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INNOVATIONS AS A FACTOR OF REGIONAL MANUFACTURING DEVELOPMENT IN RUSSIA

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ABSTRACT

Background. The search the reasons for a manufacturing development is very important for Russia. Nowadays the extractive enterprises are the most important part of Russians economy. For example, in 2013 year the part of mineral products in common Russian export was 76,1% (data of Russians Federal State Statistics Service). But to be competitive in the global economy the country needs in production of more complex products.

Methods. The method of this research is a production function which was constructed for the Russian manufacturing. The most known production functions which are used for used in the regional economics are the Cobb-Douglas function and the CES function. In spite of long life of the Cobb-Douglas production function and availability of large amount of new functions, we can say, that this instrument is still applicable today. Many scientists use this production function in their research. So in our article we used the Cobb-Douglas function and the factors were labour, capital, transport infrastructure and innovations. The coefficients for the selected function were obtained using the correlation-regression analysis approach.

Results. The result is that transport infrastructure doesn't matter for Russian manufacturing. The coefficient of innovation in logarithmic production function is 0,15 and it's significant on the 1% level. It's means that innovations play an important role in manufacturing production increasing.

Conclusions. The first conclusion is regarding the possibility of using the Cobb-Douglas function to research the Russian industry and regarding factors, which influence the development production. The main factor except labor and capital is innovations that means that to increase manufacturing production in Russia the government should improve innovation infrastructure.

Keywords: manufacturing, innovations, production function

JEL Code: R11, L11, O14

INTRODUCTION

Study of the factors influencing the manufacturing industry development is of considerable practical importance for any economics, and Russia is not an exception in this case. At the moment, the lion's share of the domestic export covers unprocessed products of extractive industries. In 2013 this share was equal to 76.1 %. Need to expand the volume of manufacturing industry export with simultaneous reduction of overseas delivery of primary commodity places the country before the necessity to search industries in which it can be a worthy competitor on the world market and ways of modernization of these industries.

Many authors write about a significant role of innovations in development of manufacturing. For example, Srithanpong T. [14] in his paper analyzes the relationship

between innovation, R&D (Research and Development), and productivity in Thai manufacturing and comes to conclusion, that product innovation plays an important role in increase of labor productivity in the industry along with company size, foreign participation and exporting. Crespi G. and Zuniga P. [5] study the role of process innovation in increase of labor productivity using the data of six Latin American countries. The authors state that company size, foreign participation and exporting in their turn stimulate investments in innovation but only for half of the countries under study. At that science and market information resources have little effect on innovation success. And the same as in the previous paper this article emphasizes a significant role of innovation in productivity increase. Brown, F. and Guzmán, A. describe the situation in Mexico [2], where as noted in their paper major industrial and technologically advanced companies with a big share on the market have more tendency to innovative activity. This case also indicates positive significant influence on labor productivity of innovative efforts of companies along with labor costs and capital assets. Griffith R., Huergo, E., and Mairesse J. [6] compare the systems of interrelation of innovation and productivity in France, Germany, Spain and Great Britain and come to conclusion on significant similarity of these countries; however they also reveal a range of interesting differences. For example, the authors note difference in tendency to investments in innovation by industrial companies partially owned by the government in the countries under study. And the same as in other papers the article by Griffith R., Huergo, E., and Mairesse J. [6] shows that in all four countries major companies tend towards process innovation to a greater extent. In the context of product innovation such tendency is more pronounced in Spain and less in Great Britain.

Having studied these papers it became interesting to consider a possibility of analysis of innovation role in Russian industry.

MATERIALS AND METHODS

All abovementioned studies use CDM (Crépon B., Duguet E., and Mairesse J.) model [4]. This model was suggested in 1998 and tested by the authors on the data obtained from French companies. The data of private companies were used for calculations. The result of their study consists in assertion that tendency of the companies to R&D is increased along with increase of company size, its market share and degree of diversification.

The subsequent researchers using the data on other countries obtained similar results. It would be interesting to use such approach while testing the data across Russia, however access to these data among Russian private companies is restricted, and such information is not available for generic disclosure. Therefore it is difficult to apply this approach. In this connection the other possible research methods were considered, specifically those with the use of the Russian economy data.

For instance, Rastvortseva S. [12] considers the figures characterizing the conditions for development of regional industrial clusters and reveals a significant role of innovative capacity of the region in the clusters activity. However the applied procedure studies only separate regions of the Russian Federation rather than a situation across the country on the whole.

The works involving study of information technologies influence on the production output growth rates present some features of interest. The work of Oliner D. and Sichil D. [11] is one of significant studies in this sphere. Impact of the following factors is assessed in

the model suggested by the authors: capital assets invested in PC; capital assets invested in software; capital assets invested in communication facilities, the rest of assets and labor inputs.

Plotting a production function is a widely used approach to study industry development factors. The Cobb-Douglas production function [3] used in this work and its extended version by Solow R. [13] is popular enough in recent researches. For example, Morel L. [9] developed the empirical model reflecting the income share brought by labor on the basis of the data from Canada. Hajkova D. Hornik J. [7] describe in their article possibilities of this function application for description of transition economy (by the example of the Czech Republic). Biddle J. described possibilities and experience of plotting the Cobb-Douglas function for agricultural industry [1]. Nimoh F., Tham-Agyekum E. and Nyarko P. have a similar work, but its study subject is the Ghana agriculture. The authors of this article also use the Cobb-Douglas function and supplement it with auxiliary arguments together with labor and capital assets. Nonstandard use of the Cobb-Douglas function is contained in the work of Hayes R. [8], where this function is plotted for libraries, so it is not for the industrial sector, but for the service one. The work author considers library stock as capital assets.

However in spite of popularity of the Cobb-Douglas function, this study also considered the other variant of production functions, namely its linear specification. The simplest variant of production function is a model with two factors of production (labor and capital assets) which are interchangeable. For assessment of a role of innovative activity in industrial production the production function was supplemented with the figures characterizing this activity.

Using the data of the Russian statistics irregularities of these data shall be considered at analysis of the obtained results. For example, the product value changes under the influence of inflation development and other processes and consequently the dynamics in the volume of shipped goods in rubles not always reflect exact dynamics in the physical volume. This problem is solved by means of conversion of the initial values of the figures into comparable prices. Besides the data on expenses of the products manufacturers for payment for the employee labor can be relied upon only partially as a range of companies uses shadow salaries. The expert estimation of the shadow economy size can be used to register this irregularity of statistical data. However such estimation for manufacturing industry has not been found. The data on the key assets of companies also contain some imperfections. In particular, with the knowledge of the key assets dimension it is impossible to define which part of them is used at manufacturing of the considered industry.

The other serious problem of the Russian statistics is scarcity of years for which the data are available. Objectively the economy of Russia as an independent state was established only in 1991. Before that Russia has been included in the USSR and the data available for this period are not comparable with present ones for a number of reasons. Firstly, the qualifiers of the economic activity types have been changed and some types of the activity are included in the group other than that in the soviet statistics. Besides, the recent changes of the qualifiers occurred in the new economy of Russia in 2003. Secondly, the country territorial division has been changed and therefore it is impossible to collect the data for a number of regions. Thirdly, the concept of innovative activities itself had different name in the soviet statistics and was meant not the same kind of

thing as at present. Thus the figures of this phenomenon for different periods will be inconsistent.

Due to the fact that even across Russia at large the statistics is available for a short period of time, in this study it is suggested to apply the panel data as compensation. All regions of Russia are considered as panels. The data on manufacturing sector are taken for several years and due to this it is possible to obtain several hundreds of observations. At that, there are problems related to different specialties of the regional industries and to the other reasons of their individual differences. In this case assessment was carried out using "Stata" package by means of two models: FE (fixed effects) and RE (random effects). The data from 2005 through 2013 taken from the Federal State Statistics Service website (gks.ru) were considered.

The volume indicators of shipped home-produced goods, works performed and services rendered without subcontracting, million of rubles per thousand of people involved in the industry and integral indicator of manufacturing output generalizing several individual indicators (turnover of a company, balanced financial result, volume of investments in capital assets and industrial production index) were tested as a dependent variable to derive regression equations. However the undertaken econometric calculations show that application of the generalizing indicator does not allow obtaining statistically significant results.

The following indicators were used as regressors:

- volume of employment in manufacturing, thous. people;
 - volume of labor costs in manufacturing, mln. RUB.;
 - share of employment in manufacturing in total number of the region residents, %;
 - volume of investments in capital assets of manufacturing companies, mln. RUB.;
 - volume of investments in capital assets of manufacturing companies per thousand of employees involved, mln. RUB.;
 - fixed assets value of manufacturing companies, mln. RUB.;
 - share of personnel involved in research and development, in total number of the region residents, %;
 - aggregate index of transport infrastructure development.
- All monetary indicators were given for the prices of 2013.

The variant of application of the same indicators but normalized ones was tested. The indicators were normalized by division of the value for every region by the average value for all regions.

The methods used for the calculations: multiple regression, least squares method, models of panel data with fixed and random effects. Assessment was carried out in the "Stata" package using the models with fixed and random effects. Significance test of obtained results was carried out using the Student-Fischer test and the heteroscedasticity model test using the Goldfeld-Quandt test.

RESULTS

Upon reception of the first results for the Russian data when only labor and capital were considered as factors it became interesting to consider the other factors influencing the dynamics of the industry indicators: transport infrastructure and innovative development.

After testing all cases and comparison of the obtained models the logarithmical model has been selected where the volume indicators of shipped home-produced goods, works performed and services rendered without subcontracting, millions of rubles per thousand of people involved in the industry (hereinafter referred to as output) are used as a dependent variable, and share of employment in manufacturing in total number of the region residents (hereinafter referred to as zan), volume of investments in capital assets of manufacturing companies (hereinafter referred to as inv) and share of personnel involved in research and development, in total number of the region residents (hereinafter referred to as innov) are used as independent variables. The descriptive statistics is given in Table 1.

Table 1: Statistical Summary of the Key Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
output	702	1.4	1.2	0	11.0
inv	702	100.1	91.4	0.4	693.7
zan	702	85.8	90.8	0.6	714.8
innov	702	1.0	1.3	0.0	8.3

In all the rest models a range of factors or the whole model was insignificant. The results as per the selected model are given in Table 2.

Table 2: The Results of Regression Analysis for the Cobb-Douglas Production Function

Independent Variable	Factor
Log_inv	0.30 (0.2)***
Log_innov	0.15 (0.3)***
Log_zan	0.42 (0.3)***
R ²	0.58

The Goldfeld-Quandt test shows that there is no heteroscedasticity in the model. The test results for multicollinearity are given in Table 3.

Table 3: The Correlation Coefficient of Indicators.

	output	zan	inv	innov
output	1.0000			
zan	0.0980	1.0000		
inv	0.5183	0.1659	1.0000	
innov	0.4477	-0.0168	0.0884	1.0000

It is apparent from the provided data that multicollinearity is insignificant.

Looking at the results given in Table 2 it may be concluded that the obtained model covers not all factors influencing the output of the manufacturing industry of the Russia's regions, as the value of the determination coefficient is not too high – 0.58. However the coefficients obtained at regressors are significant at the one-percent level. The indicator at the regressor Log_innov is equal to 0.15, which indicates a significant role of the share of personnel involved in research and development in the results of the region manufacturing industry output. This indicator can be doubtful as it does not explain industrial advance and it is a consequence of the other characteristics of the region along with this advance. These doubts proceed from the premise that the indicator innov does not reflect the situation in manufacturing industry but it is general for the entire economy. Not considering this limitation it is fair to assume that increase in number of scientific organizations within the region territory will facilitate the development of its production sector. To continue the study the influence of the indicators of the region innovative activity more closely related to manufacturing companies shall be studied. At this stage of work such indicators were not found in the published statistics of Russia.

DISCUSSION

Plotting the Cobb-Douglas production functions is a relevant research tool of the Russian industry. The analysis of the literature on the research subject allows concluding that the data on separate companies and CDM model shall be used for studying interrelation of the manufacturing indicators and innovative activity of companies.

Due to restriction of access to the statistical data on the Russian industry application of these approaches is difficult. Therefore in this work the data by the regions are used and analyzed by the panel data models. The indicators expressed in Rubles shall be reduced to uniform prices.

To plot production function the best thing is to use separate (not integrated) indicators associated with the region size in some way or another. The integrated indicators do not allow obtaining statistically significant econometric estimates. To study the role of innovative development of the region in growth of its manufacturing output in the future it is reasonable to use the indicators of innovative activity specifically in this sphere of economy as the results obtained in this research are limited by interpretation for the reason that not innovations in industry, but region innovative activity at large, which in some cases cannot be related to the manufacturing output, is estimated here.

As per derived equations it turned out that for manufacturing activity of Russia such factors as labor, capital investments and number of personnel involved in research and development by the entire region are significant. This allows assuming that increase in a share of personnel involved in innovation sphere can facilitate improvement of industry performance quality within the country. However it is necessary to consider this conclusion with caution taking into account the above described restrictions in research of statistical data.

Further it is expected to continue the work on this area and at the following stages to try to find access to the data by separate companies of Russia.

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REFERENCES

1. Biddle J. The Introduction of the Cobb-Douglas Regression // *Journal of Economic Perspectives*. – 2012. - № 2 (Spring 2012).
2. Brown, F., Guzmán, A. Innovation and Productivity across Mexican Manufacturing Firms. *Journal of Technology Management & Innovation*. 2014, Vol. 9 Issue 4, p36-52.
3. Cobb, C. and Douglas P. A theory of production // *American Economic Review*. – 1928. - №18 (1).
4. Crépon, B., Duguet, E., and Mairesse, J., 1998, 'Research, Innovation and Productivity: An Econometric Analysis at the Firm Level', *Economics of Innovation and New Technology*, 7, 2, pp. 115-158.
5. Crespi, G. and Zuniga, P., 2012, 'Innovation and Productivity: Evidence from Six Latin American Countries', *World Development*, 40, 2, pp. 273-290.
6. Griffith, R., Huergo, E., Mairesse, J., and Peters, B., 2006, 'Innovation and Productivity Across Four European Countries', *Oxford Review of Economic Policy*, 2, 4, pp. 483-498.
7. Hajkova D. Hornik J. Cobb-Douglas production function: the case of a converging economy // *Czech Journal of Economics and Finance*. – 2007. - №. 9-10.
8. Hayes R. Application of the Cobb-Douglas Production Model to Libraries. 2005.
9. Morel L. A Sectoral analysis of labour's share of income in Canada. - Bank of Canada, 2006.
10. Nimoh F., Tham-Agyekum E., Nyarko P. Resource Use Efficiency in Rice Production: the Case of Kpong Irrigation Project in the Dangme West District of Ghana// *International Journal of Agriculture and Forestry*. - 2012. - № 2(1).
11. Oliner, D. and Sichil D., 2000. The Resurgence of Growth in the Late 1990s: Is Information Technology the Story? *The Journal of Economic Perspectives*, 14: 3-22.
12. Rastvortseva S., Assessment of the regional economic potential for the industrial clusters development. SGEM2014 conference on political sciences, law, finance, economics and tourism, Conference Proceedings, ISBN 978-619-7105-27-8/ ISSN 2367-5659, September 1-9. 2014, Vol. 3. P. 75-82.
13. Solow R. A Contribution to the Theory of Economic Growth // *Quarterly Journal of Economics*. - 1956. - №70.
14. Srithanpong, T. Innovation, R&D and Productivity: Evidence from Thai Manufacturing *International Journal of Economic Sciences & Applied Research*. Dec2014, Vol. 7 Issue 3, p103-132. 30p.