ARTÍCULO PRODUCTO DE INVESTIGACIÓN

The impact of selected variables on the unemployment rate in a given region

El impacto de las variables seleccionadas en la tasa de desempleo de una región determinada

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Abstract

Unemployment is a permanent element of the market economy that negatively affects the entire society. This research aims to analyze the impact of selected variables on the unemployment rate. The scope of the research covered the years 2009 to 2023, and their analysis was carried out using an econometric model, which allowed for the estimation of the impact of selected variables on the unemployment rate. The analysis showed that increasing the demographic burden and the number of people has a significant impact on reducing the unemployment rate. The values of the determination coefficient suggest that the model describes the unemployment phenomenon well. Although the time series showed a downward trend for the unemployment rate, the possible forecasting was burdened with too much error. The research results can contribute to a better understanding of the factors influencing the unemployment rate. Appropriate adjustment of educational programs related to the obtained

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results can contribute to reducing the unemployment rate and improving the situation in the local labour market.

Keywords: unemployment rate, econometric analysis, statistical models, multiple regression, labour productivity, forecasting, employment dynamics

Resumen

El desempleo es un elemento permanente de la economía de mercado que afecta negativamente a toda la sociedad. Esta investigación tiene como objetivo analizar el impacto de las variables seleccionadas sobre la tasa de desempleo. El ámbito de la investigación abarcó los años 2009 a 2023, y su análisis se llevó a cabo utilizando un modelo econométrico, que permitió estimar el impacto de las variables seleccionadas en la tasa de desempleo. El análisis mostró que el aumento de la carga demográfica y del número de personas tiene un impacto significativo en la reducción de la tasa de desempleo. Los valores del coeficiente de determinación sugieren que el modelo describe bien el fenómeno del desempleo. Aunque las series temporales mostraban una tendencia a la baja de la tasa de desempleo, la posible previsión estaba lastrada por un error excesivo. Los resultados de la investigación pueden contribuir a una mejor comprensión de los factores que influyen en la tasa de desempleo. Un ajuste adecuado de los programas educativos relacionado con los resultados obtenidos puede contribuir a reducir la tasa de desempleo y mejorar la situación del mercado laboral local.

Palabras clave: tasa de desempleo, análisis econométrico, modelos estadísticos, regresión múltiple, productividad laboral, previsión, dinámica del empleo

Introduction

In a market economy, unemployment is considered a permanent element. It occurs and causes many negative effects on economies all over the world (Kozek, 2013, p. 38). It can affect people of all ages. It often means a complete or almost complete lack of means of living. Its effects are also felt by the families of the unemployed. Therefore, we talk not only about the economic effects of lack of work but also about social and psychological ones. The most severe problem is long-term unemployment (Wojdyło-Preisner, 2013, p. 137). As T. Budnikowski (2009, p. 221) notes, similarly in Poland, it was the biggest problem at the beginning of the 21st century.

The unemployment phenomenon itself occurs when the demand for employees is lower than the supply. In such a case, market activities aim to increase employment, for example through state orders (Wiśniewski, 2012, p. 12). Increasing employment should function until the so-called natural unemployment is achieved, which according to A. Szydlik-Leszczyńska (2012, pp. 17-18) means a situation when every job seeker receives it or an offer of employment within a short period, on terms generally accepted in a given region.

An unemployed person is a person who is not employed and does not perform any other gainful work, is capable and ready to take up employment, does not study full-time, and is registered with the district labour office (Paluszkiewicz, 2023, p. 16). The category of unemployed also does not include people who in the last month earned an income not exceeding half of the minimum wage in a given region (Budnikowski, 2009, pp. 222-223).

In economic theory, unemployment is divided into categories distinguished according to various criteria, which results from the multifaceted nature of this phenomenon. It can be structural and cyclical unemployment or voluntary and involuntary or frictional unemployment. [2](Sztanderska, Socha, 2000, pp. 14-15).

[2] Frictional unemployment is related to the normal dynamics of the labour market (Kwiatkowski, 2007, p. 46).

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Frictional unemployment also includes people who voluntarily do not take up the work offered to them, for personal or economic reasons. Therefore, there will always be a certain level of frictional unemployment in the labour market, which depends on the number of people leaving and entering the labour market, and on the number of jobs created and liquidated. Reducing this type of unemployment can take place by increasing the availability of information or through the actions of employment agencies (Madras-Kobus, Rogowski, 2013, p. 100).

Structural unemployment combines frictional and institutional unemployment (Sztanderska, Socha, 2000, p. 26). As a rule, it is about the mismatch of supply and demand of labour force on local markets, which may be caused by the implementation of technological progress, uneven geographical distribution of capital or changes in foreign trade. Unemployment poses a major threat to the harmonious development of the labour market. According to M. Gersdorf et al., the lack of jobs results primarily from high labour costs, as well as from the existing protective provisions of labour law (Gersdorf et al., 2012, pp. 12-13).

Among the effects of the impact of human resources on work, we can distinguish: the employee effect, the allocation effect, the research effect and the diffusion effect (Grodzicki, 2013, p. 43). The employee effect of the impact of human capital on work also called the effect of own productivity, means positive marginal productivity of education, which can be explained by the fact that a better-educated employee is often more effective (Madras-Kobus, Rogowski, 2013, p. 101). The allocation effect assumes that a higher level of education of an employee maximizes the marginal value of production, which reduces the costs of acquiring important information and increases the benefits of using it (Mikuła, 2006, p. 198).

The scientific and research effect means stimulating scientific research through education. High qualifications become necessary in conducting development research, which is the basis of technical progress, as well as an increase in the productivity of the economy (Dąbrowski, 2016, p. 157). The diffusion effect is an increase in the degree of acceptability of organizational changes depending on the level of education. Education becomes a factor accelerating the process of developing new technologies. A higher level minimizes the risk of

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making bad decisions, and increasing the number of employees with high qualifications speeds up the possibility of using modern technologies (Madras-Kobus, Rogowski, 2013, p. 102).

Unemployment causes a decrease in the value of human capital. The unemployed not only do not create new material values, but they consume values that others have created. Labour productivity is growing faster than the demand for modern products or services. This contributes to various qualitative changes in professions and workplaces. In the 21st century, there is an increase in demand for new qualifications requiring specialized education (IT, robotics, digitization), while the demand for traditional work (saddlery, blacksmithing, carpentry) is decreasing. Society is striving for multi-professionality and for educating people with many competencies because it will be easier for them to change professions and adapt to the needs of the labour market (Nasiłowski, Smolaga, 2016, p. 149).

In the face of dynamic changes in global markets, it is becoming important to take effective measures to reduce unemployment and improve the skills of those employed. Governments, educational institutions and employers should work together to adapt education and training programs to the requirements of the modern labour market. It is also necessary to develop policies supporting professional mobility and the reintegration of the long-term unemployed. Strengthening human capital, through investments in education and continuous development of skills, will not only benefit individual employees but will also contribute to overall economic growth. Unemployment, being a complex phenomenon, requires an interdisciplinary approach and integrated strategies. In an era of technological progress and globalization challenges, communities must adapt to new realities, ensuring that everyone has the tools to actively participate in the labor market. Only through joint efforts can the negative effects of unemployment be counteracted; a stable and flexible economy be built and a vision of the future created in which everyone has the chance for decent work and personal development. Therefore, it is necessary to continue research into analyzing the many variables that may influence the unemployment rate in a given region to reduce it.

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The article consists of seven parts. The first part discusses unemployment and the registered unemployment rate. The second part describes the methodology of the author's research, specifying the aim of the study, the main research problem and the research tools. The remaining parts concern econometric and statistical analyses. At the beginning, the necessary assumptions regarding the formulation of the research hypothesis were adopted, then a set of variables was selected and the model was estimated, the coefficients of determination and mean errors of estimation were presented and the model was statistically verified. Finally, an attempt was made to forecast with the calculation of the mean values of forecast errors.

1. Own research methodology

The unemployment rate is most often used for the quantitative analysis of the unemployment phenomenon, which is most often represented by the registered unemployment rate, which uses labour market statistics. Such an unemployment rate is calculated as the quotient of the number of registered unemployed and the number of the economically active population, but excluding people doing military service and employees of national defence and public security (Madras-Kobus, Rogowski, 2013, p. 102).

The economically active population includes people who work in public and private sector entities, but also unemployed people. The unemployment rate is given taking into account all employed people, including those working on farms. Their number is estimated based on the National Population Censuses and the Agricultural Census, carried out by the Central Statistical Office (Rozkruta et al., 2022). The registered unemployment rate does not include unemployed people who have not registered with the office, which results in an underestimation of the actual unemployment rate.

The set of administrative units that will be included in the constructed model are the communes of the Wielkopolska province, including cities with county rights. Data taken from the local database of the Central Statistical Office will create the following subsets (Table 1):

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income per capita (*d_1m*) – PLN,

population size (*LL*),

demographic burden per 100 persons of working age (*wsk_100*),

registered unemployment rate (*sbr*) – %.

Table 1. Data set (explanatory variables and explained variable *sbr*)

LP.	Year	d_1m income per capita	LL population	wsk_100 demographic burden	sbr registered unemployment rate
		PLN		/100 people	%
1.	2009	2852	3408281	53.9	9.20
2.	2010	3007	3446745	54.2	9.20
3.	2011	3185	3455477	55.1	9,10
4.	2012	3387	3462196	56.0	9.80
5.	2013	3437	3467016	57.1	9.60
6.	2014	3590	3472579	58,4	7,60
7.	2015	3852	3475323	59,7	6,10
8.	2016	4396	3481625	61,3	4,90
9.	2017	56448	3496821	61,8	5,49
10.	2018	59865	3505302	62,9	4,89
11.	2019	64801	3513783	64,0	4,29
12.	2020	66499	3522265	65,1	3,69
13.	2021	74224	3530746	66,2	3,09
14.	2022	75673	3500000	67,2	3,30
15.	2023	82642	3487973	68,3	3,00

Source: Local Data Bank of the Central Statistical Office

The explained variable is *sbr* in percentage (registered unemployment rate), the remaining variables will become explanatory variables. The created subsets will be used to answer the

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question of how explanatory variables can affect the explained variable in the form of the registered unemployment rate.

The aim of the research, understood as the pursuit of achieving significant and true knowledge and using it in practice (after Nowosielski, 2016, p. 471), included demonstrating that the assumed explanatory variables (income per capita, population size and demographic burden) affect the unemployment rate registered in the communes of the Wielkopolska voivodeship. The main research problem was formulated as the following question: How do income per capita, population size and demographic burden affect the unemployment rate in a given region?

The following research methods were used in the research: statistical, econometric and graphical as well as research tools in the form of software: GRETL, and EXCEL.

2. Formulation of the research hypothesis

Model hypothesis record:

$sbr_t = \alpha_0 + \alpha_1 \cdot d\_1m_t + \alpha_2 \cdot LL_t + \alpha_3 \cdot wsk\_100_t + \varepsilon_t$(Gładysz, Mercik, 2007. p. 9),

Where:

sbr_t– time-varying registered unemployment rate *t (%)*

d_1m_t– per capita income variable (*PLN*)

LL_t-population variable

wsk_100_t– demographic dependency ratio variable

$\alpha_0, \alpha_1, \alpha_2$– estimators of unknown parameters,

ε_t– random effect.

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3. Selecting a set of variables, estimating and interpreting model parameters

The selected set of explanatory variables shows the degree of the number and wealth of people living in the Wielkopolska region in the years from 2009 to 2023. Income per capita *is* one of the most commonly used measures of economic growth of a region, voivodeship, or country in the world (Kozak, 2024, p. 10). The demographic structure has an immediate and direct impact on the dynamics of economic development per capita in a given region (Florczak, Przybyliński, 2016, p. 397). On the other hand, demographic burden shows how many people of non-working age fall per 100 people of working age. The lower this indicator, the better the economic situation of the region (Nasiłowski, Smolaga, 2016, p. 15).

The linear econometric model for a given explained variable and selected explanatory variables was estimated using the classical least squares method – KMNK. KMNK estimation, observations used: *1-15*; dependent variable: *sbr*. – Model 1 [calculations were performed using the GRETL program].

Model 1: KMNK estimation, using observations 2009-2023 (N = 15). Dependent variable (Y): sbr

	Factor	*Standard error*	*t-Student*	*p-value*	
const	-4510.80	848,866	-5.314	0.0003	***
YEAR	2.35344	0.438029	5,373	0.0003	***
d_1m	1.53622e-06	7.71115e-06	0.1992	0.8461	
LL	-2.02324e-05	7.17851e-06	-2.818	0.0182	**
wsk_100	-2.58640	0.386687	-6.689	<0.0001	***

Mean arithmetic mean of dependent variance	6.216667	Dependent standard deviation	2.605987

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Sum of squared residuals	1.638993	Standard error of residuals	0.404845
Coefficient of determin. R-squared	0.982761	Adjusted R-squared	0.975866
F(4, 10)	142.5225	P-value for F-test	9.00e-09
Log-likelihood	-4.679315	Akaike Information Crit.	19.35863
Bayes crit. Schwarz	22.89888	Hannan-Quinn Crit.	19.32092
Autocorrel.residual - rho1	0.044392	Durbin -Watson Stat.	1.846409

Linear econometric model for the dependent variable and explanatory variables:

$$sbr_t = -4510{,}80 + 0{,}000001536 \cdot d\_1m_t + 2{,}35344 \cdot LL_t - 2{,}58640 \cdot wsk\_100_t$$

Interpretation of model parameter estimates:

- $0{,}000001536 \cdot d\_1m_t$– means that an increase in income per capita by PLN 1 will result in a negligible increase in the unemployment rate by 0.000001536%, with other factors remaining unchanged,
- $-\,0{,}00002353 \cdot LL_t$– means that an increase in the population in the region by 1 person will result in a minimum decrease in the unemployment rate by 0.000023%, with other factors remaining unchanged,
- $-2{,}58640 \cdot wsk\_100_t$– means that an increase in the demographic burden per 100 persons of working age by one unit will result in a decrease in the unemployment rate by 2.58640%, with other factors remaining unchanged.

4. Interpretation of determination coefficients and mean errors of estimate

The value of the coefficient of determination R^2 = 0.982761 means that 98% of the total variability of the unemployment rate was explained by the variability of the factors included in the model, while 2% of this variability is random. The model fit is therefore very good. The value of the adjusted coefficient of determination R^2_{sk}= 0.975866 is lower, but also very high.

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In the case of adopting a different number of explanatory variables (based on the same statistical data), the best-fitting model can be selected, and the criterion for this selection is the highest value of this coefficient. The values of the mean errors of parameter estimation and the mean relative errors of parameter estimation are presented in Table 2.

Table 2. Values of mean errors of estimation and mean relative errors of estimation of parameters

Factor	Parameter	Mean errors of parameter estimation	Mean relative errors of parameter estimation
const	-4510.80	848,866	18.82%
d_1m	2.35344	7.71115e-06	0.0003%
LL	0.00007	7.17851e-06	10.26%
wsk_100	-2.58640	0.386687	14.95%

Source: own study based on Model 1

Interpretation of mean errors of parameter estimates:
. when estimating the parameter for the free term we are wrong on average by +/- 848.87,
. with per capita income we are wrong on average by +/- 0.0000077,
. with the population number, we are wrong on average by +/- 0.0000072,
. with the demographic burden per 100 people of working age, we are wrong on average by +/- 0.3867.
All values of the mean relative error of estimation range from 0.0003% to 18.82% < 50%, hence the adopted model can be assessed positively.

5. Statistical verification of the model

In the estimated model, parameters significantly different from zero were marked at the end of the line with additional symbols (***) or (**), the lack of asterisks means a variable is statistically insignificant. In the studied case:
. *intercept = 0.0003 < 0.001,*
. *pd_1m = 0.8461 > 0.05,*

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. pLL = 0.0182 = < 0.05,
. pwsk_100 < 0.0001.

As can be seen, the above-mentioned variables have a statistically significant impact on the unemployment rate in the communes of the Wielkopolska region, including cities with county rights, with the exception of the variable of income per capita.

Snedecor test (F-statistic) allows for an overall assessment of the usefulness of the econometric model. The results of this test are *F(4, 10) = 142.5225* for the *p-value < 9.00e-09 = 0.00000001*. It follows that the estimated model contains significant variables.

The assessment of the degree of model fit to empirical data was performed by estimating the standard error of residuals (standard error of model estimate) $S_e = 0.4048$ and the coefficient of residual variation: $V_e = \frac{S_e}{\bar{y}} = \frac{0{,}4048}{6{,}2167} = 0{,}06511$, which informs about what part of the mean value of the explained variable is the standard error of estimation. The permissible limit value was set at $V_{e-max} = 0{,}1 > V_e = 0{,}06511$(Wątroba, 2011, p. 36), so the model is suitable for practical use.

Assessment of the normality of the residual component distribution: test statistic: Chi-square(2) = 3.798 with p-value = 0.14971 > 0.10, which means that the residual distribution has the characteristics of a normal distribution – Figure 1.

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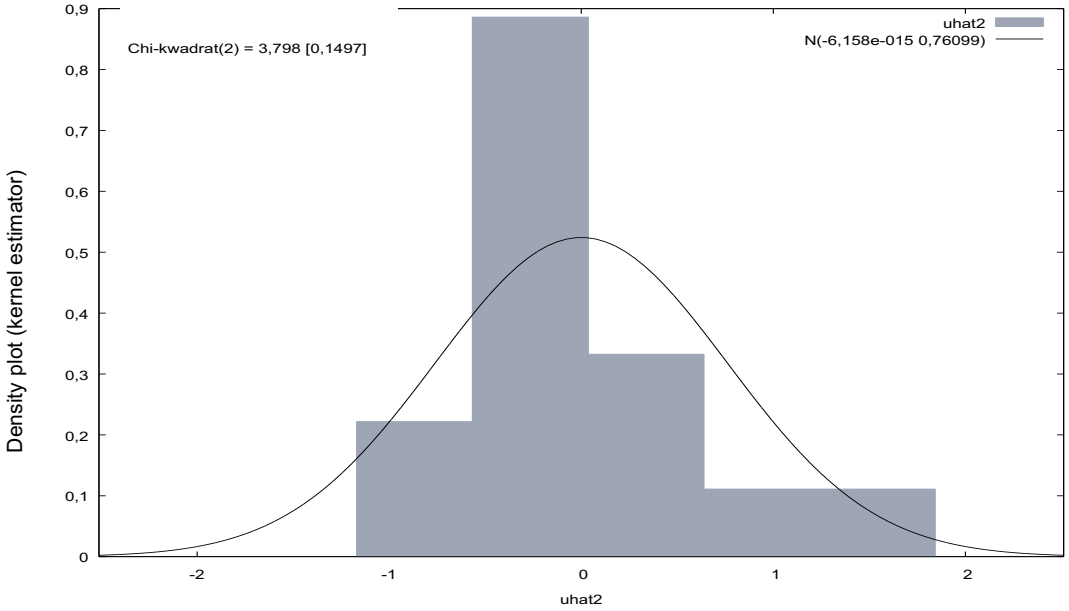
Figure 1. Test for normality of residual distribution [Gretl]



Source: Author's own work

Frequency distribution for uhat2; observations 1-15;

number of intervals = 5; mean = -0.0000000000000062; std dev. = 0.760995

Compartments	mean	number	frequency	accumulated
< -0.56656	-0.86756	2	13.33%	13.33% ****
-0.56656 to 0.035449	-0.26555	8	53.33%	66.67% **********
0.035449 to 0.63745	0.33645	3	20.00%	86.67% *******
0.63745 to 1.2395	0.93846	1	6.67%	93.33% **
>= 1.2395	1.5405	1	6.67%	100.00% **

Null hypothesis: the empirical distribution function is normally distributed. Doornik - Hansen test (1994) - transformed skewness and kurtosis.: Chi-square(2) = 3.798 with p-value 0.14971

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Assessment of the homogeneity of the variance of the residual component.

White's test for heteroscedasticity of residuals (variance of residual).

KMNK estimation, using observations 2009-2023 (N = 15)

Dependent variable (Y): uhat^2

coefficient standard error Student's t-value p

---

const 6247.95 22707.3 0.2752 0.7942
d_1m −0.000302689 0.0625029 −0.004843 0.9963
LL −0.00411463 0.0120209 −0.3423 0.7461
wsk_100 29.8913 348.538 0.08576 0.9350
sq_d_1m −1.19486e-09 7.92914e-09 −0.1507 0.8861
X2_X3 −1.62575e-010 1.85548e-08 −0.008762 0.9933
X2_X4 1.51615e-05 3.80569e-05 0.3984 0.7068
sq_LL 6.58347e-010 1.95924e-09 0.3360 0.7505
X3_X4 −7.53743e-06 0.000112179 −0.06719 0.9490
sq_wsk_100 -0.0335910 0.373383 -0.08996 0.9318

The data matrix is singular.

Coefficient of determin. R-squared = 0.348855

Test statistics: TR^2 = 5.232827,

with p-value = P(Chi-square(9) > 5.232827) = 0.813558

The test statistic: $TR^2 = 5.232827$ with p-value = P(Chi-square(9) > 5.232827) = 0.813558, that is $TR^2 = 5.232827 < \chi^2(10\%, 9) = 14.6837$ (critical value), which means that variance is homogeneous. It follows that all outlier observations were correctly described by the model.

Nonlinearity test (logarithms). Auxiliary regression equation for nonlinearity test (logarithms of variables). KMNK estimation, using observations 2009-2023 (N = 15)

Dependent variable (Y): uhat.

coefficient standard error Student's t-value p

---

const −97326.3 46493.2 −2.093 0.0697 *
d_1m 0.000322964 0.000132942 2.429 0.0412 **
LL −0.00196682 0.000953796 −2.062 0.0731 *
wsk_100 −8.10769 4.37014 −1.855 0.1007

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l_d_1m −6.12883 2.55521 −2.399 0.0433 **
l_LL 6822.62 3313.75 2.059 0.0735 *
l_wsk_100 474.006 259.950 1.823 0.1057

Warning: the data matrix is peculiar!

Coefficient of determin. R-squared = 0.590445

Test statistics: TR^2 = 8.85667,
with p value = P(Chi-square(3) > 8.85667) = 0.0312584

The test statistic: T R^2 = 8.85667, with p-value = P(Chi-square(3) > 8.85667) = 0.0312584, i.e. T R^2 = 8.85667< χ^2 (1%,3) = 11.3449, which means that there is no reason to reject the linear form of the model.

Multicollinearity assessment VIF(j) - variance inflating factor. VIF (Variance Inflation Factors) - minimum possible value = 1.0. Values > 10.0 may indicate a multicollinearity problem - variance inflated. VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient between variable 'j' and the remaining independent variables of the model.

Belsley-Kuh-Welsch collinearity diagnostics:

--- variance proportions ---
lambda cond const d_1m LL wsk_100
3.613 1.000 0.000 0.004 0.000 0.000
0.386 3.059 0.000 0.172 0.000 0.000
0.001 74.765 0.008 0.811 0.004 0.782
0.000 550.841 0.992 0.013 0.996 0.218

lambda = eigenvalues of X'X, largest to smallest
cond = condition index
Multicollinearity assessment VIF - variance increasing factor:

1.0 < d_1m = 5.890 < 10,

1.0 < LL = 3.574 < 10,

1.0 < index_100 = 8.045 < 10.

The results of the multicollinearity test indicate that in the estimated model, the correlation of explanatory variables does not disturb the quality of the model.

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The assessment of the significance of the impact of individual independent variables on the dependent variable shows that the listed variables statistically significantly affect the unemployment rate in municipalities, including cities with county rights. The performance of the Snedecor F-test (F-statistic) indicates that the estimated model contains significant variables, except for the per capita income variable. The assessment of the degree of model fit to empirical data indicates that the model is suitable for practical use. The results of the multicollinearity test indicate that in the estimated model, the correlation of explanatory variables does not interfere with the quality of the model, and also indicates the high quality of the estimated econometric model. The model has good qualitative properties and can be used for interpretative and forecasting analyses. Both positive and statistical substantive verification authorizes economic analyses and the construction of forecasts.

6. Forecast and mean values of forecast error and their interpretation

To build a forecast of the explained variable, data are required for the explanatory variables in the forecast period. This requires supplementing the database with information about the explanatory variables in future periods. Supplementing the information in the database requires defining the sample scope and indicating the variables. For the explanatory variables, the forecast for the years 2024-2026 – Table 3.

Table 3. Forecast of explanatory variables in the years 2024 to 2026

Forecast years	Designation of the explanatory variable		
	d_1m	LL	wsk_100
2024	89612	3098357	69.39
2025	96581	3104504	70.47
2026	103550	3110651	71.55

Source: own study based on time series estimation

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To determine the forecasts of variables, they had to be treated as time series. Forecast of the value of the explained variable – Table 4.

Table 4. Forecast of the registered unemployment rate in the years 2009 to 2026

Year	Registered unemployment rate (sbr)	Forecast of the registered unemployment rate
2009	9.20	10,10
2010	9,20	9,54
2011	9,10	8,99
2012	9,80	8,43
2013	9,60	7,88
2014	7,60	7,33
2015	6,10	6,77
2016	4,90	6,22
2017	5,49	5,66
2018	4,89	5,11
2019	4,29	4,55
2020	3,69	4,00
2021	3.09	3.44
2022	3.30	2.89
2023	3.00	2.33
2024		*1.78*
2025		*1.23*
2026		*0.67*

Source: own study based on time series estimation

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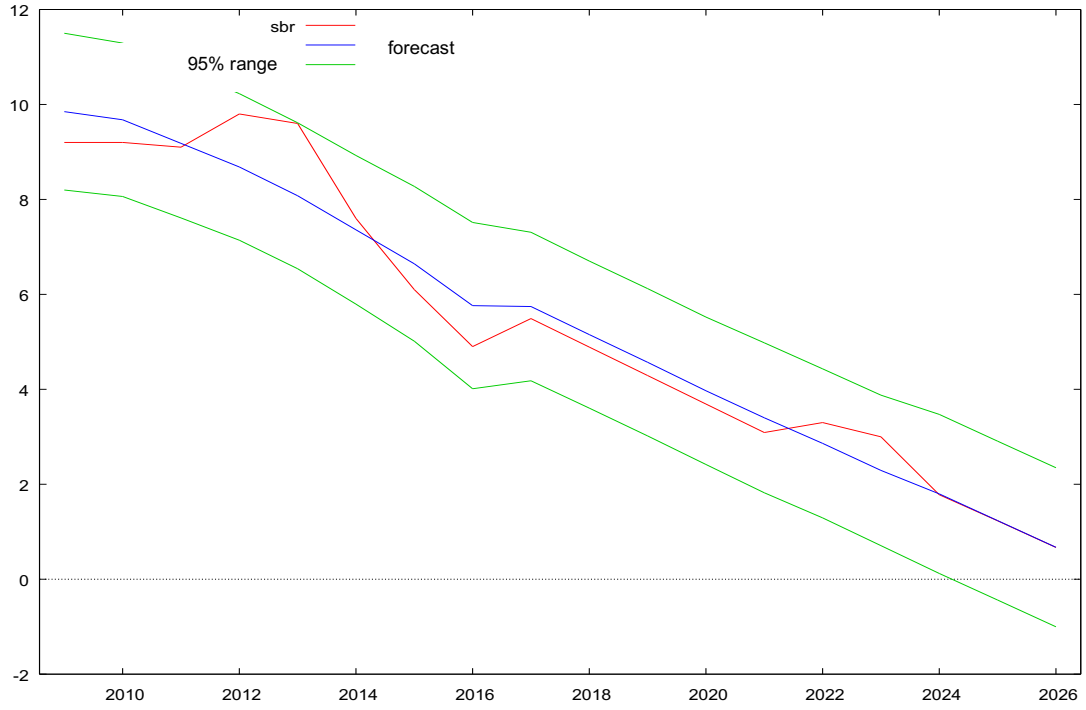
The forecast of the value of the explained variable shows that in the next three years the unemployment rate in communes, including cities with county rights in the Wielkopolska region, will decrease from 1.78% in 2024 to 0.67% in 2026 – Figure 2.

Figure 1. Forecast of the dependent variable (2024-2026)



Source: prepared based on own research results

Average *ex-ante prediction error* provides information on the expected average deviations of the forecast variable realization from the forecasts at time t > n. The relative *ex-ante prediction error informs how big the expected error (deviation calculated as a percentage of the forecast values) will be at time t > n. If the relative ex-ante* prediction error $V\tau \leq 3\%$, then the forecasts are very accurate, if $3\% < V\tau \leq 5\%$, then the forecasts are considered accurate, if $5\% < V\tau \leq 10\%$, then the forecasts may be acceptable, if $V\tau > 10\%$, then the forecasts are unacceptable – Table 5.

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Table 5. Forecast and mean values of forecast error and their interpretation, for 95% confidence interval, t(13, 0.025) = 2.160

Year	sbr	forecast	mean forecast error *beforehand*	mean relative forecast error *beforehand*	95% confidence interval
2024	-	1.78	0.780949	43.87%	(0.121873 ; 3.47181)
2025	-	1.23	0.780001	63.41%	(-0.438004; 2.90787)
2026	-	0.67	0.781116	116.58%	(-1.00231; 2.34835)

Source: results obtained using GRETL software

Ex-ante relative forecast errors in this study exceed 10%, which means that *the forecast is unacceptable*.

Conclusion

The analysis of the impact of selected variables on the unemployment rate in the Wielkopolska region, conducted on the basis of data from 2009-2023, revealed significant relationships between income per capita, population size demographic burden and the registered unemployment rate. The final results of the econometric model indicate a significant impact of demographic burden and population size on employment dynamics, while the variable concerning income per capita did not show statistical significance.

Projections of the future unemployment rate, although indicating a downward trend, were subject to high relative forecast errors, suggesting that caution is needed in interpreting the results and that further research in this area is needed. Contemporary market challenges, such as demographic changes, technological developments, and changing employee preferences, must also be taken into account in future analyses.

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In the context of labour market policy and actions taken to reduce unemployment, the results of this study emphasize the need for an integrated approach encompassing both education and local development strategies. Increasing access to education and appropriately adapting educational programs to the needs of the labour market is key to building a flexible workforce. Further research should focus on identifying additional variables that may affect the unemployment rate, as well as on the effectiveness of implemented intervention programs.

The research results showed that the assumed explanatory variables (income per capita, population size and demographic burden) affect the unemployment rate registered in the communes of the Wielkopolska province. The answer to the question posed at the beginning is as follows:

. An increase in income per capita by PLN 1 will result in a negligible increase in the unemployment rate by 0.000001536%,
. An increase in the population in the region by 1 person will result in a minimal decrease in the unemployment rate by 0.000023%,
. An increase in the demographic burden per 100 persons of working age by one unit will result in a decrease in the unemployment rate by 2.58640%.

The unemployment rate in the Wielkopolska region is a complex phenomenon that requires multi-faceted analysis and appropriate systemic actions. The results of the analysis should contribute to modern employment strategies and regional development, supporting the construction of a better future for the region's residents.

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