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SMEs in Regions of Russia: Workers Salary

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Abstract

This paper aims to explore the impact of factors socioeconomic position of Russian regions on the average wage of employees in small and medium enterprises (SMEs). The present study uses empirical data to obtain new knowledge and estimate the current wages of employees of SMEs in the regions of Russia. It was the data from the official statistical observation of activities of all Russian SMEs for 2015 year. Authors estimated multiple nonlinear regression model on the spatial data. The ratios between wage of employees in SMEs and the subsistence minimum were measured with the use of the function of normal distribution. Studies showed great differentiation of wages of SMEs employees in the regions of Russia. Elaborated instruments for measurement and analysis wages can ensure the development of SMEs in perspective. In order to increase wages, it is necessary to take steps to develop regions and reduce unemployment. Such activities must be carried out by the authorities at the federal and regional levels and included into the development plans of the Russian economy.

Keywords: Small enterprises, Medium enterprises, Wages, Regression model, Function of normal distribution, Unemployment, Subsistence minimum, Incomes of inhabitants, Budget expenditures, Regions.

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Introduction

Small and medium enterprises (SMEs) are considered as a driver of the economy, creating jobs and contributing to growth the production volumes (Acs et al., 2008; Baumol, 2004; Decker et al., 2014). The role of entrepreneurship as one of the most important ways in increasing sustainability, creating new jobs and growth in today's economy is seen in the researches such as Grigore and Dragan (2015); Edoho (2016). Problems of SMEs development in the context of crisis events and overcoming of unstable economic conditions were reflected in the works (Simon-Moya et al., 2016; Poire and Sabel, 1984). In the last work on the case of Northern Italy is proved, that in the circumstances of crisis small enterprises are more effective.

In the countries of the European Union, SMEs provide jobs for about 67% of the working population and produced 58% of gross value added, including in Germany these indicators are respectively 60% and 48% (Development of small..., 2015; Sollner, 2014). SMEs have not yet received large development in Russia, their share is not more than 20% in gross value production volume and number of employees of all enterprises.

This is largely due to lack of attractive wages of employees in the SMEs sector of the Russian economy. The average wage of SMEs employees in Russia (19460 rubles a month or 291.9 Euro) significantly lags (Federal State Statistics Service, 2017a) of the respective value for the full range of all the enterprises and organizations in Russia (34030 rubles a month or 510.45 Euro) (Federal State Statistics Service, 2017b).

Literature Review

Analysis of the literature showed that one of the main problems for SMEs, which are the most rapidly developing sphere of the Russian economy, is providing attractive wages to employees. This has not only economic, but also social sense. Therefore, relevant is the analysis of factors that affect on the wages in SMEs, have an important social value.

Features of the wage of SMEs employees in developing countries, authors discuss in such papers, as Dung (2017); Arunagiri et al. (2015); International Labour Conference (2015). Betcherman (2013) concluded that to date there is no necessary information on the functioning of labour market institutions in developing economies.

It should be noted that the tendency of low wages for SMEs employees compared to other sectors of the economy is noted also in the European Union countries. According to the study (Baumol, 2004), this is due to the prevalence of microenterprises among SMEs. Microenterprises are characterized by relatively low level of training, productivity and working conditions in comparison with other economic entities. These reasons lead to difficulties in attracting highly skilled workers into small enterprises and reducing the efficiency of such enterprises. Consequently, this results in a relatively low wage in such enterprises. This position has a negative impact on the possibility of attracting a high qualification workforce in the SMEs sector.

Some aspects of the impact of external factors on the development of small and medium entrepreneurship were shown in the works of following Russian and foreign authors (Arunagiri et al., 2015; Basareva, 2010; Gulin and Khamidulina, 2005; Terebova, 2017). The analysis of previous researches, which are related to methodical aspects, is given in the next section.

Methodology

The aim of the study was to study the influence of such factors socio-economic situation of Russian regions, as the unemployment level, income of the region's residents and the budget expenditure, on the average monthly wage of SMEs employees in these regions. As the object of the study were considered all small and medium enterprises (SMEs) that are located in each of the Russian regions.

Criteria, that characterize SMEs in Russia is specified in the Federal law "On the development of small and medium entrepreneurship in the Russian Federation", No. 209-FZ. The main criterion is number of employees. Basing on this criterion - small enterprise shall not exceed 100 employees, the medium enterprise range from 101 to 250 employees. Small and medium enterprises also include the so-called individual entrepreneurs. Among small enterprises are identified microenterprises (up to 15 employees inclusive). In addition, the criterion of classification to SMEs is the share of state and municipal ownership in the authorized capital, the maximum revenue from the sale of goods (works, services), as well as the book value of assets.

Statistics indicate that the average wage of SMEs employees significantly differ in various regions of Russia. We have derived from the assumption that the values of wage are determined by the current socioeconomic situation in the regions. When determining the number of factors of regression function were taken into account the proposal of Granberg (1988). He wrote about the feasibility of a small number of factors, it is convenient for calculation and interpretation of results. During the study, regression and correlation analysis methods were used. The methods of multifactorial regression analysis have recently received considerable development in scientific research. As examples of their use, you can list the works of the following authors (Uyanık and Güler, 2013; Dumitrescu et al., 2012; Lacombe et al., 2014; Schneider et al., 2010; Kanevskaya, 2017; Musienko, 2017).

As shown the correlation analysis, on the wage of SMEs employees the greatest impact put such three factors: the level of unemployment, income of the region's residents and the budget expenditure of the regions.

The authors proposed to use the multiple regression model to investigate whether the wages of SMEs workers depend on these three factors. This regression is based on the spatial data of SMEs located in each region of Russia in 2015. In the work (Schröder and Yitzhak, 2014) considered advantages of the methodical approach, which based on the spatial data. As an example, of using spatial data also it is possible to bring the article (Charoenrat and Harvie, 2013).

This approach is due to the following. Criteria for classification of SMEs in recent years repeatedly changed. The current criteria are using from 2008. Because the accounting of SMEs is held once a year simulation, using time-series are possible only for 8 years (2008 to 2015). Accordingly, the number of observations is eight, which is less than the minimum allowable value. In the work (Khodasevich, 2017) for the three-factor function, the minimum number of observations must be at least 24. Therefore, the time data for measuring of the regression function is inappropriate.

In developing this model, we considered the following relative indicators: average per month wage of SMEs employees in the region, the proportion of unemployment in the number of economically active people, the average monthly income per one region's resident, the average monthly budget expenditures per resident of the region. The use of relative measures allows for a comparative analysis average monthly wage of SMEs employees in different regions.

In addition, to assess the impact of the territorial location of SMEs on the wages of their employees for each region were calculated values of such relative indicator, as ratio between wage of SMEs employees and the subsistence minimum. Taking into account, that the subsistence minimum is established by law for each of

the Russian regions. This indicator describes how the current wage of SMEs employees in the region is able to meet the vital needs of workers and their families. The ratios of monthly wage in the regions and values of the subsistence minimum can be used for ranking regions.

The function of normal distribution was used for describing the distribution of this ratio. The following conceptual provisions define this.

Each SMEs act as the independent actor, defines the purposes and tasks, proceeding from a concrete situation, and conducts risk economic activity. In the regions of Russia, the number of such enterprises is very big (thousands SMEs). Respectively, the group of the enterprises which are in every of the regions, formed on the criteria stated above, includes a significant amount of the enterprises.

Economic, historical, climatic, demographic, educational and other features of development of the specific region in Russia have significant effect over SMEs sector indicators. This features act independently from each other, so we can assume probabilistic (stochastic) distribution of indicators values, including indicators characterize the wage of SMEs employees. The given conclusion refers to the considered ratio since the value of the subsistence minimum in the region is established by the law.

Ratio between wage of employees in SMEs and the subsistence minimum is formed by the influence of two kinds of drivers, the first of them determined the similarity of the wages of regional groups of SMEs and the second their differences (Pinkovetskaia, 2015b).

The first type of drivers led to the ratios in the vicinity of some average value for all regions. The second type of drivers determined the degree of differentiation of ratios. The deviation of ratios in specific regions from the average value could be both in the direction of reduction and in the direction of increase.

From the Chebyshev theorem (Kramer, 1962) follows that individual random values can have significant distinctions, in so doing, their arithmetic mean is relatively stable. A similar conclusion follows from the central limit theorem (Jenish and Prucha, 2009), which establishes that the arithmetic mean of quite a large number of independent random values loses the character of a random value. Thus, the ratios of each region are random values that may have a significant spread, but we can foresee the significance of their arithmetic mean.

Note that in accordance with the Lyapunov theorem, the distribution of the average values of independent random values approaches the normal distribution, if the following conditions are met: all values have finite mathematical expectations and dispersion, none of the values is not sharply different from the rest. The mentioned above conditions correspond the values of ratios by regions. As Gmurman (2003) pointed out, the distribution of random values is fast enough (more than ten observations) approaching the normal distribution. The number of SMEs located in each region and related to specific size categories and types of economic activity ranges from hundreds to tens of thousands, which is much larger than the criterion by Gmurman.

To date considerable experience has been gained in using of normal distribution functions to describe the distribution of empirical indicators.

These functions have been widely disseminated in modern scientific research in the economy, engineering, medicine, psychology, biology. The following works can be cited as examples of using these functions in economic research. Allanson (1992) presented an analysis of the evolution of the size of agricultural land, including smallholder farming, based on the function density of distribution. Vince (1992) considered in the book the application of normal distribution functions for the characteristics of trading activity and, in particular, the estimation of profits and losses. In the article of Filatov (2008) main attention is given to the method of complex assessment of the financial condition groups of enterprises. Totmianina (2011) during

the modeling of the probability of default of corporate borrowers of banks, she proceeded from the normal distribution of the value of company assets. Shapkin (2003) described approaches to portfolio investment management based on the normal distribution of equity returns. Modeling of financial profit in the Russian stock market is considered in the article Balaev (2014). In their article, Marek and Vrabec (2013) discussed the contribution to the possibility to predict the trend of the wage distribution. The possibility of applying such functions to describe relative performance follows from the pilot work (Pinkovetskaia, 2015a).

Thus, there are theoretical prerequisites for using the function of normal distribution to describe the ratio between wage of employees in SMEs and the subsistence minimum by regions of Russia.

The study used data of the official statistical observation of activities in all Russian SMEs in 2015 (Federal service of state statistics, 2017a). This observation is conducted every five years and gives more accurate information than the annual sample surveys of SMEs. The study is based on information of 82 regions (subjects) of Russia, including 22 republics, 9 territories, 46 regions, 1 autonomous territory, 1 autonomous region and 3 cities of federal significance. In addition to data on SMEs, the authors used information of official statistics for 2015 subsistence minimum.

Essential in the simulation is the decision on the number of observations. In his work, Harris (1985) suggests as the minimum value, take the number of observations equal to 52. Total number of observations, in our study constitutes 82 (which corresponds to the number of regions of the Russian Federation) and match the specified requirements.

In the process of research, we used arrays of information for each of the regions of Russia. Processing of these arrays of information allowed to define the values of five indicators, which are the initial data for the regression model and the function of normal distribution. Table 1 shows a fragment of this data for 6 regions.

Table 1. Fragment of the original data (2015 year)

Russian regions	Average wage SMEs employees, rubles per month	Unemployment rate, %	Income per inhabitant, thousand rubles per month	Budget expenditure per inhabitant, thousand rubles per month	Subsistence minimum, thousand rubles per month
	y	x_1	x_2	x_3	p
1	2	3	4	5	6
Belgorod region	18.6	3.9	28.3	5.2	7363
Bransk region	15.9	4.6	25.4	4.3	8020
Vladimir region	15.8	4.5	23.7	4.1	8616
Voroneg region	14.6	4.2	30.1	4.5	6535
Ivanovo region	11.6	6.1	22.6	4.0	8694
Kalyga region	20.2	4.3	27.6	5.9	8314
...

Source: authors' elaboration.

Evaluation of the factors, influence on the wage

In the process of study were considered several types of regression functions: linear, exponential, parabolic, power, logarithmic. Their elaboration was carried out in accordance with the adopted methodology (Kremer and Putko, 2002).

Quality assessment of obtained functions was performed using coefficients of correlation and determination, the Fisher-Snedecor test and the Student's t-test. A comparative analysis of developed functions showed that linear, exponential, parabolic and logarithmic functions inadequately describe the original data. Therefore, further we present the results of elaboration the multiple nonlinear regression model (the power function). During the development, we used methods of linearization and ordinary least squares (Qin et al., 2014; Jenčová, 2000).

The regression function describing the dependence of the average wage of SMEs employees from the mentioned above indicators by regions of Russia in 2015 is as follows:

$$y_1 = 2.33x_1^{-0.16} \times x_2^{0.54} \times x_3^{0.27}, \quad (1)$$

where y_1 - the average monthly wage of SMEs employees by region, thousand rubles; x_1 - the share of unemployment persons in the *economically active population*, %; x_2 - the average monthly income per inhabitant of the region, thousand rubles; x_3 - the average monthly budget expenditure of the region per inhabitant, thousand rubles. Table 2 presents the estimated values of statistics for testing the quality of the regression function.

Table 2. Values of the calculated statistics of regression function

Quality assessment	Calculated values	Level of significance
Coefficient of determination	0.84	-
Coefficient of correlation	0.92	-
Standard error	0.13	-
Calculated value of the Fisher-Snedecor test	135.04	less than 0.001
Calculated value of the Student's t-test on y_1	3.19	0.002
Calculated value of the Student's t-test on x_1	3.68	less than 0.001
Calculated value of the Student's t-test on x_2	6.86	less than 0.001
Calculated value of the Student's t-test on x_3	6.38	less than 0.001

Source: authors' elaboration.

Comparison of calculated values listed in Table 2, with the values of tests presented in the literature, showed that the regression function (1) is of a high quality (Demidenko, 1981). The correlation coefficient is 0.92, and close to one. The coefficients of determination characterize the quality of the regression equation. As you know the regression models are successful when the coefficients of determination are more than 0.8 (Draper and Smith, 1986). In our case, it is equal 0.84. The difference between the unit and the coefficient of determination describes the proportion of dispersion that is due to the influence of other factors, which are not included in the regression equation. That is, it can be concluded that the model (1)

explains 84% of variation in the dependent variables. Accordingly, on the other factors (which not considered here) account for no more than 16%. The calculated value of statistics (135.04) is much higher than tabular value of the Fisher-Snedecor test that is 3.98 at the significance level equal to 0.05. All the calculated values of the Student's t-test are more than the table value, which at the significance level of 0.01 is 2.64. The analysis of calculated values of significance levels was carried out (column three of Table 2). He showed that the value of the Fisher-Snedecor test is less than 0.001. That is, the stable dependence of the average monthly wages of SME employees (Y_1) by regions on the factors considered is confirmed. Levels of significance of all indicators by the Student's test are less than 0.01. That is, the coefficient and indicators of the function (1) are statistically significant with a 99 percent confidence probability. Therefore, inclusion of each of the three factors into the regression model is expedient. Thus, the conducted analysis confirmed that function (1) is of high quality and well approximates empirical data.

The study showed that the three factors under consideration have a significant impact on the wage of SMEs employees. Unemployment creates excess supply of labor in labor markets, its growth leads to a decline in wages in the region (Betcherman, 2013), including for the SMEs employees. Conversely, reducing unemployment, leads creating conditions for higher wages. In case of growth of each of the remaining factors happens the increase in wages for employees of SMEs. This is due to the following reasons. Goods and services created by SMEs are intended at most for the population of the region. Therefore, the wage of employees of SMEs is affected by the incomes of the population, namely from the possibility of acquiring goods and services. The majority of Russian regions (64 of 82) receive subsidies from the federal budget to the regions budgets. Part of the regional budget funds are spent on public procurement involving SMEs and on assisting SMEs. That is, the expenditures of the budgets of regions have a positive impact on the wage of SMEs employees.

Analysis of values indicators volumes in function (1) show that the highest influence on the average monthly wage of SMEs employees by region makes the average monthly income per inhabitant of the region. Lower influence on the level of SMEs employees wage two other factors: the share of unemployment persons in the ***economically active population and*** the average monthly income per inhabitant of the region.

In recent years, Russia has adopted a number of programmes of economic development. Some of these programmes dedicated to the factors, which were mentioned above. Among them, the reducing of unemployment level is provided by attracting unemployed persons to individual entrepreneurship and the allocation to them grants and subsidies. It is planned to increase incomes of public servants, employees of health care, education, social sphere. Regional programmes intend the budgets growth in the coming years. Therefore, based on regression model (1) we can assume that these programs are able to ensure the growth of the average wage of SMEs employees.

By plans of social-economic development Russian regions till 2022 year established average decrease of unemployment on 20%, increase people income on 25% and growth of regions budget on 30%. Using this parameters and formula (1), we made the forecast of growth SMEs employees wage. Our calculations give us opportunity to offer, that in comparison with 2015 year in average on Russian regions wage will increase on 24.8% till 2022 year.

Measuring ratios between wage of employees of SMEs and the subsistence minimum

During the research, was calculated the ratios between the average monthly wages of employees of SMEs in each of the regions and values of the subsistence minimum in these regions ($Z = y/p$). These ratios were used in the development of model (Y_2), which describes the distribution of these ratios (Z) for

each of the Russian region. This model, given below, represents the density function of the normal distribution:

$$y_2 = \frac{25.92}{0.43 \times \sqrt{2\pi}} \cdot e^{-\frac{(z-1.93)^2}{2 \times 0.43 \times 0.43}} \quad (2)$$

The quality of the developed normal distribution function (2) can be checked using tests. As showed the analysis of the literature (Bolshev and Smirnov, 1983; Hollender and Wulf, 1983; Pearson et al. 1977; Shapiro and Francia, 1972) the most common in modern studies authors are using tests of Kolmogorov-Smirnov, Pearson and Shapiro-Wilk. The calculated value of statistics by Kolmogorov-Smirnov test is 0.07, it is less than the table value that is 0.152 at a significance level of 0.05. The calculated value of the Pearson's test is 3.10, which is less than the value in the table equal to 9.49. Statistics value of the Shapiro-Wilk test is 0.97, which exceed the tabular value of 0.93 at a significance level of 0.01. In general, it can be concluded that by all the specified tests, the developed model (2) has a high quality.

The density function of the normal distribution allows to determine the average value of the considered ratio (\bar{z}). So, based on the formula (2) the average value is 1.93. In addition, based on this function, we calculated the interval of change of this ratio, describing the majority (68%) regions of Russia. The limits of this interval was determined based on the values of standard deviation. Thus to calculate the limits of the interval to the average value of the indicator respectively was added and deducted the indicated deviation. The interval of change ratio values of wage of SMEs employees and subsistence minimum for the majority of country regions on the basis of function (2) is ranged from 1.50 to 2.36. The poverty level established in Russia is 1.5 of the subsistence minimum. Such values of the wages of SMEs employees cannot, in our view, be sufficient. This wage is not considered acceptable, it does not provide the minimum level of employees needs. Minimum level includes both the expenses of the employee, the dependent family members and the 10 percent contingency reserve. It is showed in the methodical work by Anker (2006). Therefore, in those regions where average wage of SMEs employees smaller than the lower limit of the calculated interval (1.50), it is necessary to conduct measures for its increasing in the near future.

The analysis allowed to determine the regions of the country in which the values of the considered ratio (\bar{z}) is less than 1.5. These include the Republics of Kalmykia, Altai, Kabardino-Balkaria, Tuva, Karachay-Cherkessia, North Ossetia-Alania, Dagestan, Ingushetia, and Crimea, Pskov, Ivanovo regions, city of Sevastopol and the Jewish Autonomous region. For the increase of the wages in SMEs in these regions, should be used subsidies on employment and wages in SMEs, which as shows the experience of Sweden (Sjögren and Vikström, 2013) might provide a significant positive effect.

In addition, for these regions can be recommended decentralization of the establishment of the minimum wage (Lukyanova, 2016) on the basis of trilateral agreements between unions, employers and regional authorities.

Experience of Russian regions shows that in some of them the values of the considered ratio is much above the average. These are regions in which the ratio of the values of wages of SMEs employees and subsistence minimum more than the value of the upper limit (2.36) of the interval. These include Chukotka Autonomous Okrug, Tatarstan Republic, Tyumen, Leningrad, Magadan, Belgorod, Novgorod, Moscow, Kaluga, Sakhalin regions and the city of St. Petersburg. The experience of these regions in the development of SMEs should be studied and disseminated using state and public organizations that are specialized in supporting entrepreneurship.

Conclusion

Authors describe in this paper the obtained new knowledge about the factors that affect on the average monthly wage of employees of SMEs located in all regions of Russia. Developed original tool for the analysis influence of the external factors on the existing level of wages in SMEs, which represents the regression model. The estimated non-linear three factors regression function on the spatial data each Russian region has a high quality of approximation.

The regression model showed the wage growth with the increase of the average monthly income per inhabitant and the average monthly budget expenditure per inhabitant of the region. The increase of the wage also has the relation to the reduction of the share of unemployment persons in the economically active population. The results of the research showed that there are significant differences in the ratio between the value of wages of SMEs employees and subsistence minimum by regions of Russia. To measure the level of these differences, a function of the normal distribution was developed. With the use of the function the average value of this ratio and the intervals of its variation, characterize wage of SMEs employees in most regions, were established. The author defined the regions in which identified the low and high values of the ratio of the wages of SMEs employees and the subsistence minimum.

The methodical approach and tools estimating wages in SMEs in the regions can be used in the further scientific research on problems of entrepreneurship. Including they can be applied in the similar studies in the countries with a significant number of territorial (administrative) units.

The acquired new knowledge can be used in the training of students and entrepreneurs, as well as by the employees of authorities, which are related to the entrepreneurship regulation.

Achieved new information is interesting for entrepreneurs (especially for start-ups). On this base entrepreneurs can make conclusion, which average wage will be in their region in the next years and which are opportunities for growth volumes production of its enterprise (which wage will be needed for this).

In addition, the results of the work can be used in the current activities of state, municipal and public organizations related to the regulation and support of small and medium entrepreneurship in assessing the current level and solving tasks analyzing of wages employees, determining ways to improve the efficiency of SMEs.

The authorities can apply the results of the study to substantiate plans of SMEs development. The results of the simulation, namely minimum and maximum values of wages SMEs employees can be used for monitoring and defining of need for assistance to SMEs in the Russian regions. Including on the base of providing grants, subsidies, and reducing interest on loans.

The developed regression model can be used to justify the growth of wage SMEs employees. Including, in creating backgrounds for the implementation of the Federal strategy for SMEs development in Russia (The strategy of development..., 2016). Namely, solving tasks to increase twice wage and labour productivity in SMEs and creation of 4250 thousand units of new high-performance workplaces.

Further studies are related to the assessment of the wages of SMEs employees, which are specialized in various types of economic activity. Also future research is advisable to make basing on the data of SMEs in various cities and municipalities.

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