98.023	C
Malaysia	42,142.97	0.210	98.233	C
Ghana	40,000.00	0.199	98.433	C
Greece	39,803.23	0.198	98.631	C
Eritrea	33,000.00	0.164	98.795	C
Madagascar	32,730.00	0.163	98.958	C
Cameroon	31,999.56	0.159	99.118	C

1	*2*	*3*	*4*	*5*
Myanmar	31,206.20	0.155	99.273	C
Angola	22,000.00	0.110	99.522	C
Albania	14,610.01	0.073	99.595	C
Colombia	14,396.32	0.072	99.667	C
Switzerland	10,794.63	0.054	99.720	C
Côte D'Ivoire	10,000.00	0.0498	99.770	C
Mali	10,000.00	0.0498	99.820	C
Senegal	8,000.00	0.0399	99.860	C
United Arab Emirates	5,015.41	0.0250	99.915	C
Poland	3,033.49	0.0151	99.930	C
Germany	3,010.95	0.0150	99.945	C
Burkina-Faso	3,000.00	0.0149	99.960	C
Gabon	3,000.00	0.0149	99.975	C
Seychelles Islands	1,551.97	0.0077	99.983	C
China	788.30	0.0039	99.987	C
Taiwan, Republic of China	668.16	0.0033	99.990	C
Republic of Moldova	610.01	0.0030	99.993	C
Hungary	384.77	0.0019	99.995	C
Kazakhstan	301.75	0.0015	99.998	C
Czech Republic	301.02	0.0015	99.9995	C
Georgia	20.00	0.00010	99.9998	C
Lithuania	20.00	0.00010	99.9999	C
Norway	18.30	0.00009	100.0000	C
Russian Federation	0.004	0.00000002	100.0000	C
Belgium	0.0005	0.000000002	100	C
Total	**20,071,252.9**	**100**	**-**	**-**

Source: based on (*State Statistics Service, 2022*… http*; Food, and agriculture, 2022*… http).

Nigeria, Vietnam, Iran, and others with an average level of demand for Ukrainian wheat are in group B (their cumulative share is up to 10%). And such countries as Tanzania, Italy, Sri Lanka, and others were included into group C as these countries carry out minor purchases of Ukrainian wheat (their cumulative share is up to 5%).

Table 3 shows the results of the conducted XYZ analysis for 2017–2021.

The XYZ-analysis revealed that no country importing Ukrainian wheat was included into group X. This means that during the analysed period, the countries made unstable grain purchases, with their size having both increasing and decreasing dynamics.

Table 3. Results of XYZ analysis for 2017–2021

Importing country / Period	Amount of import, tons					Coefficient of variation, %	Group of XYZ analysis
	2017	2018	2019	2020	2021		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Indonesia	2,054,523.27	2,606,433.39	2,959,869.54	2,718,664.16	3,059,797.85	14.70%	Y
Tunisia	818,131.40	1,026,529.42	1,017,242.22	984,016.25	645,894.10	18.30%	Y
Israel	511,330.94	560,945.71	453,601.05	280,473.82	361,878.10	26.10%	Z
Morocco	619,307.43	1,385,244.96	904,992.84	956,482.71	846,533.02	29.60%	Z
Egypt	2,658,839.26	1,396,266.96	3,537,990.46	3,075,224.33	3,314,424.69	30.32%	Z
Libya	253,570.41	637,832.81	697,657.40	546,409.69	569,509.43	31.66%	Z
Thailand	803,489.36	573,134.63	863,545.10	563,448.24	354,543.00	32.46%	Z
Lebanon	396,888.68	287,585.87	443,248.70	669,663.17	636,737.39	33.37%	Z
Kenya	280,186.08	238,759.17	308,385.00	84,443.78	355,497.66	40.87%	Z
Bangladesh	1,971,307.44	914,599.09	2,288,224.19	1,514,724.68	849,373.40	42.07%	Z
Yemen	158,350.00	519,585.88	665,524.30	708,249.13	796,808.37	44.03%	Z
Malaysia	0.00	146,341.48	246,765.84	395,192.56	0.00	47.64%	Z
Italy	457,438.66	271,068.20	173,625.17	219,209.20	126,500.40	51.28%	Z
Philippines	876,557.45	1,754,936.34	1,016,269.67	631,965.71	412,881.74	54.50%	Z
Turkey	597,390.07	237,373.96	1,170,359.38	1,009,699.16	1,766,344.00	60.77%	Z
Mexico	184,043.17	179,738.35	285,538.02	0.00	190,408.27	61.69%	Z
Mauritania	311,841.30	293,731.00	170,410.00	0.00	177,822.63	65.39%	Z
Republic of Korea	723,595.53	925,055.83	460,181.18	0.00	396,011.37	70.08%	Z
Nigeria	107,170.00	0.00	294,784.00	0.00	348,119.00	86.49%	Z

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Spain	686,534.47	829,852.90	291,740.00	0.00	158,680.24	89.57%	Z
Djibouti	0.00	169,590.01	164,061.82	0.00	193,749.47	91.90%	Z
Sudan	115,087.14	0.00	160,116.18	109,549.00	0.00	94.78%	Z
Jordan	106,833.67	115,560.48	179,613.93	0.00	0.00	97.75%	Z
Senegal	133,183.00	180,116.74	0.00	0.00	0.00	118.03%	Z
Ethiopia	0.00	0.00	344,388.17	0.00	607,029.16	145.37%	Z
Algeria	0.00	0.00	0.00	0.00	167,890.31	200.00%	Z
The Netherlands	0.00	208,326.03	0.00	0.00	0.00	200.00%	Z
India	1,649,302.16	0.00	0.00	0.00	0.00	223.61%	Z
United Arab Emirates	0.00	0.00	137,316.53	0.00	0.00	223.61%	Z
Tanzania. United Republic	0.00	0.00	0.00	0.00	113,594.84	223.61%	Z
Pakistan	0.00	0.00	0.00	0.00	1,343,948.36	223.61%	Z
Vietnam	0.00	0.00	0.00	0.00	278,564.18	223.61%	Z
Iran (Islamic Republic)	0.00	0.00	0.00	0.00	264,189.00	223.61%	Z
Saudi Arabia	0.00	0.00	0.00	0.00	712,164.15	223.61%	Z
Mozambique	0.00	0.00	0.00	103,500.00	0.00	223.61%	Z
Oman	0.00	0.00	0.00	0.00	207,108.62	223.61%	Z
Sri Lanka	0.00	0.00	0.00	0.00	104,520.55	223.61%	Z
Total	**17,312,745.69**	**16,373,388.08**	**20,022,070.85**	**18,059,776.62**	**20,071,252.89**	-	-

Source: based on (*State Statistics Service, 2022*… http*; Food, and agriculture, 2022*… http).

Such countries as Indonesia and Tunisia had an average level of stability of purchases of Ukrainian wheat during 2017–2021. These countries are classified as Y-countries. Such countries as Israel, Morocco, Egypt, Libya, Thailand, Lebanon, Kenya, Bangladesh, and others had the most variable demand for Ukrainian grain, and so they were classified into group Z.

Combining the ABC-analysis and the XYZ-analysis produced a matrix (Figure 4) which makes it possible to consider alternative options for developing a model of Ukrainian wheat supply chains, taking into account two factors: the volume of supplies and the stability of supplies.

	A	**B**	**C**
X	-	-	-
Y	Indonesia Tunisia	-	-
Z	Egypt Turkey Pakistan Bangladesh Lebanon Ethiopia Libya Philippines Republic of Korea Israel and others	Nigeria Vietnam Iran (Islamic Republic) Oman Djibouti Mexico Mauritania Algeria	Italy Tanzania, United Republic Sri Lanka Jordan Mozambique Sudan Uganda Somali The Netherlands and others

Figure 4. Matrix of ABC- and XYZ-analysis combinations (results)

Source: own research.

The matrix highlights the AY group (Indonesia and Tunisia) which ensures a stable growing demand for grain. Therefore, they are important partners for Ukraine and, in the future, Ukraine should prioritise the requests of these countries.

The countries of the AZ group (Egypt, Turkey, Pakistan, Bangladesh, Lebanon, Ethiopia, Libya, Philippines, Republic of Korea, and Israel) are also strategically important for Ukraine's cooperation on the wheat market because they support large orders.

The countries of the BZ and CZ groups form periodic orders for Ukrainian wheat in small quantities. Because of the obstacles to exporting wheat during the war in Ukraine and the growth in logistics costs, it is recommended for these countries to consider alternative options for the supply of wheat.

According to the ABC-XYZ matrix, the countries in the AY and AZ groups are Ukraine's main strategically important wheat export partners. These countries are mainly located in South-West Asia and North Africa, and make up Ukraine's main

grain sales markets due to the close distance and convenient sea transportation to these countries.

The BZ group is less interesting for Ukraine, both in terms of volumes and stability of orders. Half of the countries in this group are located in remote East Asia and Central Africa. That means that transportation of wheat to these countries is complicated. And, of course, the war also forces unfavourable changes in Ukrainian cooperation with these countries.

The authors summarised the information regarding the changes in the logistics of Ukrainian grain supply during the war (Table 4).

Table 4 shows that the war forced changes in the transport system, including a transition to land- and river-based transportation as a result of the blockade on the seaports. Insurance companies are also refusing to insure Ukrainian grain because of the high level of geopolitical uncertainty. Moreover, warehouse logistics are finite, and limited by existing capacities for wheat storage. All these circumstances lead to higher costs of delivery.

New restrictions in supply logistics are affecting the behaviour of both the supplier and the customers, and therefore the model of wheat supply chains as a whole. However, the authors found that the main importing countries of Ukrainian wheat remain dependent on Ukrainian imports and expect further deliveries. These countries cannot meet their own grain needs due to internal limitations, among which are arid climate, insufficient agricultural land, low fertility of these lands, growing populations, and even the acute shortage of food, which leads to famine.

Table 4. Characteristics of changes in the logistics system of the Ukrainian wheat supply during the war

Before the war in Ukraine	During the war in Ukraine
1	*2*
Transportation routes	
Export by sea prevailed, seaports accounted for 80% of the agricultural product exports. Most of the wheat was sent to countries in the Middle East and Africa, such as Egypt.	Transportation by land and rivers prevails. Most of the Ukrainian grain is taken to Europe.
Choice of transport	
Water transport prevailed. Seaports accounted for 80% of the agricultural product exports.	Transition to the use of rail and road transport has occurred.
Grain storage conditions	
Total volume of operating grain storage capacity was 75 million tons.	Only 45% of warehouses remain active and free; temporary polyethylene grain sleeves, handling equipment and longer-term modular storage are used.

1	*2*
Cargo insurance	
Insurance in accordance with international rules and conditions of delivery.	Insurance companies are not ready to insure on the territory of Ukraine, as it is not known whether the safety of the Odessa region will be guaranteed when the ports are opened.
Structure of logistics costs	
Logistics costs were 20% of the price. Cost of transshipment was 5–6 euros per ton.	Logistics costs are almost 80% of the price. One fifth of the logistics costs are the railway costs, the rest are the costs at border terminals, transshipment terminals. The cost of transshipment is 25 euros per ton.

Source: based on (*Latifundist*, 2022; Tkachev, 2022; *Ministry of Agrarian Policy and Food of Ukraine*, 2022; *European business*, 2022; *Food and agriculture*, 2022; *Lebid'*, 2022; *Agropolit*, 2021).

Thus, the established model of Ukrainian wheat export with an orientation towards the countries of the AY and AZ groups should continue to work even in war conditions, in conditions of new economic, social and political challenges. According to the authors, the priority should continue to be ensuring global food security, taking into account the limited capabilities of Ukraine and the growing needs of the most dependent countries.

Conclusions

Wheat is the third most-produced cereal, and the second most-produced for human consumption worldwide. The issue of wheat supply logistics is crucial, particularly for underdeveloped countries due to their inability to produce and provide it for domestic demand. These countries are dependent on imports from other producers.

The fifth-largest exporter of wheat in the world, with a share of 9% in the 2021–2022 marketing year, was Ukraine. According to the authors' analysis, Ukraine was ranked 10th globally among wheat producers in 2010–2020, having 40 million hectares of fertile black soil. Since February 24, 2022, Ukraine has lost part of its harvest, in particular in such regions that were leaders in wheat production as Zaporizhzhia, Kharkiv, Zhytomyr, Kyiv, Dnipropetrovsk, and Kherson. The Russian invasion caused damage not only to the Ukrainian economy and agriculture but also endangered the export of Ukrainian wheat. Therefore, the authors set the goal of identifying the countries that are most dependent on the Ukrainian wheat supplies and of developing a model of its supply chains.

To achieve this goal, the ABC-XYZ analysis method was used, which divided the importing countries into groups according to their volume of wheat imports (groups A, B, and C) and the level of stability of their orders (groups X, Y, and Z). The authors supplemented this method with indicators of the share of Ukrainian wheat in the total demand of importing countries and the share of wheat imports to the given country in the total Ukrainian export of wheat.

The authors found that the main importing countries of Ukrainian wheat in 2010–2020 were Egypt, Indonesia, Bangladesh, and Pakistan. Such countries as Lebanon, Libya, and Indonesia have a share of Ukrainian wheat in the total volume of its consumption of up to 90%. Since 2010, Ukraine has been increasing the share of those countries in the total Ukrainian export of wheat.

The results of the ABC-XYZ analysis made it possible to single out two countries – Egypt and Indonesia – which had the largest supplies of Ukrainian wheat in terms of volume, and two others – Tunisia and Indonesia – which had the most stable supplies during 2017–2020. The developed matrix shows that the AY and AZ groups of countries, which are mainly located in South-West Asia and North Africa, constitute the main wheat sales markets of Ukraine. The authors emphasise that these countries should become the main partners in the supply of wheat in the long run.

The countries of the BZ group (such as Nigeria, Vietnam, Mexico, and Algeria) do not purchase stable supplies of Ukrainian wheat. In the short term, these countries would have difficulties cancelling and replacing their Ukrainian wheat supply. In the long term, under conditions of prolonged war, they may need to consider alternative options for suppliers. The authors' opinion is that it could be risky for both sides – Ukraine and the importing country. Firstly, Ukraine, without exports, would not generate the revenues that play a significant role during wartime. Secondly, for the importing countries, it would be difficult to fill the domestic gap in the wheat supply. Both sides – Ukraine as the exporter and the importing country – should resolve the problems with factors limiting the import of Ukrainian wheat: the increased transportation cost, insurance, and storage of stocks. The aim of this action is to maintain the required level of global food security.

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Summary

The year 2022 was marked for the world as the year of the full-scale invasion of Ukraine by the Russian Federation. The war caused considerable damage, not only to the Ukrainian economy, but also disrupted global economic relations. The agricultural sector was especially affected as agricultural enterprises cannot transfer their capacity to other, safer regions, like other sector enterprises, to conduct their activities.

A significant part of the grain harvest was lost due to the war, so taking into account that Ukraine is one of the main exporters of grain, many countries did not receive the ordered deliveries. Among grains, in terms of value, wheat ranks third after corn and rice. Wheat is used not only for consumption but is also exported as seeds. Obstacles to harvesting, transportation, and export of wheat have become an extremely urgent issue for countries that are very dependent on the supplies of Ukrainian wheat.

The purpose of the study is to develop a model of the Ukrainian wheat supply system in war conditions for groups of importing countries in terms of the volume and stability of supplies, to ensure food security.

The ABC-XYZ analysis was used while conducting the study. This method is based on the use of statistical data on the volume of Ukrainian wheat supplies to other countries. According to this method, all countries are grouped in terms of their order volume and stability. This approach indicates the countries that are strategically important for Ukraine as a wheat exporter.

As the results of the analysis show, at the beginning of the war, the behaviours of the wheat-importing countries changed. If they could previously diversify the wheat supply channels, choosing the most profitable channels for themselves, since 2022, many countries have cancelled supplies of wheat from the Russian Federation and have become more dependent on other producers. In addition, unfavourable weather conditions and the desire of powerful wheat producers to create additional stocks of wheat for their own needs have been added. It was found that such countries as Egypt, Indonesia, Morocco, Yemen, Tunisia, Lebanon, and Libya are most dependent on Ukrainian wheat and have positive previous experiences of cooperation with Ukraine.

The presented logistics model of wheat supply can be adapted to new changes, but the ultimate goal of its implementation should be to indicate conditions to ensure global food security.

Keywords: wheat supply, food security, Ukrainian wheat export, supply logistics, ABC-XYZ analysis.

Logistyka dostaw pszenicy w czasie wojny na Ukrainie

Streszczenie

W 2022 roku świat doświadczył pełnoskalowej inwazji Federacji Rosyjskiej na Ukrainę prowadzącej do zakłócenia globalnych stosunków gospodarczych. Wojna spowodowała znaczne szko-

dy w gospodarce Ukrainy. Z perspektywy gospodarki światowej, szczególnie ważne były straty w sektorze rolniczym. Wynikało to z faktu braku możliwości przeniesienia działalności gospodarczej i zdolności produkcyjnych do innych, bezpieczniejszych regionów, tak jak robiły to przedsiębiorstwa innych branż.

Znaczna część zbiorów zboża została utracona z powodu wojny, więc biorąc pod uwagę, że Ukraina jest jednym z głównych eksporterów zboża, wiele krajów importujących nie otrzymało zamówionych dostaw w pełnym wymiarze i na czas. Szczególne miejsce w eksporcie zbóż z Ukrainy zajmuje pszenica, która pod względem wartości zajmuje trzecie miejsce, po kukurydzy i ryżu. Warto podkreślić, że eksportowana pszenica jest wykorzystywana zarówno do konsumpcji, jak również jako materiał siewny. Przeszkody w zbiorze, transporcie i eksporcie tego zboża stały się niezwykle pilnym problemem dla krajów, których gospodarki są uzależnione od dostaw ukraińskiej pszenicy.

Celem artykułu jest opracowanie modelu systemu dostaw ukraińskiej pszenicy, zapewniającego bezpieczeństwo żywnościowe dla krajów importujących pogrupowanych według wielkości i stabilności dostaw w warunkach wojny.

Badania przeprowadzono przy użyciu analizy ABC-XYZ. Metoda ta opiera się na wykorzystaniu danych statystycznych dotyczących wielkości dostaw pszenicy z Ukrainy do innych krajów. Zgodnie z tą metodą, kraje importujące zostały pogrupowane pod względem wielkości i stabilności zamówień. Takie podejście pozwalało wskazać grupy krajów, które są strategicznie ważne dla Ukrainy jako eksportera pszenicy.

Jak pokazują wyniki analiz, na początku wojny zmieniło się zachowanie krajów importujących pszenicę. O ile przed 2022 rokiem mogły one swobodnie dywersyfikować kanały dostaw pszenicy, to od rozpoczęcia pełnoskalowej inwazji wiele krajów rezygnowało z dostawy pszenicy z Federacji Rosyjskiej. Uwarunkowania rynku pszenicy pogarszały niekorzystne warunki pogodowe i presja producentów do tworzenia dodatkowych zapasów na własne potrzeby. Stwierdzono, że takie kraje jak Egipt, Indonezja, Maroko, Jemen, Tunezja, Liban i Libia są najbardziej uzależnione od ukraińskiej pszenicy, a ich import jest długookresowy, co pozytywne świadczy o dotychczasowej współpracy z Ukrainą.

Przedstawiony model logistyczny dostaw pszenicy może być dostosowywany do nowych zmian, ale ostatecznym jego celem jest wskazanie rozwiązań zapewniających bezpieczeństwo żywnościowe na świecie.

Słowa kluczowe: dostawy pszenicy, analiza ABC-XYZ, bezpieczeństwo żywnościowe, eksport pszenicy z Ukrainy, logistyka dostaw.

JEL: F13, F14, F17, Q11, Q13, Q17, Q18.

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Sources of financing as a determinant of the development of innovative integration ties

Introduction

The success of any venture is largely determined by the proper selection of financing sources for the conducted activity. When trying to eliminate the difficulties related to functioning in a competitive environment, one should use various available sources of financing. Having the appropriate sources of financing makes operating and investing activities possible and guarantees financial security. Moreover, it has an influence on decisions made by the organisation and determines its plans and strategic goals. Access to financing instruments that cover the company's needs to a greater extent may also constitute a source of competitive advantage in a dynamically changing market (Filip, Grzebyk, 2012, p. 7).

In terms of the financial management of economic entities, one of the important issues is shaping the capital structure. The authors, who deal with this issue, prove that, in the light of the research conducted so far, it is not possible to fully define the motives of companies choosing specific sources of financing, however, they make attempts to identify factors (internal and external) that determine the structure of capital. Among the many external factors influencing its development, the financial system is of major importance, as it determines the principles of redistribution of funds and their flow to non-financial entities. It should be emphasised that the shape of the financial system affects the basic criteria for the selection of sources of financing by enterprises – the availability of capital and its price (Orechwa-Maliszewska, 2011, p. 63).

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The issue of financing the innovative activity of enterprises can be considered a duality that results from the circulation of capital in the enterprise (Borowiecki, 1993, p. 23; Tomaszewski, 2003, p. 13). As a result of investing activities, capital in the form of money turns into the company's assets, which earlier (for current assets) or later (for fixed assets) are converted back into cash. Hence, when analysing the financial aspects of the company's operations, attention should be paid to both the financial and material aspects (Janasz et al., 2007).

The main goal of this study was to identify sources of financing the activities that determine the initiation and functioning of innovative integration links in agribusiness. The financial system conditions not only the effective functioning, but also the subsequent dynamic expansion of cluster initiatives. In subsequent parts of the study, attempts were made to present sources of financing and their functions in the activities of the organisation, as well as the impact of clusters on the growth of the economy's potential. The forms of financing cluster initiatives were also reviewed. To achieve this goal, the results of empirical research were used, showing the forms and dilemmas of financing clusters. The study puts forward the thesis that properly functioning cluster structures contribute to an increase in the competitiveness of entities and the level of innovation in the economy, eliminating inequalities in their development, both at the local and regional, as well as international levels.

Financing sources and their role in the operations of an organisation

The sources of capital acquisition by economic entities have long been one of the main research issues and problems in economic practice. This is due to the fact that an enterprise, in order to first be established, then function and develop, must constantly raise funds. Therefore, ensuring a sufficient quantity of financial resources is essential at every stage of the life cycle of each economic entity. The financial market, and, more broadly, the financial system mentioned in the introduction, plays an extremely important role for all enterprises in raising capital (Rydarowska-Kurzbauer, 2013, p. 63).

The literature on the subject emphasises three basic aspects of the proper development of the financial system. An effective financial system is, first of all, effective at converting household savings into corporate investments at an appropriate interest rate level. Moreover, a properly functioning financial system enables, as a result of spreading risk or using various security instruments, the implementation of riskier, but highly profitable, investment projects. The above tools, instruments and activities are conducive to an entire company achieving specific economic results. Currently, there is a strong belief, expressed in the

economic literature, that an efficiently functioning financial system is a condition for the effective use of economic growth (Volz, 2004, p. 2). At the same time, its functioning depends on the environment, while being at the same time a subsystem of the economic system (Pietrzak et al., 2004, p. 17). The financial system will therefore depend on the economic, legal, social, and political conditions dictated by the economic system.

Taking into account sources of financing the activities of enterprises, the literature on the subject provides three criteria for their division (Cf. Bień, 2000; Dębski, 2005; Filip, Kata, 2017; Grzywacz, 2012). Pointing to the ownership criterion, the authors divide the sources into equity and foreign capital. Equity is the funds contributed to the company in the course of its operation. They constitute the basis of its economic and legal independence, financial sovereignty, and give freedom in making decisions. They also play a special role in financing investment projects. On the other hand, foreign capital is the sum of the funds put at the disposal of the enterprise by its creditors (Dębski, 2005, p. 384). Its characteristic feature is the fact that it remains at the company's disposal for a specified period of time after which it should be returned. Another criterion for the division of sources of financing is the origin of the capital – in this case, internal and external sources can be distinguished. Internal sources are developed by enterprises, while external sources are obtained when it is created, usually on the financial market. The third criterion for the division of sources of financing is the length of the period for which funds are made available: short-term (up to 1 year) and long-term (over 1 year). In practice, all three ways of dividing the sources of financing overlap, as there are close dependencies between them (Duliniec, 2011, p. 38; Rydarowska-Kurzbauer, 2013, p. 66).

Influence of clusters on the growth of the economy's potential

As the definitions of a cluster (cluster, industrial bundle, cooperation network) in various cross-sections have already been presented many times in the available literature on the subject, this study refrains from quoting them, and focuses only on a brief overview of the concepts and attributes of clustering and the meaning of these structures for the expansion of the economy.

The functioning of the cluster-type production system brings many potential benefits for the local, regional and national economy. An effectively functioning cluster is conducive to an increase in the productivity of local enterprises through access to cheap, specialised production factors and various inputs used in production activities. Moreover, the spatial proximity of economic entities stimulates and supports their innovativeness. A developing cluster is characterised by a dynamic increase in the number of newly created enterprises, which translates directly into

the creation of new jobs. An effectively functioning cluster also produces many external effects, such as an increase in the availability of specialised business-related services, investments in infrastructure, and an increase in the population's income (Cf. Brodzicki, Szultka, 2002; Chorób, 2018).

The benefits of the existence of cluster structures can be considered at various levels and planes. The connections can be beneficial both for the associated enterprises and for the industry, the public sector, the region, and the economic development of the entire country. Among the mutual benefits of operating in close cooperation with companies, research units and local authorities, one should mention the creation of new knowledge and common knowledge, which entities acquire by learning from each other. Cooperation within a cluster is a platform for an exchange of knowledge and experience of all units. A similar situation can be observed for science in the form of joint expenditure on the research and development of new products, technologies, machines, etc. Such solutions may contribute to an increase in the competitiveness of all cluster participants. Science can also manifest itself in joint training, practices, information exchange, creating standards, etc. Scientific units, therefore, have access to key financial resources in conducting research, while companies use their achievements (Jankowiak, 2014, p. 46; Chorób, 2016b, pp. 25–26).

The measurable benefits resulting from the functioning of clusters constitute the main argument in favour of supporting the development of this type of structures. The main goal of the policy based on clusters should be a permanent increase in the level of competitiveness at every level of the economy. This policy should lead to an increase in the innovativeness of enterprises and improvement of their competitive position. Activities should focus on strengthening the competitive position of the cluster by directing the development and increasing the specialisation of cooperating enterprises and institutions to achieve economies of scale and scope, division of labour and effective creation of specialised production factors on a local scale. A consistently implemented policy based on clusters may lead to their transformation into regional innovation systems characterised by effective absorption and creation of process, product and organisational innovations (*Regional*…, 2002, p. 3).

Overview of forms of financing cluster initiatives

Financing the activities carried out as part of cluster initiatives, as mentioned earlier, is one of the key elements influencing the success or failure of a given structure. It should be emphasised that when considering this issue, one should take into account both the current financing of the activities of a given initiative (i.e. the coordinator or the project office), and the financing of various types of

projects important for its development, which may be implemented by various entities within the cluster. Generally speaking, two types of financing sources for a cluster initiative can be distinguished: public and private (Erlandsson, Koszarek, 2011, p. 116).

The form of financing a cluster initiative depends largely on its nature and scale of operation. In the initial period of its development, the coordinator usually works *pro publico bono* or is financed from public funds (e.g. the city hall). In the long run, however, the functioning of a cluster coordinator requires specific financing, which may come both from public and private sources. An important assumption should be that with the passage of time, the main burden should lie with the entities-cluster participants, by replacing public funds with private funds (Kaźmierski, 2015, p. 39).

The most obvious method of private financing of cluster initiatives is membership fees (Chorób, 2016a, p. 488). In the event of formalising the initiative as an association, the contributions paid by the companies acting as supporting members will be the most important. For an organisation in the form of a limited liability company, the equivalent of contributions may be regular invoicing of structure members for services (e.g. information, marketing, advisory, etc.) provided by the cluster coordinator to its members (company shareholders). It is worth emphasising that paying membership fees does not have to mean financing all activities undertaken as part of the cluster initiative.

A different source of financing may be fees paid by entities from the cluster for the use of specific services provided by the coordinator as part of the cluster initiative. For example, they may relate to the rental of common exhibition spaces at trade fairs; part of the costs may then be covered from the joint initiative budget, while the remaining part will be paid only by the directly interested parties, depending on the demand for this exhibition space (Borowicz et al., 2009, pp. 38–40). An important source of financing may also be the in-kind contribution made by the participants of the initiative, which may take various forms (e.g. lending premises for members' meetings, etc.). Most often, however, especially in the initial development phase of an initiative, in-kind contribution is made through the social work of leaders.

The expansion of cluster initiatives and clusters can be supported from public funds and programs, both domestic and foreign. Obtaining public support most often requires entering a competition, in which one should present, inter alia, a well-thought-out strategy and action plan of the initiative and the potential importance of the cluster. Depending on the design of specific programs, the support for clusters may provide for financing only coordination and network-building activities (i.e. office costs, communication platform, information generation and analysis, and the functioning of a team of people employed to coordinate the initiative). Some programs, however, may be of a broader nature and provide for financing of other

activities undertaken as part of the cluster initiative (Borowicz et al., 2009, p. 39).

It should be emphasised that cluster initiatives and clusters can, on the one hand, use sources of financing dedicated only to them, and, on the other hand, also other programs and instruments supporting innovation, competitiveness, and entrepreneurship, addressed to all entrepreneurs. Due to the specificity of these structures, the most important in this case will be those instruments aimed at consolidating partners, and supporting transfer and diffusion of knowledge and implementation of joint ventures. Analysing the potential sources of financing for cluster structures in Poland, it should be noted that, in practice, there are two levels of support for these initiatives – at the regional level (under the Operational Programs for the development of the cluster) and at the national level (under the Innovative Economy Operational Program). Theoretically, only strong and spatially extensive cluster structures can receive support. On the other hand, Regional Operational Programs (ROP) (Kaźmierski, 2015, p. 40) are used to support regional clusters, i.e. clusters located in the area of a single voivodeship.

Scope and methodology of empirical research

The subject of the empirical research conducted in 2015 was the innovative integration ties in the agri-food industry in Podkarpackie Voivodeship, and the subjects of the research were representatives of institutions managing cluster initiatives (clusters) and entrepreneurs-participants of these cluster initiatives (clusters) operating in the area of Podkarpackie Voivodeship.

As mentioned above, the survey covered two groups of entities. The first of them, due to the deliberate choice of the agri-food industry and the research area, were representatives of four institutions managing the only clusters of this industry with their headquarters and operating in Podkarpackie Voivodeship:

1. The "AGRO-KARPATY" Association (based in Rzeszów) as the managing authority of the "AGRO-KARPATY Podkarpackie Agricultural and Food Cluster".
2. The Association for the Development and Promotion of Podkarpacie "Pro Carpathia" (based in Rzeszów) as the managing authority for the "Podkarpackie Smak" cluster.
3. Podkarpacie Chamber of Organic Agriculture (based in Świlcza) as the managing institution of the "Podkarpackie Cluster of Organic Food".
4. Local Action Group "Kraina Nafty" (headquartered in Miejsce Piastowe) as the managing authority for the "Serwatkowa Kraina" cluster.

The second group of entities to which the questionnaire was addressed were entrepreneurs-participants of the above-mentioned cluster structures. The

survey, with the use of a questionnaire and an in-depth interview, covered all 99 members functioning within the above-mentioned four clusters[2]. Out of the above number, 19 entrepreneurs-participants of the clusters refused or did not answer the survey questions. Therefore, the research results were prepared based on 80 correctly completed questionnaires constituting a representative research sample. The results concerning only a few selected questions and aspects included in the questionnaire are presented below.

FORMS AND DILEMMAS OF CLUSTER FINANCING BASED ON EMPIRICAL RESEARCH

In 2016, the Polish Agency for Enterprise Development (PAED) published the "Report on the inventory of clusters in Poland 2015". Its aim was to verify which of the clusters acquiring money for their activities from national, EU and local government funds actually operate dynamically, and which only drift on the market. It shows that a very high percentage are clusters that do not implement any projects or do not provide data on this subject (which can also be interpreted as a lack of projects). It was almost 60% of clusters for projects financed from own funds, almost 39% for projects financed from public sources, and 85% for projects financed from external private sources. The lack of implemented projects is evidenced by, inter alia, the weakness of cooperation both within the cluster and with external entities, and, thus, also the insufficient activity of the coordinators who should be promoters of joint projects. Moreover, the lack of compiled projects makes it impossible to identify or develop the value chain in the cluster, which, in turn, makes it difficult to define its specialisation (Buczyńska et al., 2016, p. 61).

On the other hand, when analysing the results of cluster benchmarking studies conducted in 2020 by PAED, and also concerning financial resources, it is worth noting the very low total median value (0.03) for most cluster categories. The low value of this measure means that among the studied clusters, there was a significant group (at least a half) that did not perform well in comparison to the leading dozen or so clusters. In terms of financial resources, for clusters operating for a minimum of 10 years the median was at the level of 0.15, for National Key Clusters of the NKC – 0.21, and for clusters with over 100 members – 0.21. Similar conclusions were provided by the analysis of benchmark values, which reached a relatively low level of 0.49. This means that it is difficult to identify a clear leader among the

[2] The number of members and their data necessary to conduct the questionnaire survey were made available by representatives of the managing authorities of the individual clusters. In a few cases, entrepreneurs-participants declared their membership in more than one cluster, therefore they were obliged to complete only one questionnaire.

studied clusters in terms of most or all of the partial indicators. The best grades were obtained by a large cluster (over 100 members) with the NKC status, established before 2010, operating in the area of medium-low and low technology and located outside of Eastern Poland (Piotrowski, 2021, p. 45).

The above report also provides detailed information (for the area: financial resources; N = 41) (Piotrowski, 2021, p. 46):

– the budgets of the studied clusters in the period 2018–2019 were very diversified: 15 clusters had a budget exceeding PLN 1 million in this period; for the two best ones, the values exceeded PLN 50 million. In both cases, these were funds from external sources (including public sources, e.g. projects co-financed under European Funds);
– one of the sources that made up the budget was contributions from members and the coordinator's own income allocated to the functioning of the cluster. Only 5 clusters exceeded the level of PLN 1 million over two years in this case; for the next 16 clusters, the amounts were in the range of PLN 100,000 – PLN 1 million;
– an important source of financing for clusters was external funds (both from public and private sources). In total, 27 clusters obtained approx. PLN 295 million from these sources, of which approx. PLN 215 million came from public sources (including projects, domestic and foreign grants, and targeted subsidies);
– the examined coordinators provide little access to additional, external financial instruments (e.g. in the form of partnerships with financial institutions). The most frequently indicated was access to a loan fund and seed capital within the cluster (7 clusters each);
– several clusters indicated support for their members in the form of advice related to obtaining subsidies from EU funds;
– cluster members assessed the availability of financial instruments in the cluster: a positive answer was given by 55% of the surveyed respondents;
– on average, approx. 9% of cluster members benefitted from all external financing services available within the cluster.

The results of the empirical research conducted by the author of this study are a valuable supplement to the above considerations in terms of financing the activities of cluster initiatives. The research conducted among the entrepreneurs shows that the surveyed cluster initiatives were created mainly from joint funds (government and entrepreneurs), then from government funds (including EU funds) or entrepreneurs' budgets (respectively: 57.5%; 18.7% and 13.8% of responses). Only every tenth surveyed entrepreneur indicated other ways of financing the initiative. The results of the research also confirm the fact that initiating and financing clusters was a task that belonged mainly to the companies creating the cluster initiative (62.5% of responses). For 43.7% of the respondents, this task was the responsibility of the government (also benefitting from EU funds), and according to 37.5% of the entrepreneurs, two or more different entities

(e.g. a university and companies) were responsible for initiating and financing. Every 4th respondent indicated international organisations as initiating institutions, and every 8th entrepreneur expressed the view that the task was undertaken by universities[3].

It is worth noting that according to a vast majority of the entrepreneurs (81.2%), the initiatives they represented benefitted from EU funds. These were mainly structural funds (62.5% of indications), and to a lesser extent, scientific and research grants (12.5% of indications). The results of the survey also refer to the activities for which cluster initiatives, in the opinion of the entrepreneurs, received subsidies. Most often these were funds allocated to investments, and the development and promotion of the cluster initiative (this was the opinion of 66.2% of the respondents). To a lesser extent, the support concerned staff training (31.2%), the development of services for participating companies (22.5%) and infrastructure construction (6.2%).

Taking into account the elements limiting the use of EU funds, Figure 1 shows the main barriers, according to the surveyed entrepreneurs, to the development of the cluster initiative. The presented data show that the respondents considered formal design requirements and difficulties related to payments and settlements to be the most important limitations (respectively: 72.5% and 36.2% of the responses). Another important obstacle was insufficient access to information about support possibilities and insufficient contact and assistance from the managing authority (25.0% of responses for each). To a lesser extent, priorities and programs that did not correspond to the needs, and low interest in the offered services (18.7% of responses for each) were considered to be obstacles.

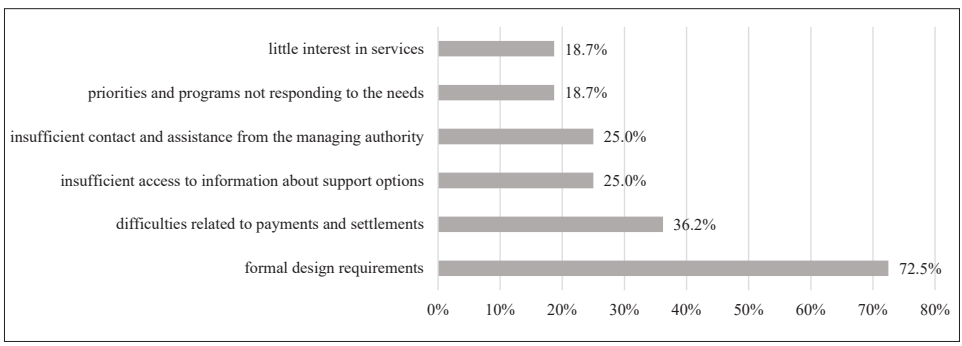

Figure 1. Factors limiting the use of EU funds in a cluster initiative according to the opinions of entrepreneurs-participants of cluster initiatives (on the scale of importance)[4]

Source: own elaboration based on questionnaire research.

[3] The data does not add up to 100% because the respondents could choose several answers.

[4] The data does not add up to 100% because the respondents could choose several answers (the record rule applies to Figures 1–2).

According to the respondents (Figure 2), the enterprises do not use (or use only to a limited extent) projects co-financed from European funds mainly for two reasons: lack of financial resources for pre-financing (70.0% of responses) and fear of bureaucracy (56.2% of responses). The above results confirm the financial problems and the related lack of funds for pre-financing projects co-financed from EU funds. Other important reasons reported were a low level of knowledge about competitions and procedures (43.7%), a lack of or limited human resources (37.5%), and a lack of programs corresponding to the conducted activity (31.2%).

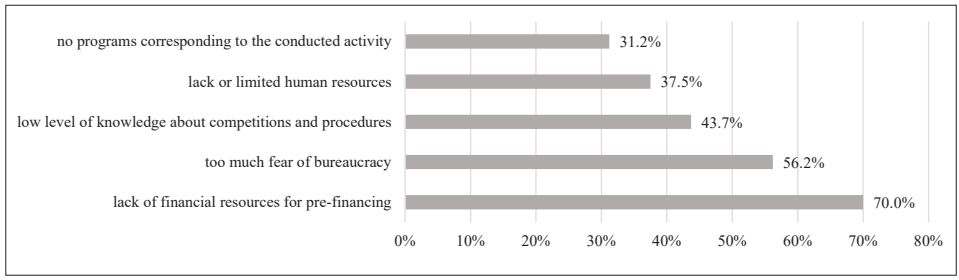

Figure 2. Reasons for enterprises not using projects co-financed from EU funds in the opinion of respondents (on the scale of importance)

Source: own elaboration based on questionnaire research.

An important issue regarding the expansion of cluster initiatives is the financial outlays incurred for their development. A vast majority of the surveyed entrepreneurs (77.5%) stated that in 2015 these outlays were lower than in previous years. Only 10.0% of the respondents expressed the opinion that these outlays were at the same level as in the previous years, and 12.5% of the respondents did not have knowledge in this regard. It seems that the reason for this state of affairs is the unfavourable situation the clusters are currently facing. On the one hand, they have exhausted the financial resources obtained in the previous financial perspective, and on the other hand, the funds they applied for in the 2014–2020 perspective have not yet reached the clusters. It can be assumed that, with the receipt of support in the form of new funds, the clusters will significantly revive their activities, which will translate into their dynamic expansion.

Final remarks

The aim of this study was to show the sources of financing the activities conditioning the initiation and functioning of innovative integration links in agribusiness. The financial system determines not only effective functioning but also subsequent dynamic expansion of cluster initiatives. This proves the

correctness of the thesis that properly functioning cluster structures contribute to an increase in the competitiveness of entities and the level of innovativeness of the economy, eliminating inequalities in their development, both at the local, regional and international levels.

The financial system and the sources of its financing play a key role in the proper functioning and effective development of the cluster initiative. The method of financing a cluster initiative depends, to a large extent, on its nature and scale of operation. In the initial period of its operation, usually the coordinator finances its activity, or it is financed from public funds. However, in the long run, a cluster initiative requires adequate funding from both public and private sources. The development of a cluster initiative may also be supported from public funds and programs (national, international), but applying for these funds requires formalisation and the appointment of an appropriate legal form.

The expansiveness of the functioning of clusters is closely related to the sources of financing. The analysis of the presented research results makes it reasonable to conclude that most of the cluster structures had a problem with financing their activities after the end of the co-financing period. This is why it is so important to select appropriate sources of financing, which should be diversified by a gradual replacement of public funds with private funds of the cluster members-participants. Hence, the broadly understood determinants of the flourishing of cluster structures, taking into account the elimination of limitations and inequalities in their development, also related to their financing, may constitute a premise for undertaking further research.

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Summary

The success of any venture is largely determined by the proper selection of financing sources for the conducted activity. To attempt to eliminate the difficulties related to functioning in competitive conditions, one should use various available sources of financing. The availability of appropriate sources of financing makes operating and investment activities possible and guarantees financial security. In addition, it has an impact on the decisions made by the organisation and determines its plans and strategic goals. Access to financing instruments covering the needs of a company to a greater extent may also constitute a source of competitive advantage in a dynamically changing market.

The main goal of this study is to show the sources of financing the activities that determine the initiation and functioning of innovative integration links in agribusiness. The financial system determines not only effective functioning, but also subsequent dynamic expansion of cluster initiatives. In further parts of the study, attempts were made to present the sources of financing and their functions in the activities of an organisation, and the impact of clusters on the growth of the economy's potential. Forms of financing cluster initiatives were also reviewed. To achieve this goal, the results of empirical research were used, showing the forms and dilemmas of the financing clusters. They were carried out in 2015 among 80 entrepreneurs-participants of four agri-food clusters, and among 4 representatives of institutions managing these clusters in Podkarpackie Voivodeship. The study confirmed the thesis that properly functioning cluster structures contribute to an increase in the competitiveness of entities and the level of innovation in the economy, eliminating inequalities in their development, both at the local, regional and international levels.

Keywords: financing, cluster, integration processes, innovation, competitiveness.

Źródła finansowania determinantą rozwoju innowacyjnych powiązań integracyjnych

Streszczenie

Sukces każdego przedsięwzięcia w dużej mierze determinowany jest właściwym doborem źródeł finansowania prowadzonej działalności. Starając się niwelować trudności związane z funkcjonowaniem w warunkach konkurencyjnych, należy korzystać z różnych, dostępnych źródeł finansowania. Dysponowanie odpowiednimi źródłami finansowania umożliwia prowadzenie działalności operacyjnej, inwestycyjnej oraz gwarantuje bezpieczeństwo finansowe. Ponadto ma wpływ na podejmowane przez organizację decyzje, warunkuje jej plany i zamierzenia strategiczne. Dostęp do instrumentów finansowania, pokrywających potrzeby przedsiębiorstwa w szerszym zakresie, może również stanowić źródło przewagi konkurencyjnej na dynamicznie zmieniającym się rynku.

Głównym celem niniejszego opracowania jest ukazanie źródeł finansowania działalności warunkujących zainicjowanie i funkcjonowanie innowacyjnych powiązań integracyjnych w agrobiznesie. System finansowy warunkuje nie tylko efektywne funkcjonowanie, ale również późniejszą dynamiczną ekspansję inicjatyw klastrowych. W kolejnych częściach opracowania starano się przybliżyć źródła finansowania i ich funkcje w działalności organizacji oraz oddziaływanie klastrów na wzrost potencjału gospodarki. Dokonano również przeglądu form finansowania inicjatyw klastrowych. Dla realizacji podjętego celu posłużono się wynikami badań empirycznych ukazując w ich świetle formy i dylematy finansowania klastrów. Przeprowadzono je w 2015 roku wśród 80 przedsiębiorców-uczestników czterech klastrów rolno-spożywczych, jak też wśród 4 przedstawicieli in-

stytucji zarządzających tymi klastrami na obszarze województwa podkarpackiego. W opracowaniu potwierdzono tezę, iż prawidłowo funkcjonujące struktury klastrowe przyczyniają się do wzrostu konkurencyjności podmiotów oraz poziomu innowacyjności gospodarki, niwelując nierówności ich rozwoju, zarówno na szczeblu lokalnym, regionalnym czy międzynarodowym.

Słowa kluczowe: finansowanie, klaster, procesy integracyjne, innowacyjność, konkurencyjność.

JEL: D41, F20, L20, O31, R11.

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Impact of COVID-19 pandemic on labour market situation of young people

Introduction

Any epidemic or pandemic will affect a number of aspects of human life and introduce changes in the working life of individuals. The world has been radically changed by the COVID-19 pandemic, which led to a global health crisis, but also an economic one, caused primarily by the imposed lockdowns (Kacperska, Kraciuk, 2021), which affected and are still affecting supply chains, the demand for labour and employment, and consequently increased unemployment (Przybytniowski, Grzebieniak, Pacholarz, 2021). The pandemic has caused effects not only of an economic nature but also of a psychological and social one.

This is especially relevant to the situation of young people – their mental health and psychological well-being (Akkaya-Kalayci et al., 2020; Cowie, Myers, 2021; Porter et al., 2021; Silva Junior et al., 2020), social life (McKinlay et al., 2022), lifestyle (Panarese, Azzarita, 2021), as well as their position as employees – young workers are among the groups that have been particularly negatively affected by the pandemic (Abraham et al., 2022; Radulescu et al., 2021; Raimo et al., 2021).

Young people make up a specific social group as they make the transition from the education system to working life. Significant changes occur at this stage of an individual's life, with challenges that include, in particular, searching for a job, clarifying their desired career path, and discovering the expectations placed upon them in their new, professional roles (Mackenzie Davey, Arnold, 2000). Taking up

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the first permanent job affects the individual's further professional activity – their professional development, career, but also their personal development and family life (Wiatrowski, 2009). It is also important for an individual's entrepreneurship, their openness to new experiences and their ability to become self-employed (Bańka, 2007).

At the same time, it is emphasised that young people lack employability skills and are unprepared for the world of work, which is different from school (Leonard, Wilde, 2019). Less favourable values of employment and unemployment rates are recorded for young people than for other groups due to young people's lack of work experience, while unemployment, especially youth unemployment, is a central concern of the European Union (Jentsch, Schucksmith, 2004). In addition, their employment is usually under less favourable conditions. This difficult situation has been further exacerbated by the constraints of the COVID-19 pandemic.

As a result of the crisis caused by the pandemic, unemployment among young people has increased significantly, on-the-job training has been severely disrupted, and financial insecurity, housing instability and mental problems have become a cause of hardship for many representatives of the younger generation (*What have countries done…*, http). Although the pandemic affected the lives of young people most immediately after its announcement, they will suffer its consequences for a long time.

The purpose of the paper is to assess the impact of the COVID-19 pandemic on the situation of young people in the labour market.

Young people in developing economies with "flexible" labour markets have been adversely affected by the pandemic (*Preventing Exclusion…*, http). Although employment losses were a frequent consequence of the pandemic, it concerned primarily lower-paid sectors and occupations (Cortes, Forsythe, 2020). In addition, the consequences of the pandemic affected people identified as belonging to low social class to a greater extent than young people from the middle class (*What have countries done…*, http).

Hence, attention was focused in particular on Podkarpackie Province, which is one of Poland's peripheral regions (Żukowski, Chelminiak, 2014). It is characterised by an unfavourable situation in the labour market for employees, especially for young people. Compared to other regions in Poland, the province has a lower percentage of professionally active people, the lowest employment rate, a high unemployment rate, few job offers per 1,000 unemployed young people, and a low reported demand for specialists, which makes it impossible to use the potential of young people, who do not have specialist knowledge, qualifications and experience in a specific field (Mazurkiewicz, 2021). At the same time, the developing industrial sector (*Województwo podkarpackie*, http), and the creation and dynamic development of small- and medium-sized

enterprises are an advantage of the Podkarpackie labour market and enable the use of the available human potential. Despite these possibilities, the lack of stability of employment makes the consequences of the crisis particularly severe for young people, which is also reflected in their extremely pessimistic prospects for the future.

The presented conditions provide a premise for the hypothesis that the main consequence of the pandemic for young people in the Podkarpackie labour market was the loss of a job, followed by a reduction in salary.

Performing the above-stated assessment required an analysis of the literature on the consequences of the crisis for the labour market, with particular emphasis on the situation of young people, studies and reports presented on the websites of institutions dealing with the labour market, an analysis of the basic measures of the labour market using statistical data presented in regional, national and international databases (The Provincial Labour Office, The Central Statistical Office, and Eurostat). Research was also carried out using a survey questionnaire. The selection of the sample was intentional. Eighty young people (aged 18–29) from Podkarpackie Province participated in the survey.

Descriptive statistics were used to analyse the data obtained in the quantitative research, and graphs were used to visualise the data.

CONCEPT OF YOUNG PEOPLE

The concept of young people is a heterogeneous category. This problem translates into different definitions of age limits, which creates implications for further research. The International Labour Organization, when presenting statistics on the youth, refers to the age range of 15–24 (*Statistics*…, http), treating those aged 25 and over as adults. The data on the situation of young people in the labour market published by Eurostat include a group of 15–24-year-olds (referred to as youth), or more broadly, 15–29. Eurostat also sometimes includes people aged 30–34 in this group (*Participation of young people*..., http). Poland's Central Statistical Office defines this group as the population in the 15–34 age range. Such a broad range of age ranges results in heterogeneity and differentiation of the group not only by age but also by the level of education acquired, as well as continued education (*Participation of young people*..., http). Some young people become professionally active during school internships, some enter the labour market fully after completing vocational or high school, and some continue their education at university (*Wejście ludzi młodych*..., 2010). The limit up to the age of 25 applies especially to students, while the age of 25–29 applies to those in the labour force. On the other hand, in the statistics of district labour offices, the category of young people refers to those aged from 18

(the age of acquiring full legal capacity) to 30, with a group up to 25 also being singled out, which is related to the continuation of education. In this paper, it was assumed that young people belong to the 15–29 age group. Attention has been focused on them as a category of employment. It is emphasised that people aged 30 and over already constitute a market-strong category of workers and their situation in the labour market is more favourable than that of younger people (Pańków, 2012).

Consequences of the pandemic for the labour market

The primary effect of the crisis observed in the labour market is an increase in unemployment, which is temporary (Rutkowski, 2020a). Unemployment is a phenomenon that alternately intensifies and weakens in Poland (Ślebarska, 2010), and its size depends on current events, such as crises.

Unemployment affects a number of aspects of human life; while it is possible to point out its positive aspects for an individual, such as more free time, stimulation of competition among job seekers, and the reorganisation of occupational choice, among others, negative consequences are more severe, and there are many more of them. A lack of a regular income or its significant reduction leads to a lower standard of living and the worsening of the material situation of the unemployed person and their family. There is also a depreciation of their long-term human capital. Work is also a source of well-being, and mental and social balance (Zdun et al., 2016). Unemployment results in the loss of an individual's social skills, causing them to become socially maladjusted (Bańka, 1992). A significant consequence of joblessness is degradation of the individual's social position, i.e. their social marginalisation. Further consequences include social tensions, conflicts and pathologies, moral-ethical damage, and threats to their physical and mental health. Unemployment, therefore, causes harm in many areas of human life – emotional, motivational, and cognitive (Czechowska-Bieluga et al., 2009; Winiarczyk, 2011). It becomes a particularly difficult experience at the initial stage of a career, as it affects its development (Barone, Schizzerotto, 2011). Remaining unemployed for a long period of time leads to the deepening of the identified consequences, further perpetuating them. A young person who remains unemployed and does not find work within 3 years, and an adult within 5 years, becomes incapable of looking for work (Domańska, Niedzielski, 2005). Hence, the unemployment of young people and their entry into the labour market during the crisis becomes an important issue.

Unemployment, especially long-term, is one of the prerequisites for inclusion in the NEET (*not in employment, education or training*) group – people who are not active in the labour market and are not participating in formal education

or training to improve their professional skills. Other factors that increase the chances of becoming NEET include individual reasons related to, among others, a low level of education of both the young person and their parents (*Wsparcie młodych osób…*, http), living in peripheral regions (Saczyńska-Sokół, Łojko, 2016), coming from an immigrant background or having health problems (*Wsparcie młodych osób…*, http). This is followed by gender – the NEET phenomenon affects women more than men (Rollnik-Sadowska et al., 2016), addiction problems, low level of social competence, negative attitudes towards work, lack of readiness to move, low motivation, aggressive behaviour, criminal experiences, a difficult family situation, and early parenthood (*Wsparcie młodych osób…*, http). Institutional and cultural risk factors for inclusion in the NEET group include (*Wsparcie młodych osób…*, http): segmentation of the labour market and its inflexibility, as well as the mismatch between the education system and labour market requirements.

The crisis caused many young people to lose their jobs or the opportunity to work; in the case of the pandemic, this applies to the lockdown period, the holiday season, or the time afterwards, especially for students taking jobs for the duration of the academic year. The available work is then limited to working in services, such as sales, telecommunications, IT or as bike and scooter couriers (Rutkowski, 2020b).

Their lack of experience, specialised knowledge (Braziene et al., 2014) and general skills (Bell, Blanchflower, 2011a) make young people less attractive employees than more experienced ones, and their position in the labour market is weaker. In addition, their employment means large costs for the employer to prepare them for their tasks, and is associated with relatively easy dismissal should financial difficulties arise (Bell, Blanchflower, 2011b). Hence, they are often employed under unfavourable conditions (*Europejski semestr…*, http), and based on temporary contracts or civil contracts. At the same time, the difficult labour market situation is leading to increased employment flexibility. Many advantages of flexible forms of employment have been pointed out, both for the employer (such as a reduction of labour costs and better use of the potential of their employees) and for the employee (including an increase in employment opportunities, maintaining contact with the labour market, especially by the long-term unemployed, and gaining professional experience for those entering the labour market) (Kalinowska et al., 2016). However, such solutions carry many risks, especially for young people, such as:

– the trap effect of repeated short-term jobs, also making it more difficult to transition from temporary contracts to permanent employment (Kiersztyn, 2021),
– lower wages (wage discrimination), fewer opportunities for advancement, longer working hours (night and weekend work), and greater stress – physical

and mental workload – compared to permanent employment (Lewandowski, Góra, Lis, 2017),
– in the case of contracts other than based on the employment relationship – the lack of legal protection related to remuneration, the need to acquire the necessary skills on one's own, a lack of certainty of continuity of work, and an inability to exercise employee rights (Kalinowska et al., 2016),
– delaying procreation plans, lower fertility rates and poorer mental health of women entering into fixed-term contracts (Auer, Danzer, 2015).

Young learners are also in a difficult situation. Disrupting the process of traditional learning for a long period can further lower educational aspirations, and reluctance or difficulties in participating in remote activities, and a lack of or limited support can lead to dropping out of school (*What have countries done…*, http), which will later translate into reduced labour market opportunities.

These issues are relevant to the new challenges (Sefton-Green et al., 2020) and uncertain future that is troubling young people's transition into workforce and has deep implications for them (Black, Walsh, 2019). New circumstances were created by the COVID-19 pandemic.

The impact of the pandemic on the situation of young people in the labour market

The analysis of the labour market situation during the pandemic period took into account the development of the unemployment rate, the share of NEETs, and temporary employment contracts.

The situation in Poland in terms of unemployment was much more favourable than in the European Union until the beginning of 2020. Since the end of the previous crisis, there had been a decline in the unemployment rate since 2013 (Figure 1), which was 4.7 p.p. in the 15–74 age group by 2019 in the European Union countries (from 11.4% to 6.7%), while in Poland it was much higher at 7.0 p.p. (from 10.3% to 3.3%). Changes also affected those aged 15–29, with this group experiencing significantly higher unemployment – the average unemployment rate in the EU fell by 7.9 p.p. and 12.3 p.p. in Poland, amounting to 11.9% and 6.6%, respectively, in 2019. This trend was interrupted by the COVID-19 pandemic. In 2020, youth unemployment rate increased by an average of 1.4 p.p. in the EU, and 0.5 p.p. in Poland. In the following year, the trend continued in Poland – the unemployment rate for the analysed group increased slightly to 7.2%, while in the EU it fell by 0.3 p.p. on average and amounted to 13%, which is significantly higher than the unemployment rate obtained for the population aged 15–74 (amounting to 3.4% in Poland and 7.0% in the EU, in 2021).

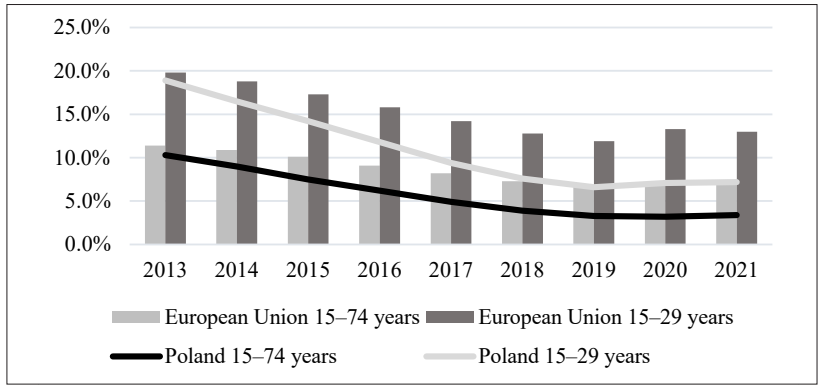

Figure 1. Unemployment rates in European Union and Poland

Source: own research based on Eurostat database.

A detailed analysis of the impact of the pandemic on young people shows that in Poland, there was already an increase in the number of young unemployed people in the second quarter of 2020 – from 195,000 to 198,000, and in the next quarter, the increase was higher at almost 15% – to 227,000 people (Figure 2). A year later, the number of young unemployed was less than 200,000, and since then it has been steadily declining. The same changes apply to the unemployment rates both in Poland and the average of the EU countries – after an initial increase, which was particularly large in the third quarter of 2020, there was a decline. The year 2022 is associated with a stabilisation of the unemployment rate among young people, reaching values even lower than before the pandemic.

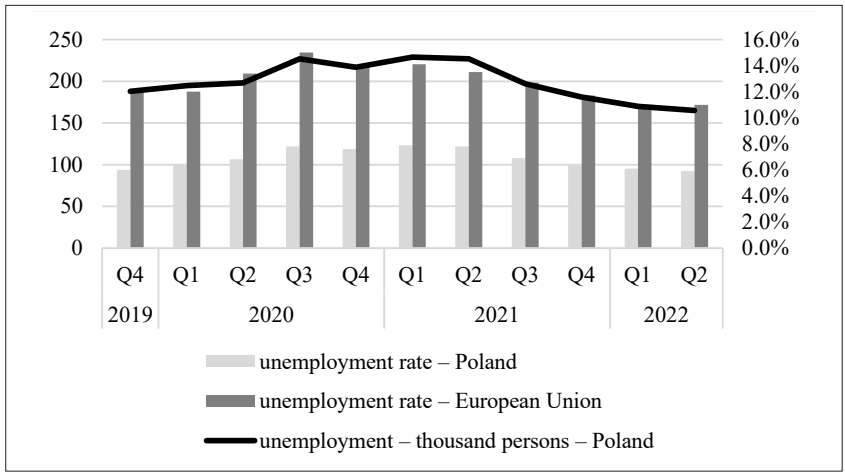

Figure 2. Quarterly unemployment in European Union and Poland (from 15 to 29 years of age)

Source: own research based on Eurostat.

Despite the negative changes, the situation in Poland is more favourable than that of most EU countries, which is presented in Figure 3.

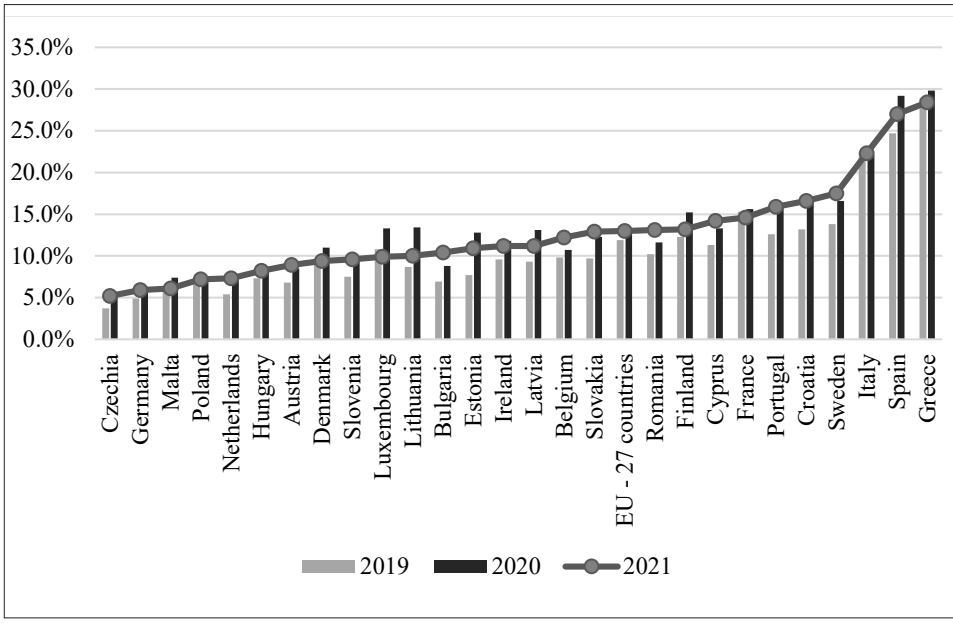

Figure 3. Unemployment rate (from 15 to 29 years of age) in European Union countries

Source: own research based on Eurostat.

The share of young NEETs in the European Union has been steadily declining since the second quarter of 2020, when it reached 15% – the highest during the pandemic (Figure 4). It currently stands at 12.1%, which is lower than in the last quarter of 2019 (12.9%). Such changes are not observed in Poland – the share of young NEETs is currently, despite a decline in 2021, still higher than in late 2019 (12.9% vs. 12.2%) and early 2020 (12.6%); it is also higher than in the European Union.

These changes provide grounds for believing that young people in Poland were more strongly affected by the pandemic, one of the factors contributing to the inclusion of NEETs. However, it exacerbated the impact of other factors contributing to remaining NEET, including living in peripheral regions, which include almost all of Poland (Owczarczuk, 2010), which increases the likelihood of entering this group by 150% (Saczyńska-Sokół, Łojko, 2016). Another key factor is gender – more women than men belong to the NEET group, regardless of the macroeconomic conditions.

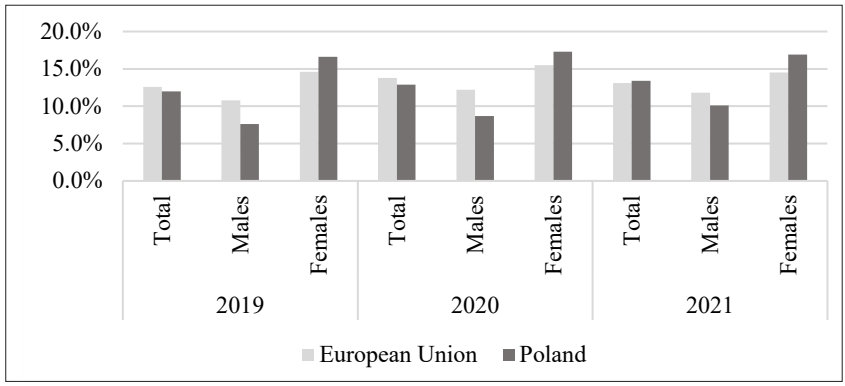

Figure 4. NEET rates (from 15 to 29 years of age) by sex in European Union and Poland

Source: own research based on Eurostat.

Unfavourable changes in Poland as compared to other EU Member States are presented in Figure 5.

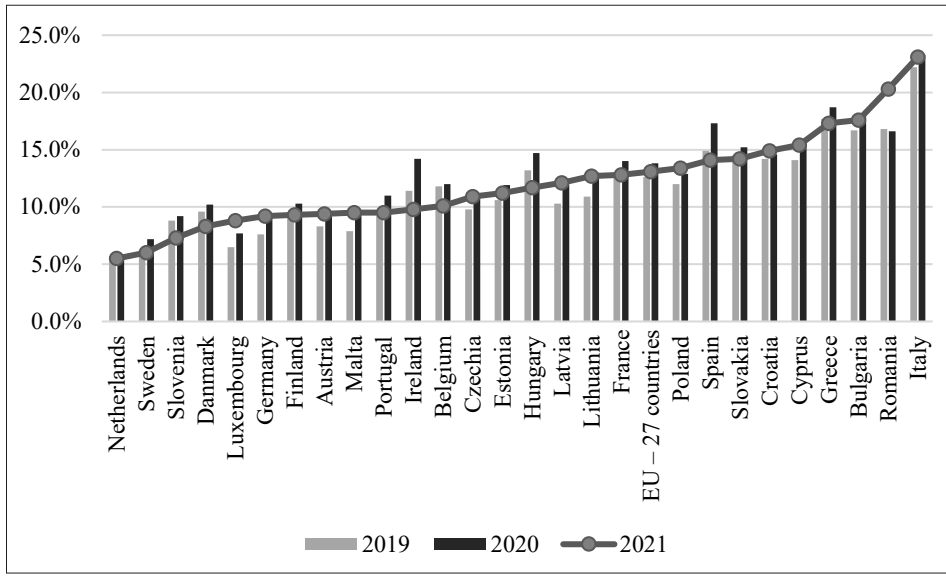

Figure 5. NEET rates (from 15 to 29 years of age) in European Union countries

Source: own research based on Eurostat.

In Poland, the percentage of workers with temporary contracts in 2021 was above the EU average, at 14.8% vs. 14.1% for the EU countries, but has been steadily declining since 2014, when it was almost twice as high as the EU average (28.3% vs. 15.2%).

The importance of temporary employment is greater in younger age groups – on average, about half of people in Poland aged 15–24 have temporary contracts, more than 20% of workers aged 25–34, one in eight workers aged 35–44 and, on average, one in nine workers aged 50–64.

In the 15–29 age group, the percentage of people with temporary contracts in Poland was higher than in the European Union in 2019, at 42.9%, 7.1 p.p. higher than the EU average (Figure 6). In the subsequent years, it fell in both cases, with Poland falling faster – in 2021 it was 33.3%, 2.2 p.p. lower than in the EU. It should be emphasised that temporary employment affects women more than men. The need to care for dependants (the elderly and children) should be emphasised as a reason for women's lower labour force participation, which was especially true during the pandemic period.

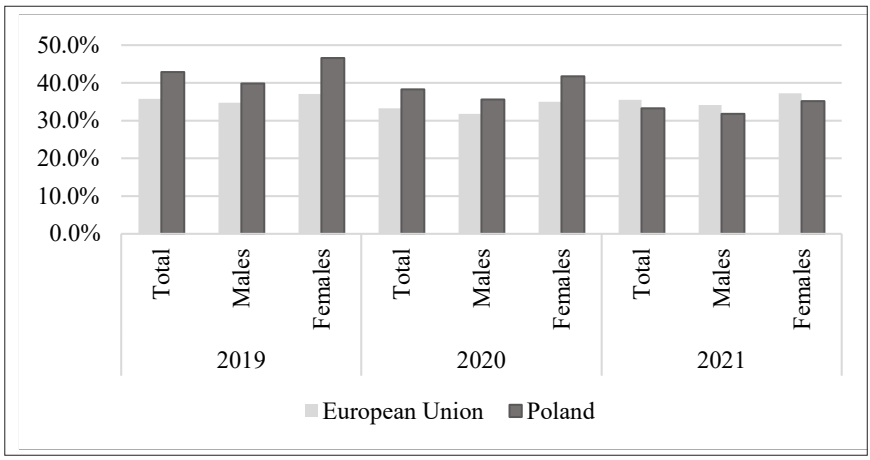

Figure 6. Temporary employees (from 15 to 29 years of age) by sex in European Union and Poland

Source: own research based on Eurostat.

The percentage of young people with temporary contracts in the EU countries is presented in Figure 7.

Among the reasons for temporary employment, the young respondents participating in survey conducted by Eurostat[2] primarily cited the inability to find permanent employment (32.3%). However, more than 22% of the young people did not feel the need to enter permanent employment, and one in five indicated

[2] The results of research conducted by Eurostat concern 2021 and a group of young people (15–29 years old). The results are part of the European Union Labour Force Survey (EU-LFS), which is conducted on a large sample of private households in EU Member States. The data in Poland were collected mainly with the use of telephone interviews (CATI method) and face-to-face interviews (CAPI method) (See: *Employment and unemployment…*, http).

probationary employment. Among other reasons declared were the availability of a specific job solely based on a temporary contract (13.2%) and the need to reconcile work and study (11.7%).

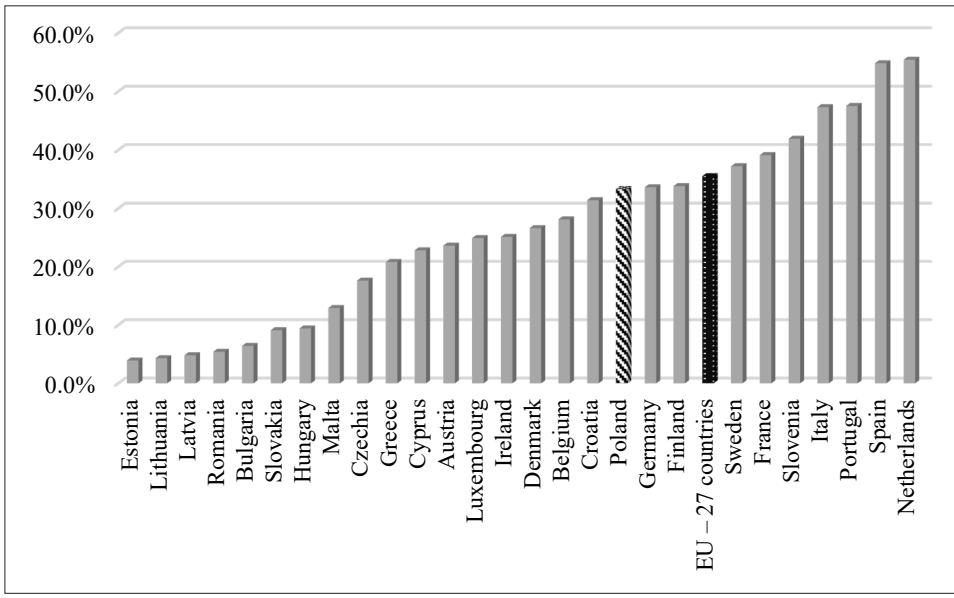

Figure 7. Temporary employees (from 15 to 29 years of age) in European Union countries

Source: own research based on Eurostat.

LABOUR MARKET IN THE COVID-19 PANDEMIC – THE PERSPECTIVE OF YOUNG RESIDENTS OF PODKARPACKIE PROVINCE

Podkarpackie Province is characterised by a low level of economic development in relation to other provinces and EU regions – it ranked 15th (out of 16) among provinces in terms of gross domestic product per capita, which in 2020 amounted to PLN 41,937 (GDP per inhabitant, properly converted, amounted to EUR 9,400 compared to the average for Poland and EUR 13,700 and the EU amounting to EUR 29,900), and last in terms of average gross monthly salary in the national economy, which in 2020 amounted to PLN 4707.81 and accounted for 85.2 percent of the national average. The province is characterised by the lowest share of population living in cities (41.4 percent of the population), resulting in a low urbanisation rate (10th place in the provincial ranking) (*Analiza sytuacji…*, 2021; *Analiza sytuacji…*, 2022, http).

The pandemic in Podkarpackie Province reduced industrial and service activities to the greatest extent. The largest number of unemployed people

registered at the end of 2020 previously worked in industrial processing plants and trade establishments – industrial workers and craftspeople, as well as service and sales workers accounted for almost half of the unemployed – 25.4% and 21.2%, respectively. Many young people find employment in trade and services. These people constituted the second largest group of the unemployed, behind the long-term unemployed. Although their share of the total unemployed fell by 0.3 p.p. in 2020 to 28.1%, their number increased by 3156 people – to 24,558, 56% of whom were women (*Analiza sytuacji…*, 2021).

The pandemic also affected the increase in the share of young people in the NEET group; like for the whole of Poland, the increase in Podkarpackie Province affected both men (from 9.6% in 2019 to 10.6% in 2020 and 12.4% in 2021) and women (20.9%, 21.8% and 22.1%, respectively). In 2021, 17.1% of young people constituted the NEET group, which is 3.7 p.p. higher than the average in Poland and 4.0 p.p. higher than in the European Union. Living in Podkarpackie Province, as a peripheral region, contributes to inclusion in the NEET group.

To verify the hypothesis, a survey was conducted from August to October 2022 at the Department of Economics and Management of the Institute of Economics and Finance at the University of Rzeszów. The aim of the survey was to assess the impact of the pandemic on the situation of young people in the Podkarpackie labour market.

The survey questionnaire, on the basis of which the study was conducted, contained twenty single- and multiple-choice questions concerning the situation of young people in the labour market during the pandemic, the changes made to employers and their opinions on changes in the labour market (Pietranowicz, 2022). To achieve the stated goal, this paper will present selected results.

Eighty young people participated in the study. The characteristics of the research sample are presented in Table 1.

Table 1. Study group structure

Criteria	Structure
1	2
Sex	Male – 33% Female – 67%
Age	18–24 – 57.5% 25–29 – 42.5%
Employment	Employed – 85% Unemployed – 15%
Education	University – 92.5% Secondary – 7.5% Elementary – 0%

1	2
Place of residence	Urban area up to 50K residents – 10% Urban area up 50K–100K residents – 5% Urban area over to 100K residents – 32.5% Rural areas – 52.5%

Source: own research.

The study found that young people experienced the consequences of the pandemic to a negligible extent personally; they were far more likely to indicate such experiences among relatives (Figure 8). The largest number of respondents experienced forced leave and/or a reduction in salary (10.5% of responses each), one in 13 people lost their jobs, and for 5%, retraining was necessary. Most of the respondents did not experience the indicated consequences, nor did their loved ones.

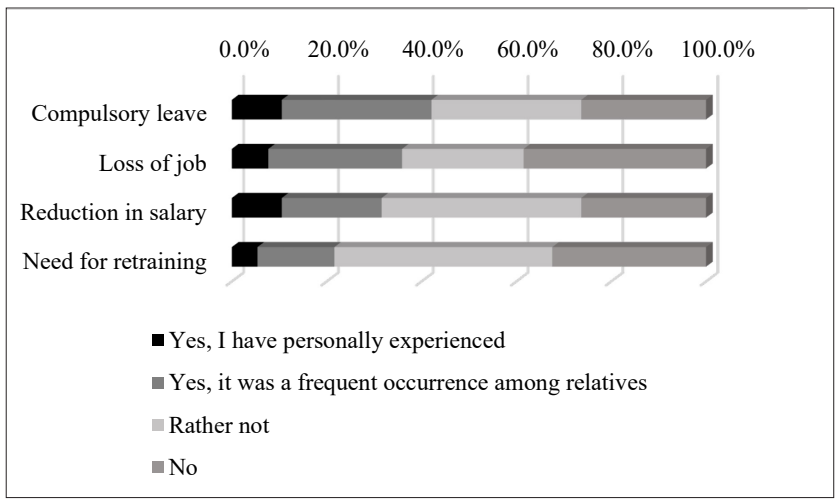

Figure 8. Consequences of the pandemic as experienced by respondents

Source: own research.

The changes experienced by respondents as a result of the pandemic are reflected in their household budgets. Nearly two-thirds of them said they had not felt any financial changes in their lives, as the employer who employed them had not reduced spending on workers' salaries (Figure 9). This may also be because the salaries of young people are mostly not high – they often receive the lowest national salaries, hence the inability to reduce them. Half of those who had felt the financial consequences of the pandemic did so due to job cuts (10%), salary reductions (5%) or withholding of bonuses (2.5%). The remainder (17.5%) did not indicate specific changes or reasons for them.

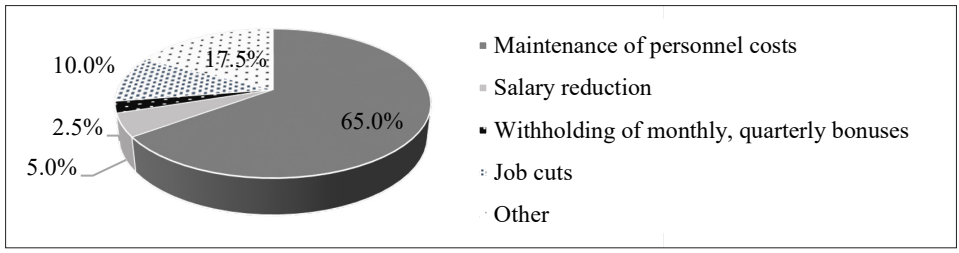

Figure 9. Financial changes caused by the COVID-19 pandemic

Source: own research.

Young people confirmed their favourable situation by answering a question about competition in the labour market related to job cuts. Nearly one in three respondents said that there were no layoffs at their employer, and ¼ of the respondents worked in industries where operations had not been suspended. Almost as many saw themselves as experienced and valuable employees, which is due to a large diversity of the surveyed group, which includes both learners and those with several or even more years of work experience. A large proportion of the respondents were not worried about their jobs, but some of them confirmed the existence of competition, which is mainly related to the awareness of their lower value as an employee, since, as indicated, jobs are sought by many valuable, skilled workers (18% of responses) (Figure 10). In addition, employers do not always use objective criteria in the selection process of job candidates (18% of responses). Another factor contributing to job anxiety was competition within the organisation (12% of responses).

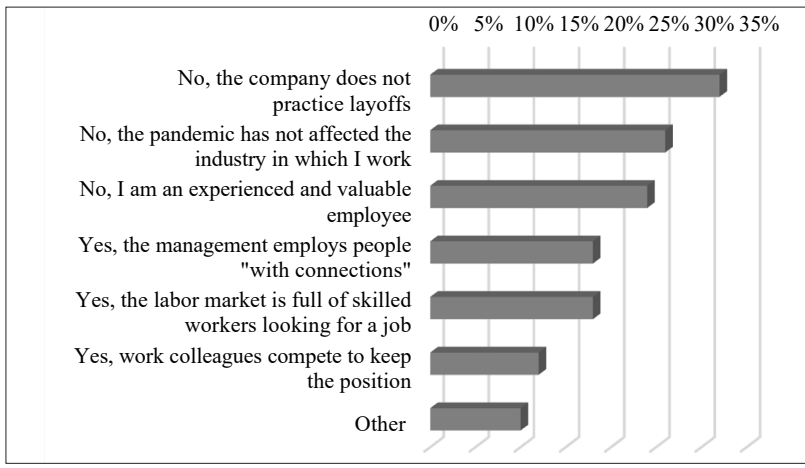

Figure 10. Respondents' sense of competition related to job reductions

The number of responses does not add up to 100% as the respondents could select multiple answers.

Source: own research.

Another consequence of the pandemic was employers implementing many organisational changes. A large number of respondents (38%) said that no changes had been implemented, while 6% had no knowledge of this, which may be due to their finding employment after the introduction of restrictions (Figure 11). Many respondents mentioned that hybrid (36% of responses) or remote (34% of responses) work was introduced. A less common solution was to work in a two-shift mode (8% of responses). In the case of in-person work, employers took care to maintain social distance and, due to this necessity, the number of positions in one room was reduced (18% of responses).

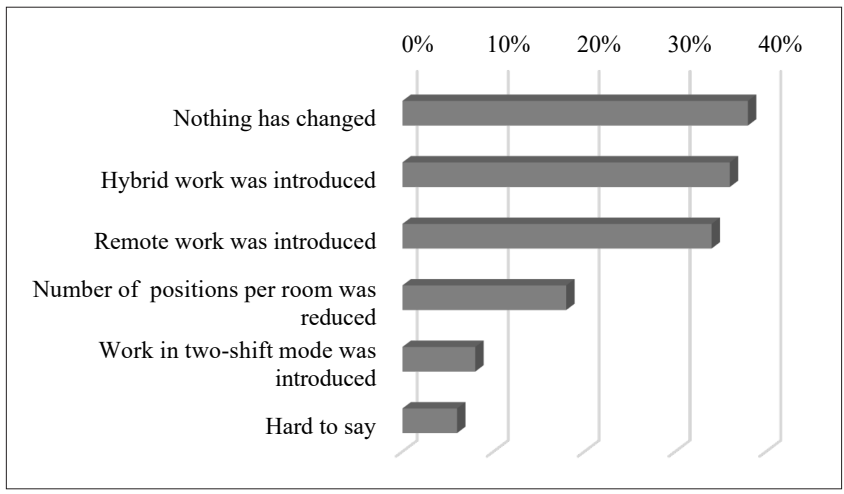

Figure 11. Organisational changes at the respondents' companies in connection with the pandemic

The number of responses does not add up to 100% as the respondents could select multiple answers.

Source: own research.

A corollary of the improvements of an organisational nature, and often a necessity, was the introduction of new solutions – systems that required employees to acquire additional or develop their existing skills. Due to the insignificant changes implemented at most of the respondents' companies, almost half of those surveyed (48%) said that no new solutions requiring new qualifications had been implemented at the company. Only 2% of those participating in the survey confirmed that such solutions had been implemented throughout the company, and 22% in selected departments.

The organisation and performance of the respondents were also affected by new solutions, in the form of an e-signature or trusted profile, among others, as well as on the issue of less reliable identity verification. More than half of the respondents (55.8%) said that such solutions had not been implemented at

their workplace. In the opinion of almost 20% of the respondents, the indicated solutions have improved their work, as they provide a faster and easier method of communication with other entities than before (i.e., direct) (Figure 12). The remaining respondents perceived the introduced changes as a hindrance to their professional duties – for 12%, they increased the scope of duties and the time spent on necessary verification, according to 7%, the authentication process hindered communication, and in the opinion of almost 5%, direct contact produced more favourable results from cooperation with the company's partners. 2% of the respondents stressed that the employer did not protect itself from online fraud, and suffered losses as a result.

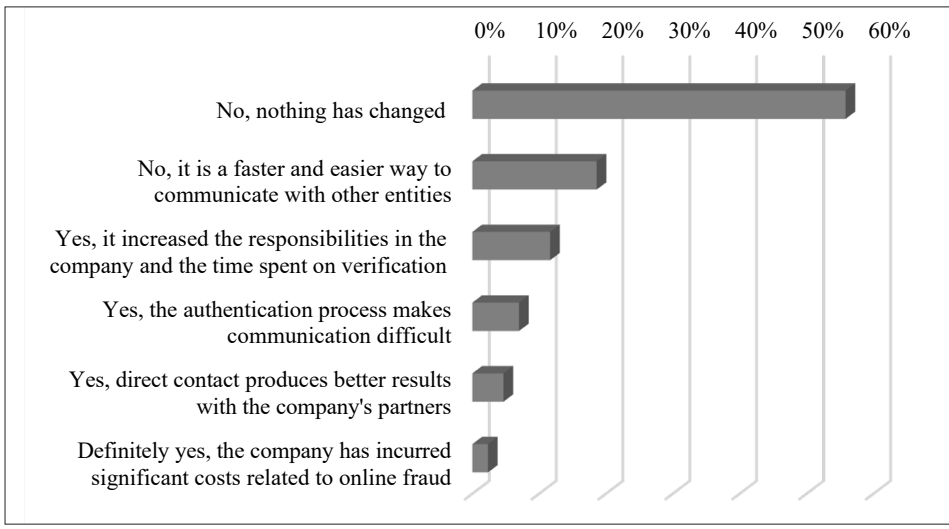

Figure 12. Impact of new obstacles (electronic signature, trusted profile, reduced credibility of identity verification, etc.) on work

Source: own research.

Young people were also asked about the effects of the pandemic that they felt could be described as "positive". The respondents said that the pandemic, and the consequential lockdown, allowed them to pursue several issues at the same time, such as working and studying (50%). It should be emphasised that the new work organisation did not provide a rationale for reconciling their professional and personal life – only one in seven respondents pointed to opportunities in this regard. To a large proportion of respondents (42%), the pandemic enabled savings due to the absence of the need to pay for both public and private transportation (ticket costs, fuel expenses, etc.). The same percentage of young people confirmed that they had more time for themselves, which does not mean that this time is better organised – such an answer was given by only 32% of the respondents.

Young people used the "saved" time to sleep longer (40%), they also devoted it to their loved ones (36%) (Figure 13).

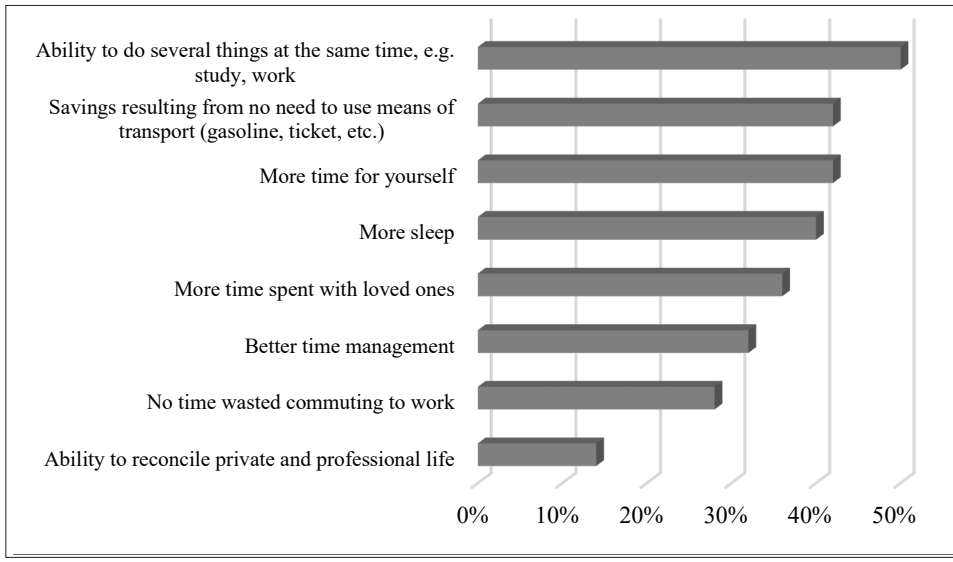

Figure 13. Positive effects of the pandemic in the opinion of respondents

Source: own research.

ANALYSIS AND DISCUSSIONS

The effects of macroeconomic conditions, such as pandemic-related constraints, among others, are particularly severe for young people (Bell, Blanchflower, 2011b; Blanchflower, Oswald, 2011) as this group is more vulnerable to negative changes in the labour market (Koptiew, 2014).

Indeed, some industries are attractive to them because of the type of work they perform and the competence requirements. The share of young people in these is higher than that of older people, and this applies to activities such as hotel services, catering and trade, among others (*"Pokolenie Lockdown"...,* http), unlike, for example, in education or public administration (Grotti et al., 2019). Industries that employ young people, in particular, have been particularly hard-hit by pandemic-related constraints. The crisis caused by COVID-19 also significantly affected their employment opportunities – the increase in the number of young unemployed as soon as the first quarter of 2020 shows that many of them lost their jobs after the pandemic was declared. In addition, more people entering the labour market contributed to an increase in unemployment in the age group studied, exacerbating the trend.

In addition, due to their lack of experience, expertise, and skills, the employment of young people is often provided on unfavourable terms. It is also easier to terminate their employment, which was the case during the pandemic – there was then a decline in the share of people employed with temporary contracts. As PEI (Polish Economic Institute) calculates, with the decrease in the number of people insured under employment contracts and civil law contracts, the number of people insured under self-employment increased, which may indicate a flow of people into the self-employment zone (Sawulski, 2020).

At the same time, the results of surveys conducted in Podkarpackie Province prove that young people have not been significantly affected by the negative consequences of the pandemic. First of all, most of the respondents did not lose their jobs or were not forced to change them. The employers of many of them also did not reduce personnel costs, did not introduce new systems requiring adaptation in the form of training, among other things. This resulted in the maintenance of the current standard of living for most of the respondents. These observations do not confirm the proposed hypothesis, which may be due to the fact that some of the respondents were employed in sectors that did not experience the negative effects of the pandemic. Some respondents have professional experience, despite their young age, and describe themselves as valuable employees.

Some of the respondents adapted relatively easily to the new situation and solutions implemented by their employers. However, for most of those whose employers implemented new solutions, they were a hindrance.

It should be emphasised that the organisational changes introduced in many enterprises during the pandemic, the development of innovative platforms and advanced digital solutions, are based on flexibility, which is the basic advantage of the sharing economy. Flexible working also allows for better use of employees' potential (Kelliher, Menezes, 2019), providing a way for companies to achieve a competitive advantage. The sharing economy allows companies to reduce costs (Munger, 2018; Munger, 2021) and create a new way of organising business activity, replacing traditional solutions.

The younger population is more likely to use IT tools (Vinod, Sharma, 2021), but flexibility, although important, is not the main positive characteristic of their employment (*Young people's experiences…*, http).

Young people affected by the pandemic are aware of their value in the labour market. Their experience makes them see themselves as valuable, while a lack of experience shapes the awareness of their lack of qualifications.

According to the respondents, the pandemic has also produced positive effects consisting primarily of improving the efficiency of performing one's own duties (not only professional), focusing more on one's needs and spending time together with loved ones. It also produced savings of a financial nature.

However, it should be noted that the notion "positive" applies to short term effects, since one consequence of social isolation is the deterioration of young people's mental health. Hence, the solutions presented generate benefits for both employees and employers, primarily in terms of optimising or saving time and costs. However, in the long run, especially for young people, they pose a major threat affecting their professional and private lives. Indeed, those entering the labour market during the pandemic will incur significant costs of this situation, both short- and long-term. Primary among these is an increase in unemployment, which affects wages, as well as an increase in mental health expenses. Global short-term costs are estimated to total $1.7 trillion, including $407 billion in mental health expenses and $1,294 billion in lost wages. In the long term, the cost of the pandemic will be $44 trillion, determined primarily by a reduction in education during the pandemic, as well as an increase in permanent unemployment caused by the crisis. As a result, the future earnings of those entering the labour market at that time will be reduced – those currently in education by 6.2%, and young people currently in the workforce by 4% (Kutwa, 2021). The difficulties experienced by those entering the labour market during the crisis result in significantly lower earnings for up to 15 years (Schwandt, von Wachter, http).

It is emphasised that young people are likely to find employment more quickly in lower-paid, lower-skilled occupations where there is less competition from older workers (Grotti, Russell, O'Reilly, 2019). It should be concluded that the pandemic crisis has exacerbated career insecurity in its early stages (O'Reilly et al., 2019).

The limitation of the study is the analysis of a non-representative sample of the population, as well as the fact that it does not have a directly comparable base value in the sample for the data analysed before COVID-19.

The obtained results cannot be generalised to the whole population. The respondents' answers are influenced by the cultural, social and economic conditions of young people, which were not taken into account in the study.

Further studies are needed to examine this topic.

CONCLUSIONS

The considerations carried out show that young people were strongly affected by the COVID-19 pandemic, especially immediately after its announcement. In particular, the pandemic affected an increase in unemployment among this group. Moreover, looking for a job – often for the first time – at a time of limited job vacancies and strong competition from experienced workers further hinders labour force participation.

The pandemic has exacerbated existing crises affecting young people. Even before the outbreak of the pandemic, many young people were not working, not in education or training (NEET), and this group increased after the announcement of the restrictions. This results in a problem for young people to determine their future life and career path. The crisis caused by the pandemic has limited their opportunities for professional development, and for gaining attractive employment. The pandemic will have a long-term negative impact on the professional situation of young people, and on their personal and family life.

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Summary

The COVID-19 pandemic has had a significant impact on the work and life of young people. Against this group, less favourable values of employment and unemployment rates are recorded than for experienced people, due to their lack of work experience, specialist knowledge and skills. These premises are the basis for employing young people with less favourable contract terms.

The purpose of the paper was to assess the impact of the COVID-19 pandemic on the situation of young people in the labour market. To achieve the goal, an analysis of the literature on the subject, studies and reports presented on the websites of institutions dealing with the labour market was carried out, as well as an analysis of basic labour market measures using statistical data. Own research was also carried out.

The analyses of the literature and statistical data showed that young people were particularly hard-hit by the consequences of the pandemic – unemployment in this group increased significantly and the percentage of NEET increased. In addition, the entry of new generations into the labour market contributed to the difficulty in keeping a job.

At the same time, the results of research conducted among young people from Podkarpackie Province prove that the respondents did not suffer significantly from the negative consequences of the pandemic. Most of them did not lose their jobs and were not forced to change their jobs. Many employers did not reduce personnel costs, which made it possible for them to maintain their current standard of living.

Keywords: pandemic, young people, labour market, unemployment, NEET.

Wpływ pandemii na sytuację młodych osób na rynku pracy

Streszczenie

Pandemia COVID-19 znacząco wpłynęła na życie zawodowe młodych osób. Wobec tej grupy odnotowuje się mniej korzystne wartości wskaźników zatrudnienia i stopy bezrobocia niż w odniesieniu do osób doświadczonych, co wynika z braku doświadczenia, specjalistycznej wiedzy i umiejętności. Te przesłanki stanowią podstawę do zatrudniania młodych osób na mniej korzystnych warunkach. Jako cel opracowania przyjęto ocenę oddziaływania pandemii COVID-19 na sytuację młodych osób na rynku pracy. Aby zrealizować cel przeprowadzono analizę literatury przedmiotu, opracowań i raportów prezentowanych na stronach instytucji zajmujących się rynkiem pracy, analizę podstawowych mierników rynku pracy przy wykorzystaniu danych statystycznych. Zrealizowano również badania własne.

Analiza literatury i danych statystycznych ukazała, że młode osoby szczególnie dotkliwie odczuły konsekwencje pandemii – znacznie wzrosło bezrobocie w tej grupie, zwiększył się odsetek osób, które nie pracują i nie kształcą się (NEET). Ponadto, trudność w utrzymaniu pracy przez młode osoby stanowiło wejście kolejnych roczników na rynek pracy.

Jednocześnie, wyniki przeprowadzonych badań własnych wśród młodych osób z województwa podkarpackiego dowodzą, że respondenci nie odczuli znacząco negatywnych konsekwencji pandemii. Większość z nich nie straciła pracy czy nie została zmuszona do jej zmiany. Pracodawcy wielu nie zredukowali kosztów osobowych, co umożliwiło utrzymanie dotychczasowego poziomu życia.

Słowa kluczowe: pandemia, młode osoby, rynek pracy, bezrobocie, NEET.

JEL: J21, J24, J64, R23.

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