INVESTMENTS IN MEDIUM, SMALL AND MICRO ENTERPRISES IN RUSSIAN REGIONS

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Abstract: The paper aim is an assessment of the investments into the fixed capital of small and medium enterprises (SMEs) and the influence on them by factors such as size categories and territorial placement. The object of the study is the consideration of all (SMEs) that are located in each of the regions of Russia. The used data is from the official statistical observation of investment data of all Russian SMEs for 2015 in 82 regions. The comparative analysis of investments in the fixed capital of SMEs is based on relative indicators: investments which are calculated per one enterprise and per employee. Modeling was based on the functions of a normal distribution. We defined the values investments in SMEs which located in all Russian regions and related to three size categories and six types of activity; revealed regularities of distribution of investments calculated per enterprise and per worker; identified the regions with low investments in SMEs. New knowledge of the investment in the fixed capital in the Russian SMEs was achieved. The results of the study, namely new knowledge and tools for assessing production activities of small and medium enterprises in the regions, are of scientific and practical importance. The methodical approach can be used in the future studies and in the education potential entrepreneurs and students. The research results can be used by government and regional authorities to monitor the efficiency of investment in fixed assets, as well as the implementation of a Federal strategy for SMEs development for the period up to 2030.

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Introduction

Small and medium enterprises (SMEs), are the most important factors of economic development for many countries, which also may be in the conditions of economic crisis Acas et al. (2008), Simon-Moya et al. (2016). The Russian strategy of development of SMEs until 2030 (2016) includes a twofold growth in the size of small and medium enterprises in gross domestic product (up to 40%). The specified purposes, as are shown by German experience Sollner (2014), are real. In Russia we have an initiative to create a system of incentives for development of SMEs including support of investments into fixed capital of SMEs. Therefore can be used the Korean experience of investment stimulation SMEs in recent years is described in the article Choi and Choi (2015). Problems of raising the volume of investments into fixed capital puts forward a number of current scientific and applied research problems.

The authors researched the concepts and principles of investment into fixed capital of SMEs. In our opinion, the following findings of the research are of the greatest interest. In the monograph by Pichler et al. (2000), an analysis is given of the main aspects of investment policy and factors, exerting impact on the investment in the SMEs. In the article by Skuras et al. (2008), the issues of justifications of making decisions on investments into fixed capital of SMEs of six countries of the European Union are reflected. The China experience (Wu et al., 2008) demonstrates that the amount of investments, in many respects, is defined by branch specialization. In the article by Lewandowska et al. (2015), the significant differences in investments into SMEs in various regions of Poland are demonstrated. Regional aspects of small enterprise investments in Russia are considered in the monograph by Regional (2010), as proof of essential distinctions of the volumes of investment from territorial placement of these enterprises.

Analysis of the literature shows that factors such as the sizes of SMEs and their territorial location have significant effect on volume investment into fixed capital. The purpose of the present paper is the assessment of the investments into fixed capital of SMEs and the influence of these factors on them. The object of the study is the consideration of all small and medium enterprises that are located in each of the regions of Russia. In order to ensure a comparison of investments in SMEs located in different regions, the calculations are based on relative indicators. Fixed capital investments are determined in counting on one enterprise and one employee.

Methodology, data and design

The source of data used in this research is official information of activity of SMEs for 2016 (Federal, 2018). The data included all small and medium enterprises, conducting activities in the territory of the country.

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In the course of the research, information was formatted about enterprises based on size and territorial features. Three sizes categories of SMEs were chosen and these include: microenterprises, where the number of workers does not exceed 15 people, small enterprises where the number of workers is from 16 to 100 people, and medium enterprises which have workers numbering from 101 to 250.

Initial information, which we used in the course of the research, included the volume of investments in fixed capital by SMEs, the number of enterprises and the number of employees. Information was generated for each region of Russia (a total of 82 regions) for three size categories. These average values of investments were calculated, respectively for one SME and one employee.

In the course of the study, the following hypothesis was tested: distribution of values of the investments in SMEs calculated per enterprise and per employee across all regions, can be described with application of the function of a normal distribution. The following conceptual provisions define the purposefulness of testing this hypothesis. Each SME defines the purposes and tasks, proceeding from a concrete situation. In the regions of Russia, the number of such enterprises is very high. Economic, climatic, demographic and other features of the specific region of Russia act independently from one another and have a significant effect on the indicators of SMEs. Therefore, we can assume a probabilistic (stochastic) distribution of values of indicators, including investments.

In the monograph by Kramer (1962), it specified that separate random variables can have considerable dispersion, and their arithmetic average is stable. The corresponding theorem called also by the law of large numbers. As described in the work by Gmurman (2003), the law of distribution of the sum of independent random variables (already at number of about ten) quickly comes to the normal law of distribution. The functions of normal distribution have been widely disseminated in modern scientific research. The following works can be cited as examples of using these functions in economic research. Allanson P. (1992) presented an analysis of the evolution of the size of agricultural land, including smallholder farming, based on the function of the distribution. In the work by Vince R. (1992), he considered the application of normal distribution functions for the characteristics of trading activity and, in particular, the estimation of profits and losses. In the article by Filatov S.V. (2008), main attention is given to the method of complex assessment of the financial condition groups of enterprises. Totmianina K.M. (2011) during the modeling of the probability of default of corporate borrowers of banks, she proceeded from a normal distribution of the value of the company assets. Shapkin A.S. (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 by Balaev A.I. (2014). In the article by Marek and Vrabec (2013), they discussed the possibility to predict the trend of the wage distribution. The possibility of applying functions to describe relative performance follows from the pilot work (Pinkovetskaia, 2015).

The determination of the number of empirical data is important in the development of normal distribution functions. The relevant justifications are presented in the works of Heinholt and Gaede (1964) and Hodasevich (2017), which indicated that the number of observations must be at least 40.

Modeling investment in fixed capital per SMEs and per employee

We tested the formulated hypothesis with the use of the economic-mathematical models representing functions of normal distribution. These functions describe the distribution of values of investments in fixed capital in counting per enterprise and per employee, for all SMEs located in each region of Russia. Functions are developed for the SMEs belonging to three size categories. Processing of basic statistical data, implementation of the analysis and evaluation of functions of the normal distribution were carried out with the applications Microsoft Excel 2010 and STATISTICA 10.

The indicators of the obtained functions of the normal distribution are the average values of investments in the fixed capital of SMEs for 2016, standard deviations, and the intervals of change values of investment. These intervals correspond to the values of investments that are typical for SMEs located in the majority (68%) regions of Russia. The boundaries of these intervals were determined on the basis of the average values of investments and standard deviations. The minimum value of the interval corresponds to the difference between the average investment value and standard deviation. The maximum value of the interval corresponds to the sum of the average investment value and standard deviation.

Below we have presented the developed functions of normal distribution. Functions (1)-(3) describe the value of investments in fixed assets per enterprise (million rubles) for 2016. Functions (4)-(6) describe the values of investments in fixed capital per employee (million rubles). The exchange rate in 2016 for 1 ruble was 0,015 Euros in Russia.

The first function describes the distribution of investments per medium enterprise (x_1):

$$y_1(x_1) = \frac{770.0}{12.979 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_1 - 29.421)^2}{2 \times 12.979 \times 12.979}} \quad (1)$$

It is well known that in a formula for the function of a normal distribution are indicators such as expected value (average value) and a standard deviation. In the formula (1) these values are equal to 29.421 and 12.979 respectively.

The second function describes the distribution of investments counting per small enterprise, excluding the microenterprises (x_2):

$$y_2(x_2) = \frac{89.4}{1.374 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_2 - 2.315)^2}{2 \times 1.374 \times 1.374}} \quad (2)$$

The third function describes the distribution of investments counting per microenterprise (x_3):

$$y_3(x_3) = \frac{6.5}{0.096 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_3 - 0.135)^2}{2 \times 0.096 \times 0.096}} \quad (3)$$

The fourth function describes the distribution of investments per one employee in medium enterprise (x_4)

$$y_4(x_4) = \frac{9.9}{0.119 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_4 - 0.238)^2}{2 \times 0.119 \times 0.119}} \quad (4)$$

The fifth function describes the distribution of investments per one employee in small enterprise (x_5) excluding the microenterprises

$$y_5(x_5) = \frac{2.9}{0.044 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_5 - 0.071)^2}{2 \times 0.044 \times 0.044}} \quad (5)$$

The sixth function describes the distribution of investments per one employee in microenterprises (x_6)

$$y_6(x_6) = \frac{3.5}{0.049 \times \sqrt{2\pi}} \cdot e^{\frac{-(x_6 - 0.071)^2}{2 \times 0.049 \times 0.049}} \quad (6)$$

Analysis of functions normal distribution

Table 1 shows the indicators that correspond to the functions of the normal distribution in the three SME size categories

Table 1: Indicators of the functions of normal distribution in three size categories, million rubles				
Authors	Size categories	Average value	Standard deviations	Interval
	1	2	3	4
	Number per one enterprise			
	Medium enterprise	29.421	12.979	16.431-42.400
	Small enterprise excluding microenterprises	2.315	1.374	0.941-3.689
	Microenterprise	0.135	0.096	0.039-0.231
	Number per one one employee			
	Medium enterprise	0.238	0.119	0.119-0.357
	Small enterprise excluding microenterprises	0.071	0.044	0.027-0.115
	Microenterprise	0.071	0.049	0.022-0.120
	Source: Authors			

In the testing of how well the functions of normal distribution approximate the studied data, based on the application of criteria of consent, following from the theory of mathematical statistics, the authors used the Kolmogorov-Smirnov, Pearson and Shapiro-Wilk tests. The statistical tests allowed the authors to compare the empirical distribution of the studied indicators with theoretical distributions, described by the functions. The tests demonstrate the level of rejection of these data from the specified functions. The methodology of using the tests detailed in the literature to which reference we gave in the literature review. The principles of application of the test on the received functions of the normal law of distribution are described by: Bolshev and Smirnov (1983), Hollender and Wulf (1983), Pearson et al. (1977), and Shapiro and Francia (1972). The calculated values of the main statistics, received in the course of modeling, are given in table 2.

Table 2: Calculated values of statistics			
Function Number	Calculated value		
	by Kolmogorov-Smirnov	by Pearson	by Shapiro-Wilk
1	2	3	4
(1)	0.05	3.09	0.96
(2)	0.09	3.30	0.95
(3)	0.09	2.64	0.95
(4)	0.06	2.86	0.96
(5)	0.05	1.16	0.97
(6)	0.04	1.04	0.98
Source: Authors			

In Table 2, the calculated values of the statistical Kolmogorov-Smirnov test are from 0.04 to 0.09, which is less than the table value that is 0.152 at a significance level of 0.05. Similarly, the calculated values of the Pearson's test are from 1.04 to 3.30, which is less than the value in the table equal to 9.49. The calculated value of the Shapiro-Wilk test is from 0.95 to 0.98, which exceed the tabular value of 0.93 at a significance level of 0.01. In general, the developed models have a high quality in all the tests and describe well the studied regularities.

Received results

The data in Table 1 shows that the current level of investment in microenterprises ranges from 39 to 231 thousand rubles (585 to 3465 Euros) per year (per one enterprise) in most regions. The investment is not very large. That is why entrepreneurs invest their own money and the money of their relatives. Therefore, microenterprises rarely use bank loans. In addition, microenterprises have no credit history and system of accounting, which banks need.

The data in Table 2 show that the current level of investment in medium enterprises ranges from 16431 to 42400 thousand rubles (246 to 636 thousand Euros) per year (per enterprise) in most regions. These investments are significant. That is why medium enterprises often use bank loans. Medium enterprises possess fixed assets and this allows them to get the loans under the security over property (this regularity was already marked earlier in the literature review). In addition, banks more prefer to provide loans to medium enterprises, than to small enterprises. This is because in medium enterprises specialists work in lending and they have ability to provide banks more complete information

(including accounting information). This aspect of lending was described in the paper by Cook and Nixon (2000) devoted to questions on the information environment of market investors.

Values of investments, which were counted per employee in small enterprises and the microenterprises are the same. Investments counting per employee in medium enterprises much exceed this value in small enterprises (more than three times). Such provisions sound logical because medium enterprises are technically better equipped in comparison to small enterprises which require larger costs to upgrade and support their production activity. Relative investments per employee in medium enterprises differ from small enterprises and microenterprises. The size of small enterprises has no effect on relative investments per employee. That is, in SMEs with a workforce of up to 100 people, relative investments do not depend on the size of the enterprise.

The characteristics of investments provided in Table 1 are of interest directly to the entrepreneur (especially start-ups) and to the departments of federal, regional and municipal government responsible for supporting business development. In addition, lending and financial institutions, leasing and insurance companies, funds of guaranteeing and angel investors could use this information.

The volumes of investment calculated per enterprise and per employee, significantly differ from region to region, that is visible from intervals of change given in column 4 of Table 1. Values of investments could be used for monitoring of these values in regions, ratings analysis, and marking regions with highest and lowest investments in SMEs. In addition, the results are able to play an important role in addressing support for businesses by federal and regional authorities. During the research, regions of Russia which are lower than the minimum values corresponding to the lower bounds of interval investments into fixed capital SMEs were determined. The relevant data could be used in course of developing a rating of investment climate in the regions of Russia, especially in regions where the level of investments into fixed capital is low.

Conclusion

The research proves that the investments into fixed capital of SMEs depends on factors such as size categories of the enterprises and the territorial placement of the enterprises. We confirmed the hypothesis, that the distribution of values of the investments in SMEs calculated per one enterprise and one employee across all regions, can be described with an application of the normal distribution. The results received in this research, namely the specific values of investments counting per one enterprise and one employee, serve as a good reference points for businessmen (especially in the start-up stage) and divisions of the state bodies responsible for the support of SMEs. Values of investments and intervals of their change in the regions of Russia, are also of interest to credit and financial institutions participating in crediting, financing, leasing, factoring, consignment and other methods of investment.

Functions of the normal distribution could be applied to prove needs for investments, working out plans and programs of development of SMEs in Russia and regions, providing subsidies, subventions, and grants. In addition, the results of the modeling, namely the minimum and maximum values of investments could be applied in rating the investment climate in the regions of Russia.

Government and regional authorities can use the research results to ensure the implementation of the Federal strategy for SMEs development for the period up to 2030 (The strategy of development, 2016).

Prospects for further research include the assessment of the influence of different factors on the level of investments into the small and medium enterprises in municipalities of various regions.

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