LABOR PRODUCTIVITY GROWTH AND ITS IMPACT ON GROSS AVERAGE EARNINGS IN THE INDUSTRIAL SECTOR

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Abstract*. Labor productivity represents an economic growth factor together with labor and capital. Productivity affects inflation and exchange rate. Mismatching between wage costs and productivity favors increasing inflation. The competitiveness of a country is often analyzed through the correlation between wages and productivity. In this paper, we analyzed whether there is a correlation between productivity and wages in the industrial sector. In the analyzed period, January 2005-January 2017, the two variables – gross average earnings and labor productivity index – were strongly correlated, there is a very close linear association between them, which means that the evolution of the gross average salary in the industrial sector was closely related to the evolution of the labor productivity index in this sector. The industrial sector helped prevent the emergence of imbalances and dysfunctions in the economy by respecting these fundamental correlations between the gross average earnings and the labor productivity index.*

Keywords*: gross average salary; labor productivity index.*

Introduction

In this paper, based on data provided by the National Institute of Statistics, we aim to assess the impact of labor productivity on gross average wages in the industrial sector. In order to do this, we performed a statistical analysis of two selected indicators, which includes normality testing, correlation analysis and regression modeling (Druica, 2012). Based on the discovered association of the two variables, we built, as a result, the linear regression model which explains the nominal wages depending on the index of labor productivity in the industry (Duguleana, 2012).

We found this analysis suitable taking into account that the growth of labor productivity represents the foundation of real incomes increase and standard of living, and is the basis of income distribution in society as a necessary condition to avoid imbalances in the economy.

Theoretical aspects of salary, gross average wages, and labor productivity

Salary is one of the fundamental forms of income in the economy and it is of utmost importance in determining correlations between consumption and income, or between savings and investments. "The salary is the price at which transaction is made to exercise the factor production-work in a market economy" (Prahoveanu, 1998).

Salary is both revenue and cost. This double meaning gives it two opposite trends in establishing its size. The employee wants a salary increase to better meet the unlimited needs that s/he has, and the employer wants to reduce salary as a component of product cost. "In determining salary size, the economic rationality should be a priority, i.e. the ratio between the labor production factor productivity and the cost incurred by the company for this factor" (Prahoveanu, 1998).

According to Gheorghe (1999) "the substance of salary consists, at the same time, in the cost of the workforce and labor productivity. What the employee receives is a portion of labor product, conditioned by the labor productivity level".

"Labor productivity is somewhat a synthesis of the use of all production factors... However, because it is conditioned by the human production factor, labor productivity remains as important as man is to his creations, because all the other production factors – including the capital – are man's creations (as household means), while the coverage of human needs is the very purpose of household management" (Manoilescu, 1929).

The productivity or yield of the production factors is the efficiency of combining the production factors oriented to obtain the maximal effect with minimum resources (costs as small as possible). In the broad sense, productivity can be defined as the ratio between the quantity of wealth produced and the number of resources absorbed during production. Thus, it is basically determined as the ratio between the outputs (production - the output of an economic unit) and the efforts made in order to obtain them (the production factors used, i.e. the inputs). There are different ways of approaching productivity. Thus, in terms of the manner of measuring the established results, productivity is classified as:
- physical productivity - which measures the yields (in-kind) of the use of the production factors; it is expressed in physical units (natural or natural-conventional)
- measured productivity - which allows efficient financial-monetary measurement. It is widely used in the management of modern enterprises.

Another typology of productivity refers to the notions of:
- Gross productivity - which measures the production as a whole, with respect to the factors used (or the factor used). In this case, production is regarded as "final production", i.e. as a sum of the values added by various production activities.
- Net Productivity - which aims at eliminating – from the final production – the value of external acquisitions and the cost of using the installed capital (reductions in value, payments) in order to autonomize what is directly dependent on the productive effort of the analyzed company.

However, in the literature, productivity is addressed particularly in terms of the two consecrated types, namely:

- global productivity - which captures the effects of combining all production factors, measuring their overall performance and efficiency (Barre & Teulon, 1997).
- partial productivity - of each production factor, expressing the production obtained by using each consumed production factor (labor, capital, etc.)

Increasing labor productivity is the process whereby, with the same amount of work, we obtain a greater quantity of goods and services or vice versa, the same quantity of goods is made with less labor; it has a lawlike nature.

This implies a change in the production factors, in the way of combining them and, therefore, in the way of carrying out the working process. The productivity level of individual and national labor is under the influence of many primary and secondary, direct or indirect factors, which intertwine and sometimes act in different ways. Among these, we mention the following:
- technical factors - take into account the attained level of science and technology at a given moment;
- the economic and social factors - are connected to production and labor organization, both at the micro- and macroeconomic level, in terms of labor and living conditions;
- human and psychological factors - related to school education, culture level, adaptability to labor conditions, satisfaction offered, family life, the influence of religion and tradition in choosing the job. The workforce – the performers – and its rational use are decisive factors in the continuous increase of labor fruitfulness and, of course, of labor productivity.
- natural factors - related to climate conditions, soil fertility, accessibility of natural resources;
- structural factors - influence the level of labor productivity through changes in the structure of the national economy, by branches and sub-branches.

The economic agents are constantly concerned with increasing the yield of production factors and their efficient use, by resorting to different methods, depending on the material, human, natural and financial possibilities. Automation, robotization, the promotion of new techniques – essential coordinates of contemporary technical progress – entail productivity gains because they ensure higher productivity with the same labor costs, favor the diminishing of other expenses on products in general and increase savings.

Technical progress has increased the share of intellectual effort compared to physical effort, entailed more labor promptness and accuracy. In this context, the continuous raising of labor force qualifications is a prerequisite for the efficient use of human resources. Improving the organization of management, production and labor represents a complex, dynamic and continuous process that involves the adoption by the management of the economic units of a set of measures and the use of methods and techniques established on the basis of technical and economic calculations, which take into account new scientific findings.

Continuing vocational/ professional training and development represent the main self-capitalization and development way of the human factor, in order to capitalize better on the creative and anticipative human potential. This underlies the responsiveness and speed of adaptation to the new and the possibility of rapidly reintegrating the human

resources in other activities that are useful to the society. Labor material co-integration – it conditions the income of the population on their work results.

In this respect, it is very important to implement an apportionment system, which, on the one hand, determines as accurately as possible the size of each worker's salary, i.e., what is due for the work performed, and, on the other hand, a modern system of work norms whereby to determine the contribution of each person to social activity. Any neglect in this area is reflected unfavorably, sooner or later, in the sense of insufficient co-integration, when the incomes do not increase adequately according to the work performed, as in the case of higher revenues than the activity carried out, attracting the failure to observe a fundamental economic correlation, i.e. the increase in labor productivity and salary growth. It is widely accepted that, in order to have an efficient economic activity, productivity dynamics must be superior to salary dynamics.

Increasing labor productivity is of particular economic importance for the entrepreneur because:
- it creates the premises for reducing the total average (unitary) cost;
- it increases company competitiveness the and its ability to cope with competition on the domestic and international market;
- it is possible to save the consumed production factors;
- it is possible for the owners of the production factors to obtain higher incomes when the produced goods are sold at the same prices or even lower, etc.

The effects of productivity growth are also felt at the consumers' level through:
- nominal salary growth;
- saving work time;
- increasing the satisfaction of needs, etc.

Productivity growth is also important for the national economy as a whole, because:
- more wealth is produced with the same volume of production factors;
- there is a mitigation of the tension between needs and resources;
- the population welfare increases;
- the national income per capita increases, etc.

The labor productivity level, among other factors, is a key element used for determining the salary level on categories of employees, observing the correlation between the dynamics of labor productivity and that of the average wage in the economy being essential in meeting efficiency-equity ratio in the economy (Ignat, 2004).

The theory of efficiency salary belongs to the American H. Leibenstein. The author starts from the idea that "individual productivity is an increasing function of the real wage (the number of goods that the employee gets). Therefore, an increase in salary attracts the increase in the direct cost of labor unit and labor productivity. On this basis, it is determined the efficient use of labor as work volume balanced with its productivity" (ASE, 1995).

"The return on labor capital-labor productivity expresses the efficiency with which labor is used, defined as the ratio between the amount of wealth produced and the number of resources absorbed during its production." (ASE, 1995).

The distribution of fundamental income in the economy – wages, profit, interest, annuity – must be correlated with labor productivity growth to avoid imbalances and dysfunctions in the economy.

It is very important that "labor productivity grows alongside the increase in employees' wages, but this increase in wages must be, however, correlated with the personal contribution of each individual to labor productivity growth, wages not being able to increase faster than the rise in the newly created value" (Gheorghe, 1999).

We are among the leaders of Europe in terms of hours worked, but we earn among the lowest salaries on the continent. Employees in Romania work on average for almost 41 hours a week. Thus, we rank the 9th in the European Union in terms of the number of hours worked. For example, in one week, the Romanians work one hour more than the Spanish and about two hours more than the French or the Italians. It is also true that the Romanians work a little less than the British, who ranks first in this top.

Nevertheless, Romanians have among the lowest salaries in the European Union, i.e. 565 Euros per month, on average. Only Bulgarians earn less than we do, i.e. almost 460 Euros per month. Moreover, if we looked at the western states where people work less, we would notice that the net salaries are higher. Employees in Spain and Italy earn approximately 1,700 Euros per month and those in France and Germany earn over 2,200 Euros.

This phenomenon – as explained by specialists – is triggered by the fact that the Romanians work a lot but produce little. According to statistical data, labor productivity accounts for almost 62% of the European average. Even in this case, only the Bulgarians have lower productivity. On the other hand, in Western Europe, this indicator exceeds the European average.

Table 1. Labor productivity and revenues in the EU (Source: Eurostat)

Country	Hours worked per week	Average salary (euro)	Labor productivity (% of UE average)
Great Britain	42,3	1.990	101,1%
Poland	41,1	832	74,2%
Bulgaria	41	457	45,4%
Romania	40,7	565	61,6%
Germany	40,4	2.270	105,8%
Spain	39,9	1.749	101,9%
France	39,0	2.225	114,8%
Italy	38,8	1.758	107,4%

In the context of the recent economic monitoring at the EU level, the role of salary developments in influencing macroeconomic performance has attracted increasingly more attention. Salary changes represent one of the main channels of labor supply and demand adjustment and directly affect employment outcomes. Therefore, too high or too low salary growth (compared to productivity and rising prices) may indicate imbalances in the labor and product markets. This phenomenon can induce inflationary or deflationary pressures and may lead to a decrease or increase in the attractiveness of employing and retaining workers in the workforce. It can also affect job offers, including the decisions to participate in the labor market (European Commission, 2017).

Among the European countries, Romania has recorded the highest percentage increase of the minimum salary over the last 10 years, i.e. 195%. However, our salary level is still incomparably lower than the salary level in Western countries. Why does this happen?

According to KeysFin analysts, "The wages reflect, to a significant extent, the economic realities. Even if there is a significant economic growth, it comes largely from consumer spending thus not solid, sustainable in the long-term" (KeysFin, 2018).

The labor productivity in our country is still low, and companies avoid investing heavily in employees. By increasing salaries in the public sector, the state is trying to boost the market, but given the unstable economic framework, too few investors have followed this trend. In the absence of favorable investment conditions, such as infrastructure or the tax system, Romania remains attractive to investors, especially through low labor costs. In order to change this trend, macroeconomic policies are needed to support the horizontal development of investments. KeysFin analysts also explained that "only when the economy will not be that fragile will we see a real increase in Romanians' disposable incomes" (KeysFin, 2018).

Beyond the reality of 2018, the future of the labor market is quite bleak. The decline of the birth rate, the retirement of a whole generation of employees in the coming years and, in particular, the exodus of the labor force towards the West will cause Romania to face a growing labor force crisis in the coming years.

The education system, as it is currently set up, is completely useless in front of the challenges faced by the labor market. There are still being rolled out generations of unemployed graduates – i.e. with high school and university diplomas – that are not connected to economic realities", argued the experts.

According to them, the Romanian state needs to invest significantly in reorienting the educational system to the needs of the economy. "We need craft schools in all fields, from auto to agriculture, from materials processing to craftsmanship. It is also necessary to develop a real program of fiscal and financial support for firms that employ the young labor force. Without such measures, the crisis will deepen, and the alternative will be bringing workers from poor countries, from Africa and Asia, with inherent social consequences, as is the case in Germany", said KeysFin experts (KeysFin, 2018).

In this paper, we analyzed two indicators – the monthly gross average salary and the index of labor productivity per employee in the industry – to see if there is a connection between them and if labor productivity influenced the earnings.

The gross average salary represents (INSSE, 2017) "the ratio between the gross amounts paid to employees by economic units in the reference period, for whatever period it is due, and the average number of employees". In our case, we are interested in the industrial sector.

The ratios of labor productivity per employee in the industry are calculated according to the indexes of industrial production and the indexes of the average number of employees for the economic units with industrial activity (Sowell, 2007).

Statistical analysis of indicators

The statistical analysis of the economic indicators used in this study concentrated on the analysis of each indicator in terms of descriptive statistics and normality of the distribution. Then, we investigated the association between them. Q-Q plos were employed in order to visually analyze the distribution, but Kolmogorov-Smirnof tests were also considered in order add significance to the study. Pearson correlation coefficient was computed to test the existence of the linear association between the two indicators. Based on the results, a linear regression model was calculated and the analysis of its residuals proved they are Gaussian white noise (Seskin, 2007).

The data series contains 145 monthly values recorded in the time interval January 2005 – January 2017, it was obtained from INSSE (2017). The statistical analysis was performed using SPSS (IBM Corp, 2013).

Based on the data from Tables 2 and 3, we calculated, for the two indicators, descriptive statistics – maximum, minimum, average, standard deviation, skewness coefficient, and kurtosis coefficient (see Table 4).

Table 2. Average gross monthly

Unit: Lei												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	835	819	877	923	913	921	941	954	968	939	971	1075
2006	952	944	1051	1048	1046	1059	1085	1098	1109	1101	1134	1254
2007	1129	1151	1274	1288	1267	1271	1321	1333	1319	1364	1375	1544
2008	1379	1385	1456	1626	1556	1583	1646	1598	1654	1627	1628	1836
2009	1615	1604	1688	1776	1704	1745	1820	1768	1802	1797	1796	1983
2010	1780	1775	1959	1867	1879	1905	1953	1932	1953	1915	1964	2180
2011	1945	1920	2044	2100	2022	2042	2077	2055	2064	2029	2094	2288
2012	2038	2021	2152	2208	2170	2147	2209	2155	2153	2160	2193	2389
2013	2111	2099	2221	2326	2260	2241	2326	2257	2262	2246	2308	2533
2014	2248	2240	2395	2445	2406	2389	2466	2375	2423	2394	2465	2720
2015	2409	2391	2563	2607	2536	2596	2637	2522	2573	2561	2663	2891
2016	2548	2556	2737	2831	2750	2807	2825	2777	2795	2774	2919	3144
2017	2891											

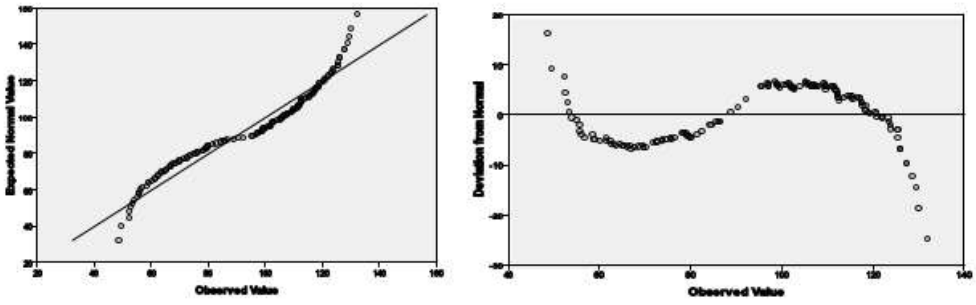
We notice that both have negative skewness coefficients, so there is some moderate skewness of the distribution. In terms of the kurtosis coefficient, we see that it is smaller than 0, thus the distribution has short tails (we call it 'light tailed'), without outliers. Since the values of these two indicators are moderate, we shall test the normality of the data using other complementary methods (Q-Q plot and the Kolmogorov-Smirnov test).

Table 3. Labor productivity ratios in the industry

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	48.6	49.5	56.1	53.9	52.4	55.7	53.3	52.5	58.8	58.4	61.5	55.6
2006	53.0	55.0	62.4	56.7	63.3	64.5	61.4	58.8	66.8	69.4	69.5	60.0
2007	62.6	66.1	75.0	65.2	73.7	72.6	72.5	67.0	71.6	79.9	79.3	67.7
2008	70.1	76.4	78.0	74.7	79.9	78.9	79.7	68.5	81.4	84.5	75.8	63.6
2009	65.2	73.8	82.4	79.1	85.6	90.3	92.1	78.3	95.6	100.3	97.0	86.1
2010	84.2	88.7	102.1	95.2	99.0	105.6	103.9	86.5	109.2	111.5	112.6	102.2
2011	98.7	102.6	115.6	101.5	109.5	106.4	105.2	97.0	112.0	112.2	115.1	98.5
2012	99.2	101.6	112.4	99.5	112.2	105.7	107.1	96.8	109.6	117.0	115.4	97.0
2013	102.7	106.3	112.4	117.7	109.5	110.8	119.2	100.9	120.6	129.9	125.9	107.6
2014	113.6	116.4	123.7	118.4	122.1	120.8	123.8	99.0	125.9	131.9	123.4	108.0
2015	111.6	117.1	125.3	117.4	118.3	121.8	125.3	101.9	127.4	128.5	123.2	109.3
2016	107.0	114.4	125.4	118.8	117.4	120.4	118.4	105.1	129.4	125.9	127.4	111.2
2017	111.6											

Table 4. Descriptive statistics

	N	Min.	Max.	Mean	Std. Dev.	Skewness		Kurtosis	
	Stat.	Stat.	Stat.	Stat.	Stat.	Stat.	Std. Err.	Stat.	Std. Err.
Ratios of labor productivity	145	48.60	131.90	94.39	23.66	-.331	.201	-1.200	.400
Gross average salary	145	819.00	3144.00	1909.80	581.86	-.202	.201	-.938	.400
Valid N (listwise)	145								

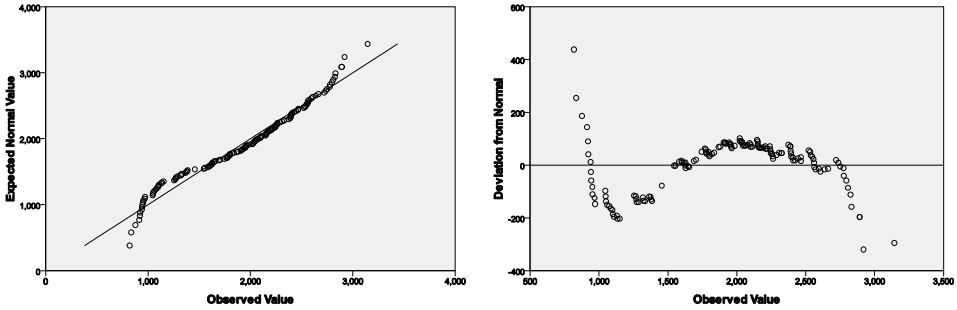


(a) *(b)*

Figure 1. Normal Q-Q Plot (a) and Detrended Normal Q-Q Plot (b) for ratios of labor productivity

The graph Q-Q plot for productivity (Figure 1) index shows a seemingly normal character of the distribution, but a nonlinear trend of data is visually observed. The Kolmogorov-Smirnov test has the value p<0.05 (0,047) - see Table 5, thus rejecting the hypothesis of data normality.

By visually analyzing the graph Q-Q of the variable monthly gross average salary it is seen that the data follows a normal distribution (all the points are close to the diagonal) (Figure 2). KS test obtains the p-value of 0.367, thus we conclude that there is no information which could lead to the rejection of the hypothesis that the distribution of salary is normal. Therefore, we can say that the monthly gross average salary is a normally distributed statistical variable.



(a) ***(b)***

Figure 2. Normal Q-Q Plot (a) and Detrended Normal Q-Q Plot (b) for gross average salary

Table 5. One-Sample Kolmogorov-Smirnov Test

		ratios of labor productivity	gross average salary
N		145	145
Normal Parameters[a,,b]	Mean	94.39	1909.80
	Std. Deviation	23.66	581.85
Most Extreme Differences	Absolute	.114	.076
	Positive	.075	.076
	Negative	-.114	-.072
Kolmogorov-Smirnov Z		1.370	.919
Asymp. Sig. (2-tailed)		.047	.367
a. Test distribution is Normal.			
b. Calculated from data.			

The histograms of the two indicators, accompanied by the normal curve, also show some deviation of the data from normality. The productivity ratio has a multi-modal distribution (analyzing the shape of the histogram) (see Figures 3 and 4).

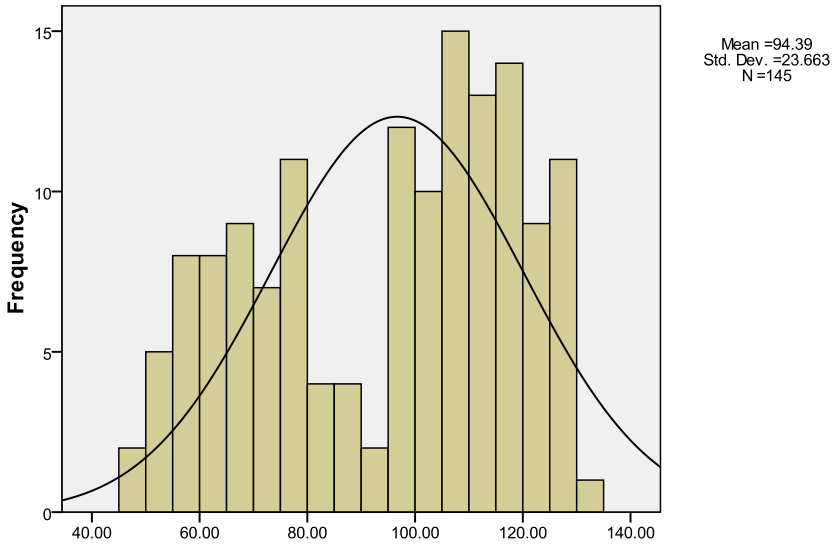


Figure 3. Evolution of ratios of labor productivity

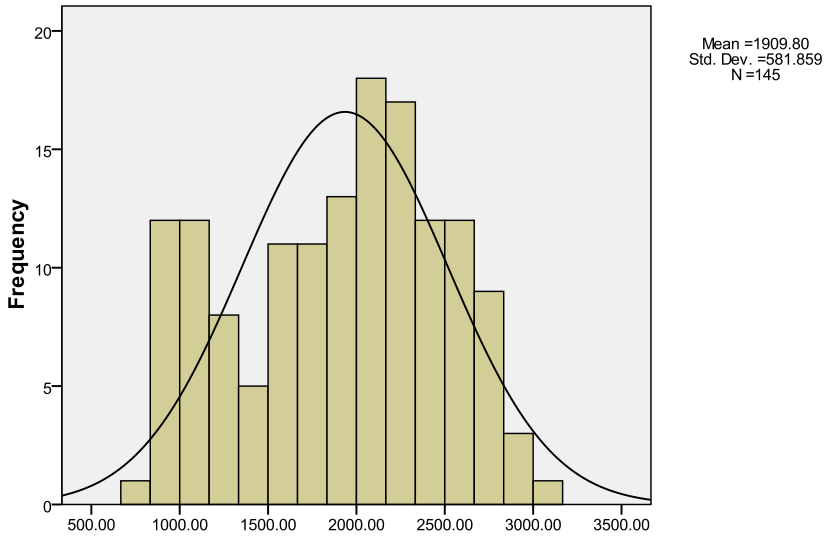


Figure 4. Evolution of gross average salary

For the analysis of the linear association between the two variables, we calculate the correlation coefficients. The calculated correlation coefficients reveal that the two variables are closely correlated. Pearson correlation coefficient is 0.922- see Table 6, which indicates a very close linear association between the two variables (the associated p-value is smaller than 0.01, so the coefficient is also statistically significant).

Table 6. Correlations

		Ratio of labor productivity	Monthly gross average salary
Ratio of labor productivity	Pearson Correlation	1	.922**
	Sig. (1-tailed)		.000
	N	145	145
Monthly gross average salary	Pearson Correlation	.922**	1
	Sig. (1-tailed)	.000	
	N	145	145
**. Correlation is significant at the 0.01 level (1-tailed).			

Given the documented association of the two continuous variables and that there are no significant outliers, we built the linear regression model which explains the salary based on the productivity index – see Table 7.

Table 7. Correlations[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-230.240	77.458		-2.972	.003
	Ratio of labor productivity	22.672	.796	.922	28.477	.000
a. Dependent Variable: Monthly gross average salary						

Thus, the model is: -230.24+22.67*index=salary
The Anova table characterizes the linear regression model. The significance level is <0.01, thus, the regression model is statistically significant to predict the salary on the basis of productivity index – see Table 8.

Table 8. ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.144E7	1	4.144E7	810.960	.000[a]
	Residual	7308096.025	143	51105.567		
	Total	4.875E7	144			
a. Predictors: (Constant), Ratio of labor productivity						
b. Dependent Variable: Monthly gross average salary						

The residuals of the linear regression model follow a normal distribution – see Table 9 and Figure 5. This is important in order to have a well fit model.

Table 9. Residual Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	871.62	2760.20	1909.80	536.47	145
Residual	-468.86	853.10	.00	225.27	145
Std. Predicted Value	-1.93	1.58	.00	1.00	145
Std. Residual	-2.07	3.77	.00	.99	145
Dependent Variable: Monthly gross average salary					

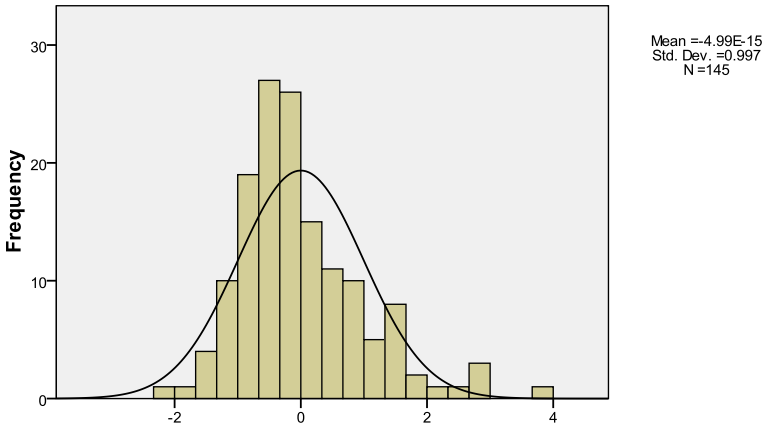


Figure 5. – Regression Standardized Residual (Dependent Variable: Monthly gross average salary)

Conclusions

Gross average earnings and the labor productivity index were analyzed over a period of 145 months, between January 2005 and January 2017. The two variables were found to be strongly correlated, with a strong linear association. A linear regression model was built to model the evolution of the gross average salary in the industrial sector as a function of the labor productivity index in this sector. The industrial sector helped prevent the emergence of imbalances and dysfunctions in the economy by respecting these fundamental correlations between the gross average earnings and the labor productivity index.

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