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MODELS AND FORECASTS OF OUTFLOWS FROM UNEMPLOYMENT IN THE KUJAWSKO-POMORSKIE VOIVODSHIP

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ABSTRACT

The outflow from unemployment is defined as the number of persons who were excluded from the register of public employment services in a given reporting period. Employment outflows from unemployment to employment are of particular importance.

The aim of this article is an econometric analysis of the factors influencing the outflows from unemployment in the Kujawsko-Pomorskie voivodship in the years 1999-2016 and forecasting for 2017. The obtained results clearly indicate that the congruent dynamic model is the appropriate tool for causal analysis of the outflow from unemployment. The forecasts obtained on this basis are characterised by high accuracy. Forecasting results were compared with the expert forecast.

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INTRODUCTION

The outflow from unemployment is defined as the number of persons who were excluded from the register of public employment services in a given reporting period. The reasons for exclusion of persons from the unemployed register include, among others: lack of confirmation of availability for work, voluntary resignation from a status of unemployed, taking up education, acquisition of pension rights, acquisition of rights to early retirement benefit or early retirement allowance, beginning training or traineeship with an employer. The outflows from unemployment to employment, defined as

taking up wage labour, starting own business activity, undertaking interventional work or public work or seasonal work, are of particular importance for the functioning of the labour market and its efficiency.

Taking work by unemployed persons is the result of impact of many factors, including: the activity of employment agencies, expenditure on active labour market programs, the availability of job offers, motivation to search for a job by the unemployed, the nature of recruitment procedures conducted by employers (Gałecka, 2007). In fact, taking work is a combination of persons searching a job and the employer. Such matching is the result of acceptance of the working and pay conditions proposed by the employer by a person searching for job. In turn, these conditions must meet the expectations of employees.

In spatial terms, matching in the labour market is not of uniform nature. In regions with greater availability of the labour market, with a relatively larger number of business entities, a developed service sector, taking work by the unemployed is easier than in economically weaker regions.

The aim of the article is the econometric analysis of the factors influencing the outflows from unemployment in the Kuyavian-Pomerian (Kujawsko-Pomorskie) voivodship in the years 1999-2016 and forecasting for 2017.

OUTFLOWS FROM UNEMPLOYMENT IN THE KUYAVIAN-POMERANIAN VOIVODSHIP

Removals from unemployment (BEZR_WYR) and removals from unemployment due to undertaking a job (BEZR_WYR_PP) in the Kuyavian-Pomeranian voivodship are subject to seasonal fluctuations throughout the year. The outflows usually take low values in the winter months: November, December, January, and relatively high values in the spring months – April, May and late summer in September. This is probably the result of the seasonal nature of work in agriculture and construction, as well as in tourism. In 1999-2016, the outflows from unemployment changed the trend periodically. In the years 1999-2007, visible are increases in the number of removals (as to the trend), then decreases may be observed until the effects of the crisis in 2009 appeared. Since 2010, there have been visible slow increases in the outflow from unemployment.

In relative terms, the outflow from unemployment can be expressed by the outflow from unemployment rate (STOPA_ODPL_BEZR), which is defined as the ratio of the number of unemployed persons who were removed from registers in a given period to the number of unemployed persons in the registers of public employment services at the end of the previous period. By limiting the outflow of unemployed persons to those removed due to undertaking a job, the outflow of the unemployed to employment rate (STOPA_ODPL_BEZR_PP) is obtained. As regards to the unemployment rate, the outflow rate decreases during the periods of increase in the unemployment rate. This is due to a faster increase in the number of unemployed persons compared to the increase in the number of removals from the registers of powiats labour offices. The correlation coefficient between the unemployment rate (SB) and the outflow from unemployment rate for the years 1999-2016 amounted to -0.72, and between the unemployment rate

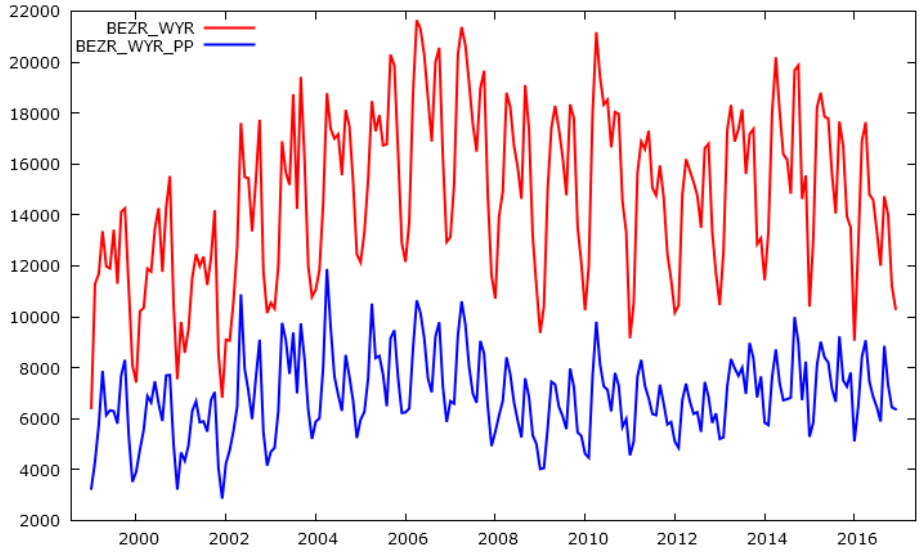

Chart 1. Outflows from unemployment and outflows from unemployment to employment in the Kuyavian-Pomerian voivodship in the years 1999-2016
Source: own elaboration.

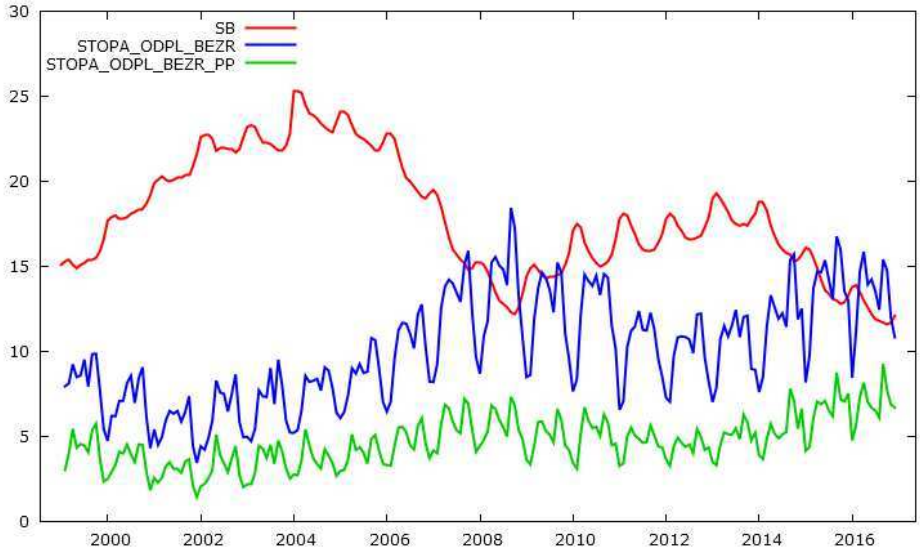

Chart 2. Unemployment rate, outflow from unemployment rate and outflow from unemployment to employment rate in the Kuyavian-Pomerian voivodship in the years 1999-2016
Source: own elaboration.

and the outflow from unemployment to employment rate amounted to -0.68, which confirms the negative relation between them. In periods when the unemployment rate was reaching the minimum values, the outflow of the unemployed rate significantly exceeded it.

THEORETICAL BASICS OF THE MATCHING FUNCTION

The matching function is a mathematical approach, on the one hand, to the process of joining labour market participants and, on the other hand, persons searching for a job and employers. It expresses the relationship between the outflows from unemployment and basic resources (job offers, labour supply). It is also a tool used to determine the impact of changes in economic processes on the state of equilibrium in the labour market (Gałecka, 2007).

In classical terms, the matching function takes the following form (Kaczorowski & Tokarski, 1997):

$$O_t = a(t) f(U_t, V_t),$$

where:
t – time variable t={1, 2, ..., n},
O_t – the outflow of unemployed persons,
U_t – the number of unemployed persons,
V_t – the number of vacancies,
$a(t) = e^{\alpha_0 + \alpha_1 t}$ – equation defining the effectiveness of the functioning of the labour market,
$f(U_t, V_t) = U_t^{\beta_1} V_t^{\beta_2}$ – functional dependency.

The efficiency of the functioning of the labour market may be a function of not only time, but also other factors. The expression describing $a(t)$ takes then the following form:

$$a(t) = e^{\alpha_0 + \alpha_1 t + \gamma_1 x_{t1} + \gamma_2 x_{t2} + \cdots + \gamma_k x_{tk}},$$

where: x_{tj} – j-th variable explaining the effectiveness of the functioning of the labour market; j=1, 2,..., k.

If $\frac{\partial a(t)}{\partial t} > 0$, then the outflows from unemployment increase with the passage of time, however, if $\frac{\partial a(t)}{\partial t} < 0$, they decrease. The assumption about the positive impact of the number of job offers and the number of unemployed persons on the outflows from unemployment applies. The increase in the number of job offers results in the fact that a larger number of unemployed persons can find employment. In turn, the increase in the number of unemployed has a positive effect on the intensity of job searching by the unemployed and, consequently, an increased outflow from unemployment (Kwiatkowski, 1998).

The matching function taking into account, next to time, also other factors influencing the efficiency of the labour market is referred to as the extended matching function. It can be estimated by the estimator according to the least squares method after it

is reduced to the linear form through the logarithmication. It then takes the following form:

$$lnO_t = \alpha_0 + \alpha_1 t + \gamma_1 x_{t1} + \gamma_2 x_{t2} + \cdots + \gamma_k x_{tk} + \beta_1 lnU_t + \beta_2 lnV_t + \varepsilon_t,$$

where: ε_t is a random component of the model.

The parameter α_0 is a model constant and does not have an economic interpretation. The parameter α_1 illustrates the relative change in the outflows from unemployment resulting from the effect of factors that were not included in the model. These factors may include the intensity and effectiveness of job searching by the unemployed themselves and the functioning of labour offices (Kubiak, 2005). $\alpha_1 \cdot 100\%$ means the change in the outflow from unemployment in subsequent moments of time. The parameter γ_j with exogenous variables reflects the percentage change in the outflow from unemployment caused by the unit change of the variable x_{tj}, which means that if the value of the variable x_{tj} increases by a unit, the outflow from unemployment will change by $\gamma_j \cdot 100\%$ (Kaczorowski&Tokarski, 1998).The parameter β_1 is the flexibility of the outflow from unemployment in relation to the unemployment rate and β_2 – the flexibility of the outflow from unemployment in relation to the inflow of job offers. If the number of unemployed increases by 1%, the outflow of the unemployed will change by $\beta_1 \cdot 100\%$. Similarly, if the number of job offers increases by 1%, the outflow of unemployed persons will change by $\beta_2 \cdot 100\%$ (Stasiak & Tokarski, 1998).

ESTIMATED ECONOMETRIC MODELS

In order to analyse the outflows from unemployment, two econometric models were estimated in which the following appeared as explanatory variables (cf. Śliwicki, 2014):

1. the total outflows from unemployment – BEZR_WYR, and
2. the outflows from unemployment due to undertaking a job – BEZR_WYR_PP.

The independent variables in these models were:

1. the number of job offers submitted to labour offices within a month – OP_CM,
2. the number of unemployed persons registered in labour offices as of the end of the month – BEZR,
3. the average monthly gross remuneration in the enterprise sector in constant prices from December 2016 – WYN_CS,
4. the minimum remuneration for work in constant prices from December 2016 – MIN_CS.

The statistical data used in the analysis came from official statistical surveys of official statistics and concerned the period from January 1999 to December 2016. In addition, delays of all variables by 12 periods were taken into account. The model was built according to the concept of dynamic consistent modelling formulated by Zieliński (cf. Talaga & Zieliński, 1986) and in accordance with the concept of matching functions.

Table 1. Econometric model of total outflows from unemployment

	Coefficient	Standard error	t-Student	p-value	
Const	1.934630	1.806510	1.0709	0.2857	
T	0.001974	0.000825	2.3923	0.0178	**
l_OP_CM_1	0.123974	0.030051	4.1255	0.0001	***
l_OP_CM_12	-0.087954	0.031799	-2.7659	0.0063	***
l_BEZR_3	2.154940	0.513261	4.1985	0.0000	***
l_BEZR_4	-2.156740	0.495724	-4.3507	0.0000	***
WYN_CS_1	-0.000311	0.000125	-2.4986	0.0134	**
WYN_CS_2	0.000532	0.000135	3.9273	0.0001	***
WYN_CS_6	-0.000562	0.000135	-4.1528	0.0001	***
WYN_CS_9	0.000354	0.000139	2.5424	0.0119	**
WYN_CS_11	-0.000248	0.000128	-1.9389	0.0542	*
MIN_CS_2	-0.000453	0.000176	-2.5783	0.0108	**
MIN_CS_7	0.000558	0.000191	2.9205	0.0040	***
MIN_CS_9	-0.000305	0.000183	-1.6705	0.0966	*
dm1	-0.207061	0.045687	-4.5321	0.0000	***
dm2	-0.129431	0.043744	-2.9588	0.0035	***
dm3	0.172013	0.036639	4.6948	<0.00001	***
dm4	0.143862	0.039794	3.6151	0.0004	***
dm5	0.078150	0.035816	2.1820	0.0305	**
dm6	0.088636	0.037871	2.3405	0.0204	**
dm7	0.059818	0.039490	1.5148	0.1317	
dm8	0.004111	0.041602	0.0988	0.9214	
dm9	0.135162	0.041811	3.2327	0.0015	***
dm10	0.100851	0.038740	2.6033	0.0100	**
dm11	-0.132889	0.042967	-3.0928	0.0023	***
l_BEZR_WYR_1	0.219298	0.067121	3.2672	0.0013	***
l_BEZR_WYR_3	0.343752	0.059819	5.7465	<0.00001	***
l_BEZR_WYR_5	-0.147310	0.058859	-2.5028	0.0133	**
l_BEZR_WYR_7	0.149923	0.058656	2.5560	0.0115	**
l_BEZR_WYR_9	0.165927	0.063176	2.6264	0.0094	***
l_BEZR_WYR_10	-0.166265	0.064471	-2.5789	0.0108	**
l_BEZR_WYR_12	0.279026	0.068210	4.0907	0.0001	***

The arithmetic mean of the dependent variable	9.584296
The standard deviation of the dependent variable	0.234709
Standard error of residuals	0.068194
Sum squared of residuals	0.799868
Determination coefficient R-squared	0.928474
Adjusted R-squared	0.915583
Autocorrelation of residuals	0.043803
The Durbin h-statistic	2.199056

Source: own elaboration.

The assessment of the parameter with a time variable means that the total outflows from unemployment increase on average by approx. 0.197% within a month.

The shaping of the number of removals from the registers of public employment services is characterised by seasonality. The biggest positive deviation from the trend occurs for March (17.2%), then for April (14.39%) and September (13.52%). The highest negative deviation is characteristic for December (-31.32%), followed by January (-20.71%), November (-13.29%) and February (-12.94%).

The increase in the number of job offers a month earlier by 1% results in an average increase in the number of removals from public employment services in the current month by approx. 12.4%. On the other hand, a 1% increase in the number of job offers twelve months earlier results in a decrease in the total number of removals in the current month on average by approx. 8.8%.

Changes in the number of registered unemployed persons also significantly influence the outflows from unemployment. An increase in the number of unemployed persons by 1% three months earlier results in an increase in the number of removals by 215.49% in the current month. Unfortunately, the increase in the number of registered unemployed persons four months earlier results in a decrease in the number of removals by 215.67% in the current month.

When assessing the impact of the average remuneration in the enterprise sector and the minimum remuneration, it should be emphasised that both these factors have a relatively small impact on the outflows from unemployment.

An increase in the average remuneration in the enterprise sector by PLN 100 a month earlier results in an average decrease in removals from unemployment by an average of 3.11% in the current month. The increase of this variable by PLN 100 two months earlier results in an increase in the number of removals in the current month by an average of 5.32%. The increase in the average remuneration in the enterprise sector six months earlier does also have a negative impact on the number of removed unemployed persons – by approx. 5.62% per PLN 100 increase in remuneration. In turn, the increase in remuneration in the enterprise sector by PLN 100 nine months earlier results in an average increase in the number of removed unemployed persons by an average of 3.54%. An increase in the average remuneration in the enterprise sector eleven months earlier by PLN 100 results in an average decrease in the number of removals from the registers of public employment services by an average of 2.48%.

An increase in the minimum remuneration by PLN 100 two months earlier results in an average decrease in the outflows from unemployment by approx. 4.53%. An increase in the minimum remuneration by PLN 100 seven months earlier results in an increase in the number of removals from unemployment by approx. 5.58% in the current month. An increase in the minimum remuneration nine months earlier – by an average of 3.05% for every PLN 100 increase in the minimum remuneration – has a negative impact on the outflows from unemployment.

A 1% increase in the number of removals a month earlier implies an increase in the number of removals in the current month by an average of 21.93%. The outflow of unemployed persons by 1% three months earlier results in an increase in the number of removals by an average of 34.38%. An average decrease in the number of removals by 14.73% is generally the result of a 1% increase in the outflow from unemployment five

Table 2. Econometric model of outflows from unemployment due to undertaking a job

	Coefficient	Standard error	t-Student	p-value	
const	-6.428700	1.419200	-4.5298	0.00001	***
l_OP_CM	0.208706	0.029301	7.1228	<0.00001	***
l_OP_CM_4	0.109423	0.035716	3.0637	0.00255	***
l_OP_CM_7	0.103798	0.030877	3.3616	0.00096	***
l_OP_CM_10	0.141965	0.036118	3.9306	0.00012	***
l_OP_CM_12	-0.088932	0.034942	-2.5452	0.01183	**
l_BEZR	2.695460	0.630248	-4.2768	0.00003	***
l_BEZR_1	4.253490	0.753719	5.6433	<0.00001	***
l_BEZR_5	-1.920020	0.546187	-3.5153	0.00057	***
l_BEZR_7	3.137570	0.974843	3.2185	0.00155	***
l_BEZR_8	-2.507020	1.142010	-2.1953	0.02953	**
l_BEZR_9	1.602820	0.903158	1.7747	0.07778	*
l_BEZR_11	-0.889899	0.349052	-2.5495	0.01169	**
WYN_CS	0.000447	0.000132	3.3825	0.0009	***
WYN_CS_5	0.000399	0.000121	3.3018	0.00118	***
MIN_CS_2	-0.000529	0.000246	-2.1467	0.03327	**
MIN_CS_3	0.000686	0.000318	2.1574	0.03241	**
MIN_CS_4	-0.000505	0.000263	-1.9198	0.0566	*
MIN_CS_11	0.000516	0.000253	2.0375	0.04319	**
MIN_CS_12	-0.000856	0.000249	-3.4326	0.00075	***
dm1	-0.052972	0.047309	-1.1197	0.26446	
dm2	-0.151413	0.045355	-3.3384	0.00104	***
dm3	0.020800	0.041133	0.5057	0.61376	
dm4	0.019041	0.044041	0.4323	0.66606	
dm5	-0.016073	0.047672	-0.3372	0.73643	
dm6	-0.022011	0.050505	-0.4358	0.66353	
dm7	0.030432	0.046734	0.6512	0.51584	
dm8	-0.094733	0.049843	-1.9006	0.05909	*
dm9	0.261435	0.049200	5.3138	<0.00001	***
dm10	0.156087	0.050774	3.0741	0.00247	***
dm11	-0.017214	0.041768	-0.4121	0.68076	
l_BEZR_WYR_PP_1	0.164035	0.053294	3.0779	0.00244	***
l_BEZR_WYR_PP_4	-0.117830	0.060614	-1.9439	0.0536	*
l_BEZR_WYR_PP_5	-0.142319	0.052330	-2.7197	0.00723	***
l_BEZR_WYR_PP_6	-0.266563	0.054179	-4.9200	<0.00001	***
l_BEZR_WYR_PP_9	0.147626	0.056051	2.6338	0.00924	***
l_BEZR_WYR_PP_10	-0.172368	0.057958	-2.9740	0.00338	***
l_BEZR_WYR_PP_12	0.153778	0.061514	2.4999	0.01339	**

The arithmetic mean of the dependent variable	8.820897
The standard deviation of the dependent variable	0.234995
Standard error of residuals	0.068443
Sum squared of residuals	0.777624
Determination coefficient R-squared	0.930632
Adjusted R-squared	0.915171
Autocorrelation of residuals	0.089486
The Durbin h-statistic	1.970779

Source: own elaboration.

months earlier. A one-percent decrease in the number of unemployed persons in the registers of powiat (county) labour offices in the Kuyavian-Pomeranian voivodship seven months earlier results in an increase in the outflow from unemployment in the current month by an average of 14.99%. A 1% increase in the number of removed unemployed persons nine months earlier also results in an increase in the outflow from unemployment by 16.59%. The decrease in the number of removed unemployed persons by 16.63% is the result of a 1% increase in the outflow from registered unemployment ten months earlier. On the other hand, a one-percent increase in the number of removals from public employment services twelve months earlier has the effect in the current month in the form of an increase in the outflow from unemployment by an average of 27.9%.

Outflows from unemployment due to undertaking a job as well as the total outflows are characterised by seasonality, whereby significant seasonal fluctuations are for February, August, September and October. In February and August, there are negative deviations from the trend on average by -15.14% and -9.47%, respectively, and for September and October they are positive and amount to 26.14% and 15.61%, respectively.

An increase in the number of job offers in the current month by 1% results in an average increase in the number of removals from unemployment due to undertaking a job by 20.87%. On the other hand, an increase in the number of job offers by 1% four months earlier results in an average of 10.94% in the current month. A one-percent increase in the number of job offers seven months earlier has the effect in the current month in the form of an increase in the outflow from unemployment to employment by an average of 10.34%. An increase in the inflow of job offers by 1% ten months earlier results in an increase in the number of removals from the registers of powiats labour offices to employment by an average of 14.2%. An increase in the number of job offers twelve months earlier – on average by 8.89% for every 1% increase in the number of job offers within a month – has a negative impact on the number of removals from unemployment due to undertaking a job.

An increase in the number of unemployed persons results in the intensification of activities of persons who have lost their jobs aiming at undertaking a job as soon as possible (including self-employment). A one-percent increase in the number of unemployed persons in the current month results in an increase in the outflow from unemployment to employment by an average of 269.5%. The stronger effect gives a one-percent increase in the number of unemployed persons a month earlier – an increase in the outflow from unemployment to employment by an average of 425.35%. An increase in the number of persons registered in powiats labour offices five months earlier – a one-percent increase in the number of unemployed causes an average decrease in

removals due to undertaking a job by 192% – causes negative effects. On the other hand, the increase in the number of applications in the registers of public employment services seven months earlier has an effect in the current month in the form of an increase in the number of removals due to undertaking a job by an average of 313.76%. An increase in unemployment eight months earlier causes a decrease in the outflow from unemployment to employment – on average by 250.7% for every 1% increase in unemployment. A positive effect is exerted by the increase in the number of registered unemployed persons in powiats labour offices nine months earlier – an increase in the outflow by 160.28% for every 1% increase in the number of unemployed persons. The current outflow from unemployment to employment is also influenced by an increase in the number of registrations in the resources of public employment services eleven months earlier – a one-percent increase in unemployment results in a decrease in the number of removals due to undertaking a job by an average of 88.99%.

The average remuneration in the enterprise sector and the minimum remuneration are characterised by a relatively little impact on the outflows from unemployment to employment. An increase in the average remuneration in the enterprise sector by PLN 100 in the current month results in an average increase in the outflow from unemployment to employment by 4.47%. The increase of this remuneration one month earlier by PLN 100 also results in an increase in the number of removals from unemployment to employment by an average of 3.99%.

An increase in the minimum remuneration by PLN 100 two months earlier results in a decrease in the number of removals from unemployment to employment by an average of 5.29%. In turn, the increase in the minimum remuneration a quarter earlier by PLN 100 has an effect in the current month in the form of an increase in the outflows from unemployment to employment by 6.86%. An increase in the minimum remuneration four months earlier – an average of 5.1% for every PLN 100 increase in the minimum remuneration – has a negative impact on the outflows from unemployment due to undertaking a job. On the other hand, an increase in the minimum remuneration 11 months earlier in relation to the current month – on average by 5.2% for every PLN 100 increase in the minimum remuneration – makes a positive impact. An increase in the minimum remuneration by PLN 100 a year earlier has an effect in the current month in the form of a decrease in the number of removals from unemployment to employment by 8.56%.

Changes in the number of removals due to undertaking a job also result from previous changes in this variable. A one-percent increase in the number of removals from unemployment to employment a month earlier results in an increase in the number of these removals by an average of 16.4% in the current month. An increase in the outflow from unemployment to employment four months earlier results in a decrease in these outflows by an average of 11.8% in the current month. One-percent increase in this variable five and six months earlier – by 14.2% and 26.7%, respectively – also has a negative impact on the number of removals in the current month. On the other hand, an increase in the number of removals from unemployment to employment nine and twelve months earlier is characterised by a positive impact – by an average of 14.8% and 15.4%, respectively. An increase in the outflow from unemployment to employment by 1% a year earlier results in a decrease in the number of these removals by an average of 17.2% in the current month.

FORECASTS OF OUTFLOWS FROM UNEMPLOYMENT

Based on the estimated models, the forecasts of outflows from unemployment for 2017 were determined. The actual values were adopted as variable values – the number of unemployed persons, job offers, the average remuneration in the enterprise sector and the minimum remuneration in the period from January to August 2017, while for the period from September to December 2017, forecasts of these variables were determined. The values of the number of unemployed persons and job offers were determined using the seasonal ARIMA(1,1,1)(1,0,1) model. The average remuneration in the enterprise sector was also determined using the seasonal ARIMA(0,1,1)(1,0,1) model. The minimum remuneration in the entire 2017 is gross PLN 2,000.

Due to the construction of models, the logarithms of natural outflows from unemployment – *ln(*BEZR_WYR*)*, and then on their basis, the forecasts of the values of outflows themselves – BEZR_WYR – were forecasted. The *ex ante* and *ex post* measures are used to assess the quality of forecasts. The *ex ante* measures are used to assess the acceptability of forecasts from a statistical point of view. Due to the fact that estimated relative errors of *ex ante* forecasts for all forecasted periods of every value are lower than 1%, it allows to conclude that each of them is permissible. The *ex post* errors are used to assess the quality of forecasts in relation to actual values. The values of a relative *ex post* error are less than 0.8% as to the absolute value, which proves the accuracy of the obtained forecasts of outflows from unemployment. The estimated forecasts retain the seasonal nature of the phenomenon, i.e. they take high values in March and April, and low in January, November and December.

The forecasts of outflows from unemployment to employment – BEZR_WYR_PP– were made in the same way as the forecasts of total outflows from unemployment – BEZR_WYR. On the basis of relative values of *ex ante* errors, the acceptability of forecasts can be concluded, whereas the relative values of *ex post* error demonstrate the accuracy of forecasts. The forecasts of outflows from unemployment to employment also retain the seasonal nature – they take relatively low values for January, February, November and December and relatively high values for April and September.

In order to compare the received forecasting results for total outflows from unemployment and outflows from employment due to undertaking a job, forecasts for 2017 were made using the prognostic Business Forecasting software available at https://businessforecast.eu/. This program offers a number of forecasting methods based on time series, whereby the so-called expert forecast, being a combination of forecasts due to maximisation of matching to real data, was used.

The structure of partial forecasts is shown in Table 5.

Forecasting results together with *ex post* forecast errors are presented in Table 6.

Table 3. Forecasts of total outflows from unemployment

month	BEZR_WYR	ln(BEZR_WYR)	forecast ln(BEZR_WYR)	forecast BEZR_WYR	ex anteln error (BEZR_WYR)	relative ex ante error	ex post error	relative ex post error
I	8870	9.0904	9.0480	8501	0.0682	0.75%	0.0425	0.47%
II	10823	9.2894	9.2179	10076	0.0698	0.76%	0.0715	0.77%
III	14644	9.5918	9.5409	13918	0.0699	0.73%	0.0509	0.53%
IV	14867	9.6069	9.6070	14868	0.0740	0.77%	-0.0001	0.00%
V	13249	9.4917	9.5009	13372	0.0747	0.79%	-0.0092	-0.10%
VI	12820	9.4588	9.4679	12938	0.0750	0.79%	-0.0092	-0.10%
VII	11206	9.3242	9.3727	11763	0.0751	0.80%	-0.0485	-0.52%
VIII	11314	9.3338	9.3130	11081	0.0765	0.82%	0.0208	0.22%
IX			9.4611	12850	0.0765	0.81%		
X			9.4505	12715	0.0774	0.82%		
XI			9.1832	9732	0.0774	0.84%		
XII			9.0787	8766	0.0775	0.85%		

Source: own elaboration.

Table 4. Forecasts of outflows from unemployment due to undertaking a job

month	BEZR_WYR	ln(BEZR_WYR)	forecast ln(BEZR_WYR)	forecast BEZR_WYR	ex anteln error (BEZR_WYR)	relative ex ante error	ex post error	relative ex post error
I	5017	8.5206	8.6254	5571	0.0684	0.79%	-0.105	-1.23%
II	5395	8.5932	8.6538	5732	0.0694	0.80%	-0.061	-0.71%
III	7202	8.8821	8.9611	7794	0.0694	0.77%	-0.079	-0.89%
IV	7433	8.9137	9.0826	8801	0.0694	0.76%	-0.169	-1.90%
V	6329	8.7529	8.8901	7259	0.0698	0.79%	-0.137	-1.57%
VI	6046	8.7072	8.8693	7110	0.0709	0.80%	-0.162	-1.86%
VII	5128	8.5425	8.7506	6314	0.0743	0.85%	-0.208	-2.44%
VIII	5399	8.5940	8.7063	6041	0.0746	0.86%	-0.112	-1.31%
IX			9.0407	8439	0.0746	0.83%		
X			8.9762	7912	0.0757	0.84%		
XI			8.7805	6506	0.0757	0.86%		
XII			8.7913	6576	0.0759	0.86%		

Source: own elaboration.

Table 5 Structure of partial forecasts for outflows from unemployment according to the expert method

Method*	ln(BEZR_WYR) [in %]	ln(BEZR_WYR_PP) [in %]
WINTERS	18.06	13.29
POISON	13.96	14.76
TSAR	12.80	14.89
SARIMA	12.80	14.89
TAR	10.85	9.85
HOLT	6.74	5.41
EMA	5.38	5.17
WMA	5.37	5.15
SMA	4.96	5.11
TREND	4.60	6.16
AMA	4.48	5.32

*the names of methods correspond to the names used in the literature, see, for example, M. Cieślak (eds.) (2005)
Source: own elaboration.

Table 6. The results of forecasting the total outflows from unemployment and due to undertaking a job using the expert method in Business Forecasting

month	Forecast ln (BEZ_WYR)	Ex post error	Relative ex post error	Forecast ln(BEZ_WYR _PP)	ex post error	relative ex post error
I	9.2063	0.115	1.27%	8.6485	0.127	0.01%
II	9.3362	0.046	0.50%	8.7199	0.126	0.01%
III	9.5402	-0.051	-0.53%	8.8941	0.012	0.001%
IV	9.5852	-0.021	-0.22%	8.9781	0.064	0.007%
V	9.5194	0.027	0.29%	8.8853	0.132	0.01%
VI	9.4953	0.036	0.38%	8.8378	0.130	0.01%
VII	9.4447	0.120	1.29%	8.7738	0.231	0.02%
VIII	9.3841	0.050	0.54%	8.7456	0.151	0.01%
IX	9.5119			8.9591		
X	9.4851			8.8679		
XI	9.3202			8.7632		
XII	9.2599			8.7433		

Source: own elaboration.

A comparison of results of forecasting the outflow from unemployment in the Kujawsko-Pomorskie voivodship including factors describing the outflow from unemployment, such as: the number of job offers submitted to labour offices within a month, the number of unemployed persons registered at labour offices as of the end of the month, the average monthly gross remuneration in the enterprise sector in constant prices from December 2016 and the minimum remuneration for work in constant prices from December 2016 with the results of forecasting based on a combination of model

and adaptation methods of extrapolations of time series point to small values of percentage *ex post* errors in both cases. A detailed analysis indicates, however, that smaller forecast errors were obtained in the case of the econometric model for the total outflow from unemployment, while in the case of forecasts of the outflow from unemployment due to undertaking a job, the expert method proved to be better.

CONCLUSIONS

The matching function in the labour market is a model derived from theory, which can be applied to econometric modelling of outflows from unemployment. In this article, the matching function for the labour market case in the Kuyavian-Pomeranian voivodship was the subject of development of a dynamic econometric model. Factors originating from the labour market, such as: the number of job offers submitted to labour offices within a month, the number of unemployed persons registered at labour offices as of the end of the month, the average monthly gross remuneration in the enterprise sector in constant prices from December 2016 and the minimum remuneration for work in constant prices from December 2016, together with their dynamic structure, allowed to describe 93% of total outflows from unemployment and outflows due to undertaking a job.

The forecasting results on the basis of estimated models proved acceptable and accurate, because in no case the relative error of the *ex ante* forecast exceeded 1%, whereby the largest error value of the *ex post* forecast in July 2017 was 2.44%.

A comparison of forecasting results of the outflow from unemployment in the Kuyavian-Pomeranian voivodship with the results of forecasting based on a combination of model and adaptation methods of extrapolations of time series indicates small values of percentage *ex post* errors in both cases. A detailed analysis indicates, however, that smaller forecast errors were obtained in the case of the econometric model for the total outflow from unemployment, while in the case of forecasts of outflow from unemployment due to undertaking a job, the expert method proved to be better.

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