Artículo de investigación

Turnover of Russian small enterprises: results of modeling

Оборот малых предприятий России: результаты моделирования

Volumen de negocio de las pequeñas empresas rusas: resultados del modelo

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Abstract

The entrepreneurship started in Russia during the process transformation of state economy into market economy, beginning from 1992. The aim of the study was to assess the two-factor production functions that describe the dependence of the volume of production of small enterprises on the wages of their employees and investments in fixed assets. The study was based on empirical spatial data characterizing the activities of small enterprises and microenterprises. Official statistical information on 82 regions of Russia for 2017 was used. Proven the high quality of approximation of the initial data by the two-factor production functions. The results of the study, namely new knowledge and tools are of scientific and practical importance and can be used in monitoring of business climate in regions, determining resource needs.

Keywords: Production function, Small enterprise, Microenterprise, Investments, Wages, Regions of Russia.

Resumen

El emprendimiento comenzó en Rusia durante el proceso de transformación de la economía estatal en economía de mercado, a partir de 1992. El objetivo del estudio fue evaluar las funciones de producción de dos factores que describen la dependencia del volumen de producción de las pequeñas empresas en los salarios de Sus empleados e inversiones en activos fijos. El estudio se basó en datos espaciales empíricos que caracterizan las actividades de pequeñas empresas y microempresas. Se utilizó información estadística oficial de 82 regiones de Rusia para 2017. Se comprobó la alta calidad de la aproximación de los datos iniciales por las funciones de producción de dos factores. Los resultados del estudio, a saber, los nuevos conocimientos y herramientas, son de importancia científica y práctica y se pueden utilizar para monitorear el clima de negocios en las regiones y determinar las necesidades de recursos.

Palabras claves: función de producción, pequeña empresa, microempresa, inversiones, salarios, regiones de Rusia.

Аннотация

Предпринимательство получило развитие в России в процессе трансформации государственной экономики в рыночную, начиная с 1992 года. Целью исследования являлась оценка двухфакторных производственных функций, описывающих зависимость объема производства малых предприятий от заработной платы их работников и инвестиций в основной капитал. Исследование проводилось на основе эмпирических пространственных данных, характеризующих деятельность малых предприятий и микропредприятий. Использована официальная статистическая информация по 82 регионам России за 2017 год. Доказано высокое качество аппроксимации исходных данных двухфакторными производственными функциями. Результаты исследования, а именно новые

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знания и инструментарий, имеют научное и практическое значение и могут быть использованы при мониторинге делового климата в регионах, определении ресурсных потребностей.

Ключевые слова: производственная функция, малое предприятие, микропредприятие, инвестиции, заработная плата, регионы России.

Introduction

Currently, there is no doubt about the importance of small entrepreneurship for economic development. Numerous studies demonstrate the positive impact of small enterprises on the economic growth and development of many countries (Acs et al., 2008; Baumol, 2004; Decker et al., 2014).

The entrepreneurship started in Russia during the process transformation of state economy into market economy, beginning from 1992. Numerous small enterprises are operating now in the market economy of Russia. In 2017, their number exceeded 2755 thousand, and 11986 thousand employees worked for them. At the same time, small enterprises have not yet been developed in Russia; their share is less than 20% of gross domestic product and employees' number of all enterprises and organizations in Russia. For comparison, it can be noted that in the European Union countries, small enterprises have a much larger share in the economy. They provide jobs for about 67% of the working population and produce 58% of gross domestic product (Development of Small and Medium Enterprises, 2015). In Germany these figures are 60% and 48% respectively (Sollner, 2014).

Solving management problems in the national economy requires an understanding of the factors that influence the volume of small enterprises production. At the same time, experience shows that it is business sector that is the main driver of regional development, especially in underdeveloped areas, and business sector creates conditions for restructuring of the economy (Mosina, 2016; Safiullin et al., 2016; Chepurenko, 2017; Pinkovetskaia et al., 2019a; Gladkova et al., 2018; Pinkovetskaia et al., 2019b). Thereby, in Russia there is an urgent need for accelerated development of small enterprises. Therefore, in recent years, one of the most urgent problems is to determine the growth reserves of such enterprises in each of the regions. The rationale for these reserves, as well as the resources required for the effective functioning of small enterprises, can be based on mathematical models such as production functions. Proceeding from it, the purpose of the study was to assess factors influencing small enterprises turnover with use of production functions.

Literature review

The experience gained so far has shown the possibility of wide application of production functions in economic analysis and management. Production functions are economic and mathematical models of production processes and they quantify stable natural relationship between the factors describing the cost of capital and labor, and the indicator characterizing the production volume (Bessonov and Tsukhlo, 2002; Kleiner, 1986; Douglas, 1967). Production functions are the basis for modeling the activities of various economic and business complexes and systems, from individual enterprises and organizations to regions, sectors and the economy as a whole.

Power functions are most widely used. Table 1 shows the analysis of the existing methods of evaluation of power production functions on the examples of Russian studies conducted in recent years.

Table 1: Characteristics of Russian studies

Authors	Factor of capital	Factor of labor	Initial data	Restrictions on the sum of indicators of the degrees	Object of studying
1	2	3	4	5	6
Nosov and Aznabaeva (2016)	fixed assets	number of employees	time series	no	BRICS countries

Sokol, Kutychkin and Petrov (2017)	investment in fixed capital	labor costs	time series	yes	one region-Yugra
Nikonorov (2017)	fixed assets	number of employees	time series	no	Russian trade sector
Pshenichnikova S. N., Romanyuk (2017)	gross capital accumulation	number of employees	time series	no	Russia
Adamaliev and Khalilov (2016)	investment in fixed capital	number of employees	spatial data	no	Russian regions
Sadovin and Kokotkina (2017)	fixed assets	number of employees	time series	no	Russian regions
Afanasiev and Ponomareva (2014)	fixed assets	number of employees	time series	no	Russia
Antipov (2012)	fixed assets	number of employees	time series	yes	Russia
Gafarova (2013)	fixed assets	number of employees	time series	no	one region-Bashkortostan
Baranov (2014)	fixed assets	number of employees	time series	no	Russian regions

Source: Compiled by the authors.

The data given in Table 1 shows that in most cases the economies of Russian regions (5 cases), Russia (3 cases), BRICS countries and trade enterprises located in Russia are the objects of the research. Gross domestic product (GDP) of the countries, gross regional product (GRP) of the regions and the volume of retail trade are respectively studied. Fixed assets of enterprises and organizations in 7 works, flows of investments in fixed capital in 2 works, gross capital accumulation in 1 article are considered as factors describing capital. In absolute majority of the works (9) the number of employees occupied in the considered productions and only in one case - labor costs were used as labor factors. Initial data in 9 researches represented time series while only in one work spatial data in one year were used. In all the works listed in Table 1, power production functions were considered, while in 8 cases no restrictions on the sum of powers were imposed. That is, we evaluated the production functions, in which increasing, constant and decreasing returns to scale were allowed.

Scientist`s studies from different countries based on production functions using the data of small enterprises have also achieved some progress. In most cases, the factors that determine the volume of production are capital costs (the cost of all machines, equipment and buildings) and labor costs. Different indicators are discussed in scientific research. Thus, Bohorquez and Esteves (2008), Husain and Islam (2016) used the number of permanent employees to describe the labor costs. Sage and Rouse (2011) explore such indicator as total number of the man-hours within a year. In most works observations are based on time series. So, Khatun and Afroze (2016) show the impact of employees' number and fixed capital on real GDP in Asian countries such as Bangladesh, India, China, Malaysia and Thailand, based on the use of time series data for 1990-2014. Batool and Zulfiqar (2013) present the analysis of interrelation of the same indicators on the production volume of small and medium enterprises in Pakistan. It should be noted that studies on the assessment of production functions describing the activity of small enterprises in Russia haven't yet gained essential development. At the same time, it is possible to note the pilot work of Pinkovetskaia (2014) in which the method of developing production functions according to the data of small and medium enterprises in the regions was considered in detail.

The analysis of the works stated above shows that assessment of production functions is related with a number of problems which are discussed below. The use of basic data for ten and more years (time series) is complicated by the need to take into account inflation processes. In addition, it is necessary to assume that operating conditions of the considered research object for the considered interval of time will be identical or, at least, undergo few changes that in practice are not always fulfilled. Time series are often

limited in length, and dynamics change of indicators experiences especially essential fluctuations because of crisis phenomena in the economy. When used as a factor describing the cost of capital and values of fixed assets, the main problem is the reliability of information on the actual share of fixed assets in production. The assumption of full use of fixed assets does not always correspond to their actual loading. The situation is similar with the second factor. The number of employees directly occupied in production processes does not always coincide with the actual labor costs, as often employees are not busy all day (working week). It leads to erroneous indicators in the evaluation of labor factors.

Methodological approach, design and data

Small enterprises located in each of Russia's regions were considered as a research object. The current law (On the development of small enterprises in the Russian Federation, 2007) has established the main criterion for classifying enterprises as small ones. It is proposed to consider the number of employees engaged in enterprises as this criterion. The number of employees for small enterprises should not exceed 100 people. Herewith number of employees for microenterprises should not exceed 15 people. Consequently for small enterprises (without microenterprises) this figure ranges from 16 to 100 people.

Taking into account the approach accepted in Russian statistics, the volume of production of small enterprises can be characterized by the total turnover, which consists of the cost of goods of their own production and proceeds from the sale of the purchased goods.

In accordance with the recommendation of Granberg (1988), the number of factors in the production function must be small, since in this case necessary calculations and interpretation of the results are simplified. Given the analysis, we considered investments in fixed assets and employees' wages as factors of production functions. Correlation analysis showed that these factors have the greatest impact on small enterprises turnover. At the same time, there is no mutual connection (collinearity) between them. It should be noted that the investment flow provides more acceptable results compared to such factor as fixed assets. As we indicated earlier, this conclusion was made by Bessonov and Tsukhlo (2002) and Gavrilenkov (2000) on the basis of incomplete use of fixed assets in small enterprises. Wages of employees in small enterprises represent a comprehensive indicator which considers not only the labor costs of production, but also the characteristics of a particular region (price level, employment and other socio-economic aspects). In addition, the use of employees' wages as a factor ensures identical dimension of all indicators of production functions. The identical dimension of all indicators of the production function, as shown in the article (Felipe and McCombie, 2012), provides high quality of the relevant models.

In our research we used spatial data characterizing the considered factors and the resulting indicators for all small enterprises located in each Russia's region. This approach is caused by the following. The criteria for classifying enterprises as small enterprises have changed many times in recent years. The current criteria have been used since 2008. Accounting for small enterprises is carried out once a year, and the data are submitted to statistical bodies. Therefore, modeling of indicators characterizing the activities of such enterprises using time series is possible only for 10 years (from 2008 to 2017). Accordingly, the number of observations is equal to ten, which is less than the minimum acceptable value, which according to the criterion proposed by Khodasevich (2017) should be at least 16 for the two-factor function. Therefore, the production functions of small enterprises based on time series data contradict this criterion. It should be noted that spatial data allow avoiding problems that are characteristic of time series, as mentioned in the literature review. Even the founder of the theory of production functions Douglas (1967) specified that at the same time functioning objects for one certain period are interesting to consider. Advantages of using spatial data in assessment of production functions are described in detail in the paper (Charoenrat and Harvie, 2013).

Our research included the following steps:

- collection and procession of initial statistical data. Formation of information arrays based on the data characterizing the sets of small enterprises, small enterprises (without microenterprises) and microenterprises located in each of Russia's regions. These arrays describe the values of this sets enterprises turnover, flow of investment and wages for 2017;
- linearization of the data obtained at the first stage, which characterize independent factors and resulting

variables for small enterprises, small enterprises (without microenterprises) and microenterprises;
- development of production functions using the method of least squares;
- assessment of quality of functions using correlation and determination coefficients, Fisher-Snedecor and Student's tests as well as corresponding significance levels;
- verification of the developed functions for the presence of autocorrelation, heteroscedasticity and multicollinearity, and also verification of hypothesis that the distributions of the remains for each of the regressions are normal distribution functions;
- consideration of the theoretical and practical results following the analysis of the developed production functions and opportunities of their use.
- In the research official statistics of Federal State Statistics Service (Federal Service of State Statistics, 2018) on activities of small enterprises in Russia for 2017 was used. The research is based on data from 82 regions of Russia.

In the course of our research three production functions reflecting dependence of small enterprises, small enterprises (without microenterprises) and microenterprises turnover on fixed capital investment and employees' wages in all regions of Russia have been developed. The functions constructed by the authors have the specification similar to the well-known Cobb-Douglas functions. The parameters of production functions were determined using the regression analysis methodology (Pindyck and Rubinfeld, 2013). Three functions correspond to three enterprises groups, that were formed according to the above-mentioned size categories: small enterprises, small enterprises (except microenterprises) and microenterprises.

The results of modeling

In the process of the computational experiment three production functions reflecting the dependence of turnover (volume of production) of enterprises on fixed capital investment and employees' wages were developed. The formulas given in the article were developed by the authors.

The first function describes the turnover of all small enterprises located in each region:

$$y_1(x_1, x_2) = 4.512 \times x_1^{0.177} \times x_2^{0.829}, \quad (1)$$

where y_1 - turnover of all small enterprises, located in the region of Russia for the year, billion rubles;

x_1 - investments in fixed capital of all SMEs in this region for the year, billion rubles;

x_2 - employees' wages of all SMEs in this region for the year, billion rubles.

The second function describes the turnover of small enterprises (without microenterprises) located in each of the regions:

$$y_2(x_3, x_4) = 4.768 \times x_3^{0.195} \times x_4^{0.812}, \quad (2)$$

where y_2 - turnover of small enterprises (without microenterprises) located in the region of Russia for the year, billions of rubles;

x_3 - investment in fixed capital of small enterprises (without microenterprises) in the region for the year, billions of rubles;

x_4 - employees' wages of small enterprises (without microenterprises) in the region for the year, billions of rubles.

The third function describes the turnover of microenterprises located in each region:

$$y_3(x_5, x_6) = 4.476 \times x_5^{0.146} \times x_6^{0.840}. \quad (3)$$

где y_3 - turnover of small enterprises (without microenterprises) located in the region of Russia for the year, billion rubles;

x_5 - investment in fixed assets of microenterprises in this region for the year, billions of rubles;

x_6 - employees' wages of microenterprises of this region for the year, billions of rubles.

Evaluation of function quality

The assessment of the quality of the obtained functions was carried out using correlation and determination coefficients, Fisher-Snedecor and Student's tests.

Logical analysis of production functions showed that they adequately describe the turnover of

relevant small enterprises in regions over the entire range of factors. Table 2 shows the calculated values corresponding to the specified coefficients and tests to verify the quality of all four production functions presented in this article.

Table 2: Calculated values on coefficients and tests

Quality indicators	Number of production function		
	(1)	(2)	(3)
Determination coefficient	0.965	0.955	0.947
Correlation coefficient	0.982	0.977	0.973
Calculated value according to Fischer-Snedekor's test	1076.687	842.848	704.938
Calculated value according to Student's test for y - intersection	19.059	20.273	18.614
Calculated value according to Student's test for the first factor	6.049	6.165	4.717
Calculated value according to Student's test for the second factor	27.221	24.919	23.805

Source: Compiled by the authors.

Comparison of the calculated values given in table 2 with the values of the tests presented in the literature showed that the production functions (1) - (3) are of high quality. The correlation coefficients are close to 1. The closer the coefficient of determination to 1, the closer it to the functional relationship between the volume of production and factors. According to N. Draper and G. Smith (1998), the functions are successful when determination coefficients exceed 0.8. In our case, they are above 0.947. The difference between 1 and the determination coefficient characterizes a share of dispersion which is caused by influence of other factors which are not included in the functions. That is, we can conclude that the functions (1) - (3) account for more than 94% of the variation of the dependent variables. Other factors which are not considered here account for 6%. The calculated values of all statistics are significantly higher than the tabulated value of Fisher-Snedekor's test, which is 3.98 with a significance level of 0.05. All calculated values of the Student's test are greater than the tabulated value, which with a significance level of 0.05 is 1.99. Thus, functions (1) - (3) well approximate the empirical data.

Analysis of the calculated values of significance levels showed that the values of significance of the Fisher-Snedecor test is less than 0.01. This suggests that there is indeed a strong correlation turnover and the factors under consideration. All p-values are less than 0.01, that is, with 99 percent confidence, the coefficient and indicators all three regression function are statistically significant.

The verification of functions (1) - (3) using Darbin-Watson test showed that there is no autocorrelation, and Breusch-Pagan test showed the absence of heteroscedasticity. There is no multicollinearity that is there is no dependence between the factors, which is confirmed by the VIF test. In the process of initial data approximation using the method of least squares, the residues showing deviations of calculated

values from the initial data have been received. Verification of distribution of these remainders for each of the three production functions was conducted on the basis of assessment of histograms graphs, normal distribution functions and tests of normality. Graphs of histograms of residues showed that all of them lumpy in the middle with thin, symmetrical tails. Residues concentrated about zero, because normal distribution functions have mean values near to zero.

In general, it can be concluded that the developed functions (1) - (3) fully satisfy the econometric requirements and therefore can be used for the interpretation of the studied phenomena.

Discussion

The developed production functions (1) - (3) prove the influence of the considered factors on the turnover of enterprises relating to the entrepreneurial sector of Russian regions' economy. Values of degrees for both factors in functions are positive, therefore, it can be stated that the stimulation of small enterprises can be provided with increase in wage costs and growth of investment in fixed assets. Production functions for all considered factor values do not reach their maximum. This is confirmed by the fact that the values of the maximum return on both factors for all functions are positive on the considered ranges of the factors values change. Therefore, it can be concluded that the economy of Russian regions has not reached saturation with products of small enterprises and microenterprises. They have significant reserves for further development. That is, in all regions there are opportunities to increase the number of enterprises and the number of employees in them.

The factor of employees' wages in all production functions affects turnover to a greater extent than the factor of investment in fixed assets.

The sum of the degree values in the coefficients of the production functions (l) and (2) is more than 1 (1.006 and 1.007), which indicates an increasing return to scale (RTS). A similar trend was observed in Asian countries (Khatun and Afroze, 2016). With the increase of both factors (fixed capital investment and employees' wages), production growth is faster than the factors growth. For example, with the growth of both factors in function (2) by 10% production increases by 10.07%. The accelerated increase in production volumes with the growth of factors is of economic and social importance. A comparison of returns to scale between different size-classes enterprises shows that returns to scale for microenterprises (function 3) is 0.986. On small enterprises (without microenterprises) RTS is more. This suggests that small enterprises (without microenterprises) provide greater production growth while simultaneous increasing the volume of resources compared to microenterprises. This situation is due to the following. In microenterprises, the number of workers is small (average 3-4 people). It does not allow to fully carry out all functions and to solve all problems facing enterprises. In micro-enterprises there is a combination of performed functions. According to the authors of the study (International Labour Conference, 2015), this leads to a relatively low level of training, lower productivity and, as a result, low efficiency of such enterprises. These causes reduce the competitiveness of microenterprises compared to small enterprises (without microenterprises).
For a rapid increase in enterprises production in Russian regions, it is advisable to provide the simultaneous growth of these both factors. It will increase the returns to scale. It should be noted that for the regions with an excess of the working population (on the example of the republics of North Caucasus), the main direction of business development is connected with increase in employment and creation of family business. In regions where there are not enough potential employees (Siberia and the Far East), the main direction of increasing enterprises production is associated with an increase in investment in fixed assets. Cross derivatives of the production functions for each of the two factors are positive for all values of the range of changing factors, therefore the increase in one factor improves conditions for using the other factor. Thus, the growth of employees' wages increases the return on investment in fixed assets. Conversely, increased investment in fixed capital increases the wages level. The second derivatives of all isoquants are positive. The level of bulge decreases with the growth production volume, which indicates an increase in the elasticity of substitutive factors: with the growth of production in entrepreneurial structures, the possibility of replacing one factor with another increases.

The use of production functions is possible when solving such a vital problem as ranking the regions based on the efficiency of using resources such as investment in fixed capital and employees' wages. At the same time a comparative analysis of the actual turnover of all enterprises in the region and the value of turnover in the same region predicted on the basis of the

production function can be used. In our opinion, the relatively great positive meaning of this value (that is, the excess of the actual turnover over the estimated one) indicates good business climate in the region. And accordingly, a large negative meaning of this value allows concluding that there are problems with the business climate in the relevant region.

The comparative analysis of the empirical data used when developing production function (1) and the predicted values for the same function showed a high level of business climate in Ivanovo, Kaliningrad oblasts, the city of Moscow and Krasnodar territory. The low level of business climate according to the criterion of efficiency of the considered factors was noted in such regions as Orenburg, Kemerovo, Amursky oblasts, Komi Republic, Khabarovsk territory.

The comparative analysis of the empirical data used when developing production function (2) and the predicted values for the same function showed a high level of business climate in Republic Mari El, the city of Moscow, Krasnodar and Altai territory. The low level of business climate according to the criterion of efficiency of the considered factors was noted in such regions as Orenburg, Kemerovo, Penza, Amur oblasts, Komi Republics, Khabarovsk territory.
The comparative analysis of the empirical data used when developing production function (3) and the predicted values for the same function showed a high level of business climate in republic Tatarstan, Vologda, Kostroma, Ivanovo, Penza oblasts. The low level of business climate according to the criterion of efficiency of the considered factors was noted in such regions as Moscow, Nizhny Novgorod, Leningrad oblasts, Kamchatka territory and Sevastopol.

Conclusion

The conducted research has a certain scientific and practical significance.
The scientific significance of the study is as follows:

- methodical aspects of evaluation of production functions are considered. The problems arising from the use of fixed assets as a factor of capital and the number of employees engaged in production processes as a labor factor, as well as data generated in the form of temporary ranks are analyzed. The advantages of choosing investment flow and employees' wages and spatial data for one year as a factor in assessing production functions are shown;
- 3 two-factor production functions similar to Cobb-Douglas functions are developed during the research. These functions describe dependence of turnover on the considered factors for all small enterprises, small enterprises (without microenterprises) and microenterprises in particular. With the use of a number of tests, high quality of all developed production functions and their good approximation of the initial data are confirmed;
- production functions prove that there are significant reserves for further development of business sector of the economy, namely, in all Russian regions, the saturation with this enterprise goods and services has not been achieved. Increase in one of the factors of production function improves conditions of using the other factor. The factor of employees' wages in all production functions affects the turnover to a greater extent than the factor of investment in fixed assets. An increasing return to scale of small enterprises is observed;
- using production functions, regions of Russia with a high and low level of efficiency in the use of available resources (business climate) are identified.

The practical significance of the research can be realized in the activities of government bodies, in business sector of the national economy, as well as in educational activities in the following areas. The new knowledge can be used in scientific research, in educational process while solving problems of small enterprises.
The proposed methodological approach and tools for assessing production functions can be used in research on business problems, as well as in justification of the development programs of this sector of the economy at the federal and regional levels. The methodology and tools that were used in the research process can be applied to similar researches in countries with a significant amount of territorial (administrative) units.

The conducted research provides government, regional authorities and other administrative bodies with information on possible ways to increase the production. The developed production functions are effective management tools that allow assessing the level of financial and labor resources of enterprises in Russia and particular regions. The results of the work can be used in the current activities of state, municipal

and public organizations connected with regulation and support of small enterprises.

The practical significance of the study is the possibility of using the results obtained to justify resources and monitor the business climate. The results of the study can be used by state and regional authorities to monitor the efficiency of investments in fixed assets and labor resources. That is, they can be used to assess the efficiency level of each of the discussed factors and also the revealed imbalance in factors values for each region. The functions can be used in justifying investments in fixed capital and labor resources, in developing plans and programs for the further entrepreneurship development. The results of the study should ensure the implementation of the Federal Strategy for the Development of entrepreneurship for the period till 2030 (Strategy of SME development, 2016).

Further research is connected with assessment of production functions which are specialized in various types of economic activity and located in municipalities of particular regions. The conducted research has a certain scientific and practical significance.

Reference

Acs, Z.; Desai, S. & Hessels J. (2008). "Entrepreneurship, economic development and institutions", Small Business Economics, no. 31, pp. 219-234.

Adamaliev, K. R. & Khalilov, M. A. (2016). "Models of production functions of the regions: calculation of parameters and characteristics, analysis of dependence of output on resources". Fundamental research, no. 4-2, pp. 339-345.

Afanasiev, A. A. & Ponomareva, 0. S. (2014). "Production function of national economy of Russia in 1990- 2012", Economics and mathematical methods, no. 50(4), pp. 21-33.

Antipov, V. I. (2012). "Production function of the Russian economy". Economics, Statistics and Informatics, no. 5, pp. 101-104.

Baranov, S. V. (2014). "Economic models of production functions: History and modernity". Economic Science, no. 10, pp. 53-57.

Batool, S. & Zulfiqar S. (2013). "Analyzing the Input Output Relationship of Small and Medium Enterprises in Pakistan: An Econometric Approach", International Journal of Business and Economic Development, no. 1(1), pp. 66-73.

Baumol, W. J. (2004). "Entrepreneurial enterprises, large established firms and other components of the free-market growth machine", Small Business Economics, no. 23, pp. 9-21.

Bessonov, V. A. & Tsukhlo, S. V. (2002). "Problems of construction of production functions in the Russian Transitional economy", Analysis of dynamics of the Russian transitional economy. Institute of Economy of transition period, pp. 5-89.

Bohorquez, V. & Esteves, J. (2008). "Analyzing SMEs size as a moderator of ERP impact in SMEs productivity", Communications of the IIMA. no. 8(3).

Charoenrat, T. & Harvie, C. (2013). "Technical Efficiency of Thai Manufacturing SMEs: A Stochastic Frontier Analysis", Australasian Accounting. Business and Finance Journal, no. 7(1), pp. 97-122.

Chepurenko, A. Y. (2017). "Combining a universal concept with national characteristics: support of small and medium enterprises", Issues of state and municipal management, no. 1, pp. 7-30.

Decker, R.; Haltiwanger, J.; Jarmin, R.; & Miranda, J. (2014). "The Role of Entrepreneurship in US Job Creation and Economic Dynamism", Journal of Economic Perspectives, vol. 28, no. 3, pp. 3-24.

Development of small and medium entrepreneurship. Foreign experience. (2015). SME Bank, Moscow, Russia.

Douglas P. (1967). "Comments on the Cobb-Douglas Production Function", The Theory and Empirical Analysis of Production. Columbia University Press, pp. 15-22. National Bureau of Economic Research, available at: http://www.nber.org/chapters/cl474. (accessed 15 December 2018).

Draper, N. & Smith, H. (1998). Applied regression analysis, John Wiley & Sons, New York, USA.

Federal service of state statistic. Small and medium entrepreneurship in Russia, available at:http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_ll 39841601359 (accessed 15 January, 2018).

Felipe, J. & McCombie, J. (2012). "Problems with Regional Production Functions and Estimates of Agglomeration Economies: A Caveat Emptor for Regional Scientists", Cambridge Centre for Economic and Public Policy. Working Paper no. 725.

Gafarova, E. A. (2013). "Modeling of regional development on the base of production functions", Naukovedenie, no. 3, pp. 1-7.

Gavrilenkov, E. E. (2000). "Economic growth and long-term development strategy of Russia", Russian economy: experience of transformation of the 1990s and prospects for its development. GU-VSFIE, Moscow, pp. 55-78.

Gladkova, V.E., Yakhyaev, M.A., Korolkov, V.E., Smirnova, I.A., Litvinenko I.L., Pinkovetskaya Ju.S. (2018). The access of

russian small enterprises to public procurement markets: data analysis. Amazonia Investiga. Vol. 7. Núm. 15. P. 20-31.
Granberg, A. G. (1988). "Modeling of the socialist economy", Economics, Moscow, Russia.
Flusain, S. & Islam, M. S. (2016). "A Test for the Cobb Douglas Production Function in Manufacturing Sector: The Case of Bangladesh", International Journal of Business and Economics Research, no. 5(5), pp. 149-154.
International Labour Conference, 104th Session. Report IV Small and medium-sized enterprises and decent and productive employment creation. Geneva: International Labour Office (ILO), 2015. 26 p.
Khatun, T. & Afroze, S. (2016). "Relationship between real GDP and Labour and Capital by applying the Cobb-Douglas production function: a comparative analysis among selected Asian Countries", Journal of Business Studies, vol. XXXVII, no. 1, pp. 113-129.
Khodasevich, G. B. (2017). "Working with experimental data processing on computer. Part 2. Processing one-dimensional arrays", available at:
http://dvo.sut.ru/libr/opds/il30hod2/index.htm (accessed: 16 December 2018).
Kleiner, G. B. (1986). "Production functions: Theory, methods, application". Finance and statistic, Moscow, Russia.
Mosina, E. A. (2016). "Regional small business: the necessary conditions and prospects for development", Social policy and sociology, vol. 15, no. 1 (114), pp. 17-23.
Nikonorov, V. M. (2017). "Refined evaluation of the production function of retail trade of the Russian Federation", Society: politics, economics, law, no. 9, pp. 32-36.
Nosov, V. V. & Aznabaev, A. M. (2016). "Production function in modeling GDP of the BRICS", New University. Series: Economics and law, no. 10(68), pp. 20-24.
On the development of small and medium enterprises in the Russian Federation: Federal law of 24.07.2007 № 209-FZ. Available from http://www.consultant.ru/document/cons_doc_LAW_52144/ (accessed: 16 December 2018).
Pindyck, R. & Rubinfeld, D. (2013). Microeconomics, Pearson, New York, USA.
Pinkovetskaia, I. S. (2014). "Some results of modeling volumes of production of entrepreneurial structures", ETAP: economic theory, analysis, practice, no. 2, pp. 107-126.
Pinkovetskaia, I., Arbeláez Campillo, D.F., Rojas-Bahamón, M.J., Gromova, T., Nikitina, I. (2019a). Female entrepreneurship development in the Russian Federation. Amazonia Investiga. Vol. 8. Num. 18. P. 111-118.
Pinkovetskaia, I., Balynin, I., Arbeláez Campillo, D.F., Rojas-Bahamón, M.J.. (2019b). Small business development in Russia: results of the assessment of sectoral structure and number of employees // ESPACIOS. Vol. 40. Num. 7. P. 1-12.
Pshenichnikova, S. N. & Romanyuk, I. D. (2017). "Analysis of production of Cobb-Douglas production function for the economy of Russia and some countries of Central and Eastern Europe", Proceedings of Southwest state university. Series: Economics. Sociology. Management, vol. 7, no. 3 (24), pp. 148-166.
Sadovin N. S. & Kokotkina T. N. (2017). "Economic analysis of statistical estimates of parameters of multiplicative production functions modeling the gross regional product", Actual problems of economy of modem Russia, no. 4, pp. 46-50.
Safiullin, R. G.; Grishina, T. P. & Malikova, E. R. (2016). "Territorial dynamics of competitiveness of small entrepreneurship in Russia", Successes of modem natural science, no. 11-2, pp. 390-395.
Sage, A. P. & Rouse, W. B. (2011). "Economic systems analysis and assessment cost, value, and competition in information and knowledge intensive systems, organizations, and enterprises", John Wiley & Sons, New York, USA.
Sokol, A. G.; Kutychkin, A. V. & Petrov, A. A. (2017). "On the use of production functions to simulate the functioning of regional economy", Bulletin of the South Ural state University. Series: computer technology\ control,electronics, vol. 17, no. 4, pp. 85-97.
Sollner, R. (2014). "The economic importance of small and medium-sized enterprises in Germany", Wirtschaft und Statistik, no. January, pp. 40-51.
Strategy of SME development in the Russian Federation for the period up to 2030: the order of the government of 2.06.2016 No.1083-R. Available from http://www.consultant.ru/document/cons_doc_LAW_199462/f3fa9da4fab9fba49fc9e0d938761ccffdd28 8bd/ (accessed: 16 December 2018).