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Investment in Entrepreneurship: Evidence from Russia[1]

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ABSTRACT

The aim of the study was to analyze patterns, describe the amount of investment in small and medium entrepreneurship by types of entrepreneurial structures and types of economic activities. This was done by empirical testing of hypotheses about the presence of a differentiation value of investment and the possibility of describing the current distributions in regions of the Russian Federation with use of economic-mathematical models. When you build models by using the methodology of density functions of normal distribution. As input data we used official statistical indicators characterizing the set of small enterprises, medium enterprises and individual entrepreneurs in all regions of the Russian Federation. The computational experiment was based on building two classes of models describing the volumes of investments accounted, respectively, to one entrepreneurial structure and one employee, and five main types of activities in which specialize small and medium enterprises, individual entrepreneurs. It is proved that the volume of investment, both in terms of entrepreneurial structure and one of its employees differ significantly depending on the number of employees of entrepreneurial structures, regions of our country. Also proved that there is significant differentiation in the levels of investment by kinds of economic activities. The developed model and the resulting patterns can be used to solve a wide range of tasks monitoring of business activities, design of development and forecasting this sector of the economy at Federal, regional and municipal levels of government.

INTRODUCTION

Development of subjects of small and medium entrepreneurship is based on efficient use of investment. That is why the justification of investment volumes seem to be an urgent problem at the present stage of formation of the entrepreneurial sector of the national economy.

Small and medium entrepreneurship begin to create in the Russian Federation since the nineties years of the twentieth century. Before that in the Soviet Union dominated state-owned enterprises and organizations. In the nineties years, began the transformation of the economy associated with the emergence of private entrepreneurs. In addition, there was a significant

imbalance with a predominance in the economy of large companies, associations and industrial complexes. They usually were not effective.

In the past time entrepreneurship has experienced significant growth. To date, the role of entrepreneurial structures (small and medium enterprises, individual entrepreneurs) in our country increased significantly. In this sector of the economy in 2010 worked more than 23 million people. The total number of entrepreneurial structures was about 4.5 million. The volume of production and services has reached to 30.8 trillion rubles (Federal service of state, 2016).

One of the significant trends of contemporary development of world economy is the increasing role of small and medium businesses, as more mobile and flexible forms of organization of business life. This is evidenced by the increase in the share of small business in GDP of the country, growth in the number of employed in small business and entrepreneurship. Over the past 15 years the share of small and medium business in Russia's GDP has nearly doubled, however it is still not comparable with the indicator in developed countries. Thus, the share of small and medium business in the GDP of the European countries reached 58% in the U.S.A. – 50%. However, small and medium entrepreneurship in our country have not yet reached the level characteristic of developed countries that show, in particular, recently published research results (National report "Global entrepreneurship monitor", 2016). In Russia it is only 21%. The dynamics of employment in the sphere of individual entrepreneurship over the last 15 years, unstable. Their share in total employment in Russia does not exceed 10%.

Despite the fact that the dynamics of investment of small enterprises in fixed capital is positive, so the investment growth of small enterprises in fixed assets in 2012 year compared to the previous year increased by 20,8%, in 2013 year - 10,2%, in 2014 year - 15,6%, one of the major problems of entrepreneurship development are lack of own funds, high interest rates on loans, and difficulties in obtaining loans (Kiseleva et al., 2015).

The need for a substantial increase in the turnover of entrepreneurial structures was repeatedly observed in the messages of the President to the Federal Assembly and Government decisions. At present, therefore, it is important to develop evidence-based recommendations for the further development of entrepreneurship in the country, increase of its role in the national economy. The increase flow of investments in the sphere of small business is an effective way of work. However, public financing and realization of target programs are not always able to provide a sufficient volume of investment resources, aided by the banking sector.

In this regard, among the urgent scientific problems extends the definition of the regularities characterizing the investment needs for the development of entrepreneurship at the present stage. Common problems of investments into the fixed capital of enterprises and organizations are considered in the works of many authors, among which are (Bystrov et al., 2008; Usowicz, 2011; Nurmukhametov, 2009; Erden, Holcombe, 2005; Voss, 2002). Some aspects of the investment policy of small and medium entrepreneurship represented in a number of monographs and papers (Pichler, 2002; Domar, 1957; Van Horn, 2003; Gitman, Jonk, 1997; Skuras et al., 2008; Anson, 2003). Note that these problems are not adequately reflected in researches of russioan economists, you can only specify works (Livshic et. al, 2000; Regional aspects of functioning and development of small entrepreneurship in Russia, 2010; Vilenskiy, 2011; Zlobin & Plakhova, 2008). The modeling of investment were considered in the monograph (Micek, 2011).

Criteria for small and medium enterprises was established in the Federal law "On the development of small and medium entrepreneurship in the Russian Federation" dated 24.07.07 year № 209-FZ (2007). The main criterion is the number of employees that for small enterprises should not exceed 100 persons, and for the average enterprise ranges from 101 to 250 people. Small and medium entrepreneurship in accordance with paragraph 1 of article 3 of the act also include individual entrepreneurs. Further, in this paper three types of business entities

– small enterprises, medium enterprises and individual entrepreneurs are called the entrepreneurial structure. Thus, entrepreneurship is seen quite widely, which is consistent with the concept presented in the work of P. Reynolds, N. Bosma, E. Autio, S. Hunt, N. De Bono, I. Servais, P. Lopez-Garcia, N. Chin (Reynolds et al., 2005). Note that entrepreneurial structures characterize by the same types of economic activities, they compete on the same markets, have largely the same production technology, work as risky activities. Individual entrepreneurs differ from small and medium enterprises on their organizational-legal form.

The paper discusses the results of research the authors devoted to the analysis and evaluation of the current volumes to date in investment of small and medium entrepreneurship, the empirical testing of hypotheses about the presence of a differentiation values of investment and the possibility of describing the existing regularities with the use of economic-mathematical models. As indicators of investment in fixed capital of entrepreneurial structures are considered, the volume of investments in the calculation for one such structure and for one its worker.

1. METHODOLOGICAL APPROACH AND ALGORITHM

In the present study, the authors have put forward the following hypotheses. Hypothesis 1. The volume of investments, both in terms on one entrepreneurial structure and one of its employees differ significantly depending on the number of employees (size) of entrepreneurial structure, regions of the country, and types of economic activities, on which specialize entrepreneurial structures. Hypothesis 2. As mathematical models that can be used to estimate the volumes of investment in entrepreneurial structures is appropriate to apply the functions density of normal distribution.

The aim of the study was to develop methodologies and tools of analysis volumes of investment in entrepreneurial structures. Thus were solved the following tasks: proved methodical approach and algorithm of the study, developed economic-mathematical models describing the volume of investments in 2010 year, made the analysis of the obtained models and formulated the regularities that characterize the achieved to date the level of investments.

The research methodology is based on the consideration of aggregates of entrepreneurial structures in all regions (republics, territories, areas) of the country. The need for this approach due to the following objective prerequisites. Entrepreneurial structure, acting as an independent economic entity, defines its goals and objectives, based on the specific situation, and leads a risky economic activity. In each of the regions of the Russian Federation the number of these entrepreneurial structures is very large. Description of individual enterprises (entrepreneurs) and their subsequent aggregation is a very complex and time-consuming process. Therefore it would be logical to build models for a set of entrepreneurial structures, combined by territorial and industrial characteristics.

The author's algorithm for estimating the levels of investment in entrepreneurial structures included the following steps:

- formation of the information base, describing for each region of the country and type of economic activity the number of small enterprises, medium enterprises and individual entrepreneurs, number of its employees and volume of investments in fixed capital;
- determination of the volume of investments on the aggregations, respectively, small enterprises, medium enterprises, individual entrepreneurs in every region on the types of activity;
- the calculation of the amount of investment attributable to one entrepreneurial structure and one of its employees for each region of the country on the types of activity;
- constructing functions density of normal distribution, approximating the values of investment volumes accounted, respectively, for one small enterprise, medium enterprise and

one individual entrepreneur, and the functions that describe the amount of investment per one of its employee (first class models);

- constructing functions density of normal distribution, approximating the values of investment volumes attributable to one entrepreneurial structure by major types of economic activity (second class model);
- assessment of the quality constructed functions on the accepted criteria;
- definition of laws of development entrepreneurial structures based on the developed functions.

2. DATA OF RESEARCH AND INSTRUMENTS

While constructing models as input data were used the indicators characterizing the sets of small enterprises, medium enterprises and individual entrepreneurs in all regions of the Russian Federation. Considered data for 21 republics, 9 territories and 46 provinces of the country. To exclude double-counting not considered data on Autonomous districts and Autonomous region. When modeling authors use the statistical data for 2010 year presented in the report on continuous monitoring activities of small and medium entrepreneurship made by Federal service of state statistics (2010).

Entrepreneurial structures currently specialize on five main types of activities (The System of "Tax help", 2016). The first type is manufacturing, specialized in the manufacture of food products, textile and garment products, as well as other similar production. The construction includes entrepreneurial structures, leading new construction, reconstruction, major and current repairs of buildings and constructions, including individual construction. The third type of activities - wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items. In the future this activity will be called in short - trade. Entrepreneurial structures of transport and communications include the enterprise in land, water, air types of transport and all types of enterprises of telecommunications and postal activity. The fifth type of activity involves not only a variety of real estate transactions, lease and provision of related services, and also scientific activities, as well as a range of support services. Table 1 shows data reflecting the total number of entrepreneurial structures included in the general population in conducting researches, investment volumes and volumes of their products.

Table 1: Whole characteristic of entrepreneurial structures

	Small enterprises	*Medium enterprises*	*Individual entrepreneurs*	*Entrepreneurial structures*
Quantity, thousand units	1644	26	2927	4597
Volume of investment, billion rubles	520,3	254,3	136,8	911,4
Turnover, trillion rubles	18,94	7,42	4,49	30,85

Table 2 presents indicators that describe the distribution of entrepreneurial structures and volumes of investment by types of economic activity.

Table 2: Distribution of entrepreneurial structures and volumes of investment

	Quantity of entrepreneurial structures, thousand units	*Volume of investment, billion rubles*
Trade	2185,4	145,3
Manufacturing	322,8	123,5
Construction	267,7	109,8
Transport and communications	430,6	67,7
Operations with real estate	666,6	231,4
Other	723,9	233,7

During the research were used methods of logical, economic-mathematical analysis, statistics. For the solution of tasks and information processing applied were used computer programs “Statistica”, “Microsoft Excel”, “Mathcad”. Verification of the obtained functions was conducted according to Pearson (Kremer & Putko, 2002), Kolmogorov-Smirnov, Shapiro-Wilk (Vukolov, 2004).

3. FIRST CLASS OF THE DEVELOPED MODELS

The developed models, describing the values of investment volumes for all regions of the country accounted, respectively, for one small enterprise, medium enterprise and one individual entrepreneur discuss further (all the following formulas and tables given in the paper are get by the author):

– investments in fixed capital per one small enterprise (x_1 , billion rubles)

$$y_1(x_1) = \frac{7,6}{0,16 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(x_1 - 0,45)^2}{2 \cdot 0,03}} \quad (1)$$

– investments in fixed capital per one medium enterprise (x_2 , billion rubles)

$$y_2(x_2) = \frac{331,5}{5,91 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_2 - 11,74)^2}{2 \cdot 34,93}} \quad (2)$$

– investments in fixed capital per one individual entrepreneur (x_3 , billion rubles)

$$y_3(x_3) = \frac{1,69}{0,022 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(x_3 - 0,058)^2}{2 \cdot 4,8 \cdot 10^{-4}}} \quad (3)$$

Models, reflecting the value of investments (in thousands rubles) in all regions of the country per one worker employed, respectively, in small enterprises, medium enterprises and for individual entrepreneurs is provided below:

– investments in fixed capital per one employee of small enterprise (x_4)

$$y_4(x_4) = \frac{855}{16{,}58 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(x_4 - 47{,}56)^2}{2 \cdot 274{,}9}} \quad (4)$$

– investments in fixed capital per one employee of medium enterprise (x_5)

$$y_5(x_5) = \frac{2357}{37{,}78 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(x_5 - 93{,}22)^2}{2 \cdot 1{,}42 \cdot 10^3}} \quad (5)$$

– investments in fixed capital per one employee, that work with individual entrepreneur (x_6)

$$y_6(x_6) = \frac{589{,}3}{8{,}59 \cdot \sqrt{2\pi}} \cdot e^{-\frac{(x_6 - 22{,}56)^2}{2 \cdot 73{,}79}} \quad (6)$$

The developed models allow to estimate the average on regions of the country the value of investment accounted respectively for one small enterprise, medium enterprise and individual entrepreneur and one its worker. In addition, with the use of models can be determined the range of values of these indicators.

4. SECOND CLASS OF THE DEVELOPED MODELS

The developed models, describing the value of investments (in thousands rubles) in all regions of the country, attributable to one entrepreneurial structure by main economic activity are presented below:

– for entrepreneurial structures of the trade

$$y_7(x_7) = \frac{1657{,}5}{27{,}66 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_7 - 63{,}62)^2}{2 \cdot 765{,}08}} \quad (7)$$

– for entrepreneurial structures of the manufacturing

$$y_8(x_8) = \frac{12257{,}14}{183{,}54 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_8 - 365{,}99)^2}{2 \cdot 33{,}67 \cdot 10^3}} \quad (8)$$

– for entrepreneurial structures of the construction

$$y_9(x_9) = \frac{10725}{182{,}07 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_9 - 345{,}23)^2}{2 \cdot 33{,}15 \cdot 10^3}} \quad (9)$$

– for entrepreneurial structures of the transport and communications

$$y_{10}(x_{10}) = \frac{4420}{58{,}19 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_{10} - 140{,}47)^2}{2 \cdot 3{,}39 \cdot 10^3}} \quad (10)$$

– for entrepreneurial structures, specialize on the operations with real estate

$$y_{11}(x_{11}) = \frac{8666,67}{183,65 \cdot \sqrt{2\pi}} \cdot e^{\frac{-(x_{11}-307,53)^2}{2 \cdot 33,73 \cdot 10^3}} \quad (11)$$

Models (7)-(11) allow us to estimate the average on main types of economic activity the value of the investments attributable to one entrepreneurial structure, in the regions of the country. In addition, with the use of models can be defined the ranges of values investment for each of the activity types.

5. MODEL VALIDATION IN TERMS OF QUALITY

Logical and statistical analysis showed that all developed models are well approximate the original data over the entire range of their changes. Table 3 shows the estimated values of the main statistics for the three quality criteria. A comparison of these calculated values showed that the statistics for the Pearson criterion is less than the table value of the criterion equal to 4,61. Similarly, the values calculated from Kolmogorov-Smirnov test is less than table value of 0.15. Statistics Shapiro-Wilk is close to one. Thus, for all considered criteria, the developed models are of high quality and can be used to describe the studied regularities.

Table 3: The calculated values of statistics by the quality criteria

Number of function	*The calculated values by the quality criteria*		
	Kolmogorov-Smirnov	*Pearson*	*Shapiro-Wilk*
(1)	0,06	4,03	0,97
(2)	0,08	3,76	0,95
(3)	0,04	3,39	0,94
(4)	0,04	3,10	0,98
(5)	0,09	3,19	0,95
(6)	0,08	3,83	0,91
(7)	0,08	2,91	0,98
(8)	0,07	3,73	0,98
(9)	0,05	1,48	0,95
(10)	0,03	2,87	0,97
(11)	0,06	3,54	0,96

Since all the developed economic-mathematical models good approximate the original data and have a high quality of the accepted criteria, we can conclude that hypothesis 2 about the feasibility of using the functions of density normal distribution to estimate the volume of investment in entrepreneurial structures found in the process of research confirmed.

6. ANALYSIS OF THE DEVELOPED MODELS

A feature of the functions of density normal distribution (Ventsel, 2001) is the fact that on them without complex calculations can be defined average values and ranges of variation of considered parameters. These intervals for most (68%) regions of the country computed from the average squared deviations of the indicators. When computing the bounds of the interval to the average value of the indicator respectively added and subtracted the indicated deviation.

Average values and ranges of variation of investment in fixed capital, attributable to one entrepreneurial structure and one employee in the data for 2010 year, presented in table 4. They are based on the developed models.

The figures shown in table 4, can be used in the solving task of monitoring the volume of investments by all levels of management and the regulation of entrepreneurship (federal, regional, municipal), identifying needs for financial resources when planning activities in credit organizations and funds, specialized on the help and support of entrepreneurship. The value of the investments per one employee with the growth of size of enterprises growing.

Table 4: Characteristics of investment in entrepreneurial structures

Entrepreneurial structures	*On one entrepreneurial structure, billion rubles*		*On one employee, thousand rubles*	
	Average value	*Interval*	*Average value*	*Interval*
Small enterprises	0,45	0,29-0,61	47,56	30,98-64,14
Medium enterprises	11,74	5,83-17,65	93,22	55,44-131,00
Individual entrepreneurs	0,06	0,04-0,08	22,56	13,97-31,15

Necessary to know that the average number of workers employed by individual entrepreneurs, as shown by earlier studies (Pinkovetskaia, 2012) is significantly below the average number of employees of small enterprises. Accordingly, the volumes of investment per worker on individual entrepreneurs have the least value for small enterprises this value is twice as big and for medium enterprises more than in four times. This trend is confirmed by the analysis of investment in large enterprises of our country. The average value of investment per employee of large enterprises (as shown by the calculations of the authors), is 160 thousand rubles per year, which is almost twice higher the corresponding indicators for medium enterprises.

The amount of investment accounted for as one entrepreneurial structure and per one employee vary greatly in specific regions of the country, which is evident from the intervals of changes of these indicators. The relevant data may be used in the formation of projects and programs of entrepreneurship development, especially in regions where its level is not sufficient.

Average values and intervals of variation of investment in fixed capital per entrepreneurial structure of different industries according to the data for 2010 year are presented in table 5. They are based on the developed models, describing the investment in entrepreneurial structures, specialized on five main types of economic activity.

Table 5: Characteristics of investment per entrepreneurial structure by main types of economic activity, thousand rubles

Type of activity	*Average value*	*Interval*
Trade	63,62	35,96-91,28
Manufacturing	365,99	182,45-549,53
Construction	345,23	163,16-527,30
Transport and communications	140,47	82,28-198,66
Operations with real estate	307,53	123,88-491,18

The investment volumes as shown by the data given in table 5 differ significantly according to the types of economic activity. The smallest investment is typical for trade enterprises, because, in our opinion, the specifics of these are, as a rule, small shops. In addition, trade enterprises have received the greatest development in previous years and, to date, their formation has basically ended. A small investment in entrepreneurial structures of transport and communication can be explained by the weak development this type of activity in most regions of the country and the small size of the concerned enterprises. Entrepreneurial structures dedicated to three other types of economic activity are characterized by similar levels of investment.

The data in table 5, can be used to solve problems of monitoring, planning and forecasting volumes of investment. The most current provided feasibility studies for development of entrepreneurial structures, specialized on the types of activities that have not received sufficient development in specific regions and municipalities.

The indicators shown in tables 4 and 5, which characterizes the intervals of change of volume investments allow us to conclude that the volume of investments per one entrepreneurial structure and one of its employees differ significantly depending on the number of employees (size) of entrepreneurial structure, by regions on the country and by types of economic activity, which specialize entrepreneurial structure. Thus, hypothesis 1 in the research process was confirmed.

CONCLUSIONS

The conducted researches allowed to draw the following conclusions:

- proven ability to use density functions of the normal distribution as models for describing the volume of investments in fixed capital entrepreneurial structures in the regions of the country and on the main types of economic activity;
- developed models approximate good the original data and are of high quality according to accepted criteria;
- showed the presence of differentiation of the volumes of investment attributable to one entrepreneurial structure and one employee, in different regions of the country and by the types of activity;
- defined average for the regions of the country values of the investment attributable to one entrepreneurial structure and to one worker, and the intervals of changes in these indicators, characterize the majority (68%) of the regions;
- established that entrepreneurial structures characterize directly proportional relationship between their size and the amount of investment: the larger the enterprise, the more investment accounted on one enterprise and also per one employee;
- defined mean values and intervals of variation volumes of investment in entrepreneurial structures on the main types of economic activity;
- shown that the relatively lower volume of investment characterize the entrepreneurial structures, specialized on trade, transport and communications, and relatively greater for structures in the manufacturing, construction and carrying out operations with real estate.

The hypotheses were confirmed during the research. Proposed methodical approach and algorithm of modeling can be used to estimate the volume of investment in entrepreneurial structures in the regions of the Russian Federation and their municipalities.

The obtained results are of certain theoretical and practical significance, in particular, in further scientific researches of small and medium entrepreneurship, as well as justify the proposals for its functioning and proving the using of investment. They are of interest for credit, financial organizations and specialized on supporting the entrepreneurial structures funds. As

well the achieved results can be wide used in education and getting another type of education employees of entrepreneurial structures.

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