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INFLUENCE OF SELECTED ECONOMIC FACTORS ON THE AMOUNT OF GROSS SALARIES IN INDUSTRY

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Purpose: the aim of the work is to study the impact of selected economic factors on the level of gross salaries in the industry sector in Poland in the years 2005-2020.
Design/methodology/approach: in the first stage of the research, the Pearson linear correlation between the average gross salary in industry and the adopted variables was examined. Then, a multiple regression model was created, which aims to indicate which of the adopted variables best explain the development of the average gross salary in industry.
Findings: the construction of the econometric model allowed us to indicate that the factors that best explain the average gross salary in industry are the average gross salary in the economy and the volume of domestic demand.
Research limitations/implications: there are many alternative models that may lead to different results by subsequent authors of scientific papers. Therefore, it is recommended to conduct further research to identify the factors shaping gross salaries in industry.
Originality/value: the article raises an important topic regarding economic factors affecting the level of salaries in industry. The existing literature lacks research specifically focused on salaries in the industry.
Keywords: industry, salaries level, economic factors.
Category of the paper: Research paper.
JEL: C10, C51, J31, L60.

1. Introduction

Technological progress, resulting from globalization processes, changes the role of the labor force as a factor increasing the level of competitiveness (Ulbrych, 2015). At the same time, the increase in innovation has contributed to a reduction in the importance of the number of hands at work, and the role of acquired qualifications has increased, which is important in particular in modern industries, which is commonly understood as a branch of the national economy dealing with the exploitation and processing of natural resources in a mass manner, using machines and applying division of labor.

Issues related to employee salaries are among the basic issues in modern economics. On the one hand, they refer to the human factor and the work it performs, and on the other, to employees' expectations related to this work in the form of salary received. The literature defines salary as payment for work performed for the employer (Borkowska, 2014). In a broader sense, salary is understood as the sum of: salary including basic salary; employee allowances and salary received for time not worked; short and long-term stimuli; additional benefits (which are usually of a material nature).

The level of salary is often one of the significant problems related to the sense of security. This is due to the two functions of salary: maintenance and motivation (Bernatt et al., 2011). The alimony function is intended to provide the employee with a level of salary that allows him to function properly in society. According to the motivational function, the level of pay is a stimulator of effective action. As Gros (2012) points out, salary should be adequate to the degree of difficulty of the work performed. The amount of salaries is therefore one of the basic elements determining the economic and social conditions of a given country.

It should be noted that they are the basic source of household income, which in turn proves the wealth of a given individual. This may cause certain inequalities and divisions in society. Additionally, salaries indicate the ability to meet one's needs, as a result of which their level will affect domestic consumption, which in turn will affect the level of economic development. Therefore, it becomes important to find the determinants influencing the level of salary. The study of individual factors is particularly important after Poland's accession to the European Union, which resulted in intensified economic migration of the community and, consequently, an increase in the level of income inequality between individual regions of Poland.

Many important factors influence the overall salary level in a given country. In existing research, they most often include socio-economic factors at the micro and macroeconomic levels. Borkowska (1999) notes that various labor market institutions, such as employers, employees, trade unions and state institutions, contribute to shaping the level and differentiation of salaries. When explaining the impact of economic factors on the level of salaries, it is reasonable according to Sobczak (2000) is to refer to the real GDP growth rate, the inflation rate and the annual growth rate of the average monthly salary. The positive relationship between the level of average salaries and the economic effects of the enterprise, labor productivity, the level of inflation and the level of investment per employee was proven by Nyk (2007, 2013). The work of Ziemba and Świeszczak (2011) proved the statistical significance between the average level of salary and the value of the development index of entities from the SME sector and the value of revenues per 1 SME entity. Przekota (2016) considers the unemployment rate and industrial production sold to be the basic factors influencing the amount of salaries. In turn, Łopatka (2015) shows that the formation of salary levels is largely sanctioned by the autonomous functioning of the market, and therefore depends on the prevailing situation in the economy and the level of competitiveness of the regions.

In world literature you can also find issues examining the impact of individual factors on the level of salaries. The issue of salaries in the euro area economy in the 1980s and 1990s was discussed in depth in the work of Genre, Momferatou, Mourre (2005). The authors state that salaries in the long run are integrated with changes in labor productivity and there is a reverse causality between the increase in the average salary and the increase in the number of people employed in a given industry. Moreover, they prove that salary differences in the euro area are similar to those in the United States. In turn, the works of Leuven and Oosterbeek (2004) and Simón (2010) state that the level of salaries is influenced by both market forces and institutional factors. Interesting conclusions are reached by Magda, Rycx, Tojerow and Valsamis (2009), who compare salaries in Western and Eastern Europe. At the same time, they confirm that salary differences are more dispersed in countries where salary negotiations are poorly coordinated. Logeay, Stephan and Zwiener (2011) draw attention to macroeconomic factors affecting the level of salaries, pointing out the high importance of such determinants as: unemployment rate, minimum salary, state economic growth rate and domestic demand growth rate. Preston (2018) also comprehensively presents the determinants of salaries, emphasizing that both supply and demand factors play an important role.

However, these studies refer to the average level of salaries in a given country or group of countries. On the other hand, there is a lack of research specifically focused on salaries in industry. In recent years, the industry has been entering the path of dynamic development as a result of numerous transformations occurring both in enterprises and their surroundings. It is important to remember that industry continues to have a significant impact on the overall economy. This is determined by the fact that this sector is a producer of investment goods for all sectors of the economy. The global financial and economic crisis has revealed that the current economy cannot function properly without industry. It is an important workplace for society, innovation and productivity. Moreover, it meets the growing needs of material consumption. Therefore, the main aim of the work was to study the impact of selected economic factors on the level of gross salaries in the industry sector in Poland in the years 2005-2020.

For the purposes of the study, it was found that the industry, in accordance with the Regulation of the Council of Ministers of 24.12.2007 on the Polish Classification of Activities (PKD), includes: - section B - mining and quarrying; - section C – industrial processing; - section D - production and supply of electricity, gas, steam, hot water and air for air conditioning systems; - section E - water supply, sesalary and waste management and reclamation activities.

2. Introduction

In the first stage of the research, an analysis of the literature was carried out identifying factors that could potentially influence the average gross salary in industry. These included:

- X1 – average employment in industry (in persons),
- X2 – unemployed registered at the end of the year (in thousands of people),
- X3 – average monthly gross salary (in PLN),
- X4 – state budget revenues (in PLN million),
- X5 – state budget expenditure (in PLN million),
- X6 – domestic demand (in PLN million),
- X7 – price index of sold production in industry (in %),
- X8 – gross domestic product (in PLN million),
- X9 – average annual euro – Polish zloty exchange rate (in PLN),
- X10 – average annual exchange rate US dollar – Polish zloty (in PLN),
- X11 – average opening prices of Brent crude oil (in PLN),
- X12 – total capital expenditure (in PLN).

The next step of the analysis is to examine the Pearson's linear correlation between the average gross salary in industry and the adopted variables. This is intended to show the strength of the relationship between individual variables. Due to emerging doubts whether the relationship between the examined features is at least approximately linear, the natural logarithms of individual variables were examined. In addition, monetary data have been reduced to constant 2005 prices to eliminate the impact of inflation.

In the last stage, a multiple regression model was created, which aims to indicate which of the adopted variables best explain the formation of the average gross salary in industry. The model was constructed based on annual data. Hellwig's integral capacity method was used to select the explanatory variables. When building the model, assumptions were made that the explanatory variables were characterized by a correlation level of less than 0.5, and that the selected explanatory variables were at least significantly correlated (correlation level greater than or equal to 0.5) with the explained variable and that they were statistically significant at 5%.

3. Results

The average gross salary in industry in 2005-2020 varies. The lowest value was recorded in 2005 - PLN 2,361.61, and the highest in 2020 - PLN 3,866.23. The average gross salaries in industry was PLN 3,057.49.

A significant role in the methodology of examining the interdependence of time series is their stationarity. Therefore, the adopted variables were tested for stationarity through the KPSS test (with a test lag of 1). The results of the test for the variables are included in Table 1.

Table 1.
KPSS test results for potential variables explaining the average gross salary in industry and their first increases

Variable	p-value	p-value for first increments
Y - average gross salary in industry (in PLN)	0.038	p > .10
X1 - average employment in industry (in persons)	0.092	
X2 – unemployed registered at the end of the year (in thousands of people)	0.016	p > .10
X3 – average monthly gross salary (in PLN)	p < .01	p > .10
X4 – state budget revenues (in PLN million)	p < .01	p > .10
X5 – state budget expenditure (in PLN million)	p < .01	p > .10
X6 – domestic demand (in PLN million)	p < .01	p > .10
X7 – price index of sold production in industry (in %)	p > .10	
X8 – gross domestic product (in PLN million)	p < .01	p > .10
X9 – average annual euro – Polish zloty exchange rate (in PLN)	0.020	p > .10
X10 – average annual exchange rate US dollar – Polish zloty (in PLN)	p > .10	
X11 – average opening prices of Brent crude oil (in PLN)	0.067	
X12 – total capital expenditure (in PLN)	0.015	p > .10

Source: own study.

When analysing the results of the KPSS test, it should be noted that the following variables are characterized by non-stationarity: the average gross salary in industry, the unemployed registered at the end of the year, the average gross salary, state budget income, state budget expenditure, domestic demand, gross domestic product, average annual euro-Polish zloty exchange rate, total investment outlays. The remaining variables were found to be stationary (at a significance level of 5%). These include: average employment in industry, the price index of sold production in industry, the average annual US dollar-Polish zloty exchange rate, and average opening prices of Brent crude oil. In situations where the time series was non-stationary, first differences were calculated for it. After applying them to variables that showed non-stationarity in the time series, the KPSS test again showed their stationarity (Table 1). From this point on, the calculated first differences were used for further analyses.

In order to empirically verify the factors that shape the average gross salary in industry, in the first stage, a Pearson linear correlation analysis was performed between the average gross salary in industry and the adopted variables. The conducted research focuses on obtaining answers as to which of the potential variables are important in connection with the explained variable. The achieved results are presented in table 2.

Table 2.
Pearson's linear correlation coefficient between the average gross salary in industry and the adopted variables

Variable	r	Test statistics
X1 – average employment in industry (in persons)	0.46	0.084
X2 – unemployed registered at the end of the year (in thousands of people)	-0.82	0.000
X3 – average monthly gross salary (in PLN)	0.90	0.000
X4 – state budget revenues (in PLN million)	0.40	0.145
X5 – state budget expenditure (in PLN million)	0.27	0.323
X6 – domestic demand (in PLN million)	0.75	0.001
X7 – price index of sold production in industry (in %)	-0.17	0.552
X8 – gross domestic product (in PLN million)	0.68	0.005
X9 – average annual euro – Polish zloty exchange rate (in PLN)	-0.49	0.062
X10 – average annual exchange rate US dollar – Polish zloty (in PLN)	-0.01	0.979
X11 – average opening prices of Brent crude oil (in PLN)	-0.01	0.983
X12 – total capital expenditure (in PLN)	0.64	0.011

Source: own study.

The calculations of the correlation coefficient using the Pearson method indicate significant differences in the results achieved. The value of the average gross salary in industry is characterized by a very high degree of correlation with the average monthly gross salary (r = 0.90), and a high degree of correlation occurs with the variables: unemployed persons registered at the end of the year (r = -0.82) and domestic demand (r = 0.75). In turn, a significant degree of interdependence (statistically significant at the 5% level) was observed with the variables: gross domestic product (r = 0.68) and total investment outlays (r = 0.64). With the remaining variables, the size of the average gross salary in industry is not statistically significant at the 5% level.

Due to doubts as to the possibility of taking into account individual variables when building a model explaining the influence of factors on the average gross salary in industry, the selection of variables was verified based on Hellwig's integral capacity method. Five explanatory variables were taken into account (those characterized by statistical significance of the correlation with the average gross salary in industry). This method indicated that the variables: average gross salary (first increments) and domestic demand (first increments) should be taken into account when building the model.

The next step was to create models that explain the influence of factors on the average gross salary in industry. For the initially estimated model, the results of the Doornik-Hansen test for the normality of the distribution of residuals indicate that the empirical distribution function has a normal distribution (for the assumed significance level of 5%). The chi-square value was 1.649, with p-value = 0.438.

In order to check autocorrelation and possible modification of variables, the Breusch-Godfrey test based on Lagrange multipliers was performed. The lag order for the test was 1. For all test statistics, the p values are much greater than 5%, so the null hypothesis that the model does not contain autocorrelation should be accepted. Detailed results are presented in Table 3.

Table 3.
Results of the initial Breusch-Godfrey test for Lagrange multipliers for first-first autocorrelation

	Factor	Standard error	t-Student	p-value
Const	0.001	0.004	0.296	0.773
d_X3	−0.041	0.126	−0.328	0.750
d_X6	0.015	0.066	0.221	0.830
uhat_1	−0.423	0.310	−1.364	0.202
Coefficient of determination R-square = 0.157.				

Source: own study.

To check heteroscedasticity, White's test was performed. The null hypothesis in this test was the lack of heteroskedasticity. In the test, the p value was greater than the significance level of 0.05 (Table 4). Therefore, there are no grounds to reject the null hypothesis. Therefore, there is no heteroscedasticity in the model.

Table 4.
Results of White's test for heteroskedasticity of residuals

	Factor	Standard error	t-Student	p-value
Const	0.000	0.000	0.936	0.374
d_X3	0.003	0.003	0.829	0.428
d_X6	-0.001	0.001	-1.159	0.276
sq_d_X3	-0.054	0.073	-0.739	0.479
X2_X3	0.023	0.049	0.465	0.653
sq_d_X6	0.003	0.013	0.235	0.820
Coefficient of determination R-square = 0.303 Test statistic: TR^2 = 4.551 with p-value = P(Chi-square(5) > 4.551) = 0.473				

Source: own study.

The VIF test was used to check the multicollinearity of the variables. The test shows that there is no multicollinearity in the model because the factor value is less than 10 (the VIF value for both variables is equal to 1.625, with the minimum possible value equal to 1.0). In the next step, the Ramsey RESET test was performed. The null hypothesis of this test was that the given model was linear. The adopted version of the RESET test (square and cube of the variable) confirmed the functional correctness of the model (Test statistics: F = 0.661365, with p value = 0.537). Therefore, this model was adopted as the final one. At the same time, it should be noted that the phenomenon of coincidence occurs in the model. The most important results of the estimation of the model explaining the influence of factors on the explained variable are presented in Table 5.

Table 5.
Results of the estimated function of the model explaining the influence of factors on the average gross salary in industry

	factor	**Standard error**	**t-Student**	**p-value**
const	0.008	0.004	2.143	0.053
d_X3	0.639	0.123	5.192	0.000
d_X6	0,145	0,062	2,329	0,038
Arithmetic mean of dependent variable		0.033	Standard deviation of dependent variable	0.017
Determination coefficient R-square		0.865	Adjusted R-square	0.843
			The p-value for the F-test	0.000

Source: own study.

The final model indicates that the average gross salary and domestic demand have the relatively greatest positive impact on the average gross salary in industry. It is also worth noting that the estimated model has a very good fit, the R2 value is 86.5%. This means that this model explains almost 87% of the variability of the phenomenon, i.e. the average gross salary in industry.

4. Conclusion

The added value is the quantification of factors influencing the average gross salary in industry. The obtained results allow us to indicate that the average gross salary in industry is related to: the average gross salary in the economy, the number of unemployed people registered at the end of the year, domestic demand, gross domestic product and total investment outlays. The construction of the econometric model made it possible to indicate that the factors that best explain the average gross salary in industry are the average gross salary in the economy and the volume of domestic demand. It should therefore be concluded that the average level of salaries in the economy exerts pressure on the level of salaries in industry. On the other hand, the volume of consumption and gross savings are becoming more important. The higher the values of the variables included in the model, the higher the level of gross salaries in the industry. The results achieved are important primarily for state authorities and production companies

The determined conditions therefore largely confirm the existing domestic and foreign research on the impact of factors on the overall level of salaries. At the same time, it is worth noting that despite the passage of time, similar factors still play a decisive role in shaping salaries.

At the same time, it should be remembered that the proposed equation is one of many possibilities to solve the problem. There are many alternative models that may lead to different results by subsequent authors of scientific works. Therefore, it is recommended to conduct further research to identify the factors shaping gross salaries in industry.

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