Adv Syst Sci Appl 2019; **04**; 45-57
Published online at http://ijassa.ipu.ru/index.php/ijassa/article/view/748

Evaluating Comparative Total Factor Productivity in the Russian Industry

Svetlana V. Orekhova[1*], Evgeniy V. Kislitsyn[2]

[1)] *Business Economics Dept., Ural State University of Economics, Yekaterinburg, Russia*

E-mail: bentarask@list.ru

[2)] *Information Technology and Statistics Dept., Ural State University of Economics, Yekaterinburg, Russia*

E-mail: kev@usue.ru

Received May 14, 2019; Revised November 28, 2019; Published December 31, 2019

Abstract: Searching for domestic reserves of economic growth has lately become one of the central problems in Russia. The paper examines the role of small industrial enterprises in stimulating economic growth. In contrast to the stereotype that small business serves as a driving force for the economic development and encourages innovation, the authors hypothesizes that in Russia this statement is false. The conceptual and methodological framework of the study rests upon neo-classical models of economic growth. The authors investigate the existing approaches to the analysis of factors influencing economic growth of the state and choose the tools of total factor productivity analysis. Total factor productivity is calculated using the translog production function, which allows determining the effect of the technological level on value added of the object under study. The choice of the type's function is due to the low elasticity between the factors of production, as well as the imperfect competition in the industrial markets under review. The information base of the research includes the data of small, medium-sized and large enterprises of 10 industrial macro-sectors of the Russian economy for 2013–2017. We use SPARK-Interfax database to assess production functions. The results of the analysis prove that small enterprises operating in the Russian industry demonstrate much lower values of average and weighted average total factor productivity than medium-sized and large enterprises. The general trend for such businesses is a decline in total factor productivity. Only single leading companies produce a gain in value added in small entrepreneurship. Thus, the economic situation in Russia rejects the hypothesis about a higher entrepreneurial potential of small businesses, business models and technological innovations emerging on its basis. Our further studies are assessing institutional traps and general context in the development of small business.

Keywords: total factor productivity, small enterprises, Russian industry, economic development.

1. INTRODUCTION

Harrod [20] and Domar [12], who described a one-factor model for determining growth rates, provided fundamentals of the theory of economic growth. Since the paradigmatic works by Solow [30; 31] and Swan [33], who proposed endogenous growth model, contemporary economic thought has been developing towards substantiating sources and refining growth models. The basic exogenous growth factors include scientific and technological progress and labor [27]. Arrow [4] и Uzawa [35] examine the role of knowledge and human capital in economic growth. The mechanisms of innovation growth are clarified in the Schumpeterian growth model [1; 18]

For Russian economic development strategy, the key issue is the effective economic structure (and also institutional environment). This aspect "solves the question of the number of types of activities, markets, the size of the general welfare and its distribution (income

[*] Corresponding author: bentarask@list.ru

inequality)" [32, p.26]. Equally important is the question of the contribution of different types of enterprises to economic growth.

The history and practices of small business have been among the most controversial issues in economic development in different countries. Science postulate that small business is an important object of economic growth [15; 17; 38; 39]. Job creation, production of innovations and technologies, and finally, profits are the outcome of small businesses activity due to their entrepreneurial potential, flexibility and maneuverability of managerial decisions, optimization and red tape reduction of business processes. Small businesses make a huge contribution to national prosperity.

On the other hand, empirical studies demonstrate that the size of enterprises can influence their growth rate differently (the positive correlation is highlighted in [6; 13; 37] and the negative one is discussed in [3; 10; 15]). The role of small business in an economy has frequently been undermined and even misinterpreted. In the past, small businesses were believed to impede economic growth by attracting scarce resources from their larger counterparts [5].

These inconsistencies between theory and practice encourage more detailed studies to be conducted on the role of small enterprises in promoting economic development of the Russian industry, and later – on the factors determining this role.

The purpose of the research is to analyze total factor productivity (TFP) of small enterprises of Russia's industrial sector in comparison with medium-sized and large companies. Such a research agenda is set for the first time and implies a consistent solution of a number of tasks.

The first task is to perform a critical analysis of the existing theoretical approaches and Russian empirical studies on measuring economic growth rates taking into account various factors.

The second task is to substantiate the choice of a method for calculating TFP and its empirical testing. It is reasonable to carry out a comparative analysis of data on small and other enterprises in the context of individual industries, which allows taking into account the organizational and production specifics of enterprises. The authors state that industrial segments, serving as the basis for the RF Government's economic growth policy, are of the greatest academic interest. At the same time, regional, technologic and economic disproportions of industrial markets are very serios [2].

The third task of the research is to interpret the obtained results of calculating the total factor productivity from the standpoint of small industrial enterprises' development in the Russian economy.

2. THEORETICAL APPROACHES AND EMPIRICAL STUDIES ON FACTOR PRODUCTIVITY

Neoclassical Economics Theory showed that the level of technological development was the primary indicator of the degree to which society masters the forces of nature. The combination of productive forces and the type of production relationships constitutes a unique mode of production. Neo-institutional economics largely associates the rate of technological growth with institutional environment for business development. [11; 28]

Total factor productivity is the most integrated indicator of technological progress and growing economic efficiency. It is calculated as the ratio of output to the volume of production factors used [23]. The logic of TFP calculation is as follows: an enterprise uses a certain set of factors of production (labour and capital) to produce the final product. Then the growth of the factors of production used or a change in the combination of their use (technology) causes an increase in output of the final product.

The dynamics of factor productivity may indicate the degree to which the growth of an enterprise, industry or economic sector is sustainable. Measuring TFP means discovering the correlation between output (production quantity) and factors of production, such as resource costs and the level of technology. Such a quantitative dependence was dubbed “production function”. There are numerous types of production functions and the most famous of them are the models of Cobb–Douglas, Leontiev, CES, etc. The choice of these models is determined by a combination of factors that embrace data access, market specificity, a dynamic or static aspect of research.

Methods for assessing TFP are widely used throughout the world, including as a way of comparing the economic state of countries [14; 16; 21; 25] and the reasons for their differentiation [19; 26; 29].

In Russia, the evaluation of the effectiveness of economic subjects are conducted on a regular basis using certain types of production functions. This fact is due to a number of reasons. First, the production function is an adequate tool for measuring the influence of various factors on economic growth. Second, this tool allows analyzing intra-industry, cross-industry and inter-regional differentiation. Third, in the context of uncertainty and volatility of incomes and expenditures of enterprises, such an assessment allows performing a real-time monitoring of the reasons behind the rise or decline in economic development and determining its trend.

For example, Bessonov [7] show that industries with relatively safe output dynamics and lacking sufficient incentives to increase productivity demonstrated the worst TFP dynamics in Russia in 1989–2002. The Tornqvist index was also calculated by Orekhova [24] to analyze the growth sustainability in metallurgy. Tornqvist index formula allows characterizing the change in the efficiency of resource use by factors. The Tornqvist index deals with the change in the volume of two resources – labor (data on the average number of employees) and capital (data on the nominal value of fixed assets). The results of the analysis illustrate the overall technological and technical underdevelopment of the industry.

Timmer and Voskoboynikov [34] prove that the growing role of capital expenditures in the growth of value added in Russia resulted in the use of an extensive model of economic growth, which is typical of rental economies. Bessonova [9] demonstrates that there is a significant gap in the total factor productivity of enterprises within the industry. Such a gap may arise due to both organizational-efficiency-based reasons and resource or institutional constraints of the Russian market.

All evaluations of the Russian industry’s effectiveness illustrate spasmodic and chaotic shifts, but also display a declining total factor productivity. At the same time, such assessments are more integrated and not explaining the behavior of individual firms, their contribution to the total efficiency of the industry or the entire economy. On the basis of the recent research [10; 39], we assume that small entrepreneurship, a priori not so rich in resources and power in comparison with large business, will be less efficient.

3. TFP RESEARCH METHOD

When it comes to the method for calculating total factor productivity, our study rests upon a series of works by Bessonova [8; 9]. Total factor productivity is value added of the final product minus changes in labour and capital costs. Empirically TFP growth can be calculated as an unexplained residue of the final product’s growth. This residue encompasses the effects from technological or organizational innovations that determine technological progress in the industry and influence the shift of the production function [9, p. 99].

However, such a calculation method is possible to be applied only on the basis of correct data on the share of costs of production factors by industry. The previous approach to the evaluation of TFP within the framework of the Solow Growth Model [30] makes an assumption about competitive factors of production. But nowadays we knows that industrial markets are characterized by a hybrid form of organization, which obliges a researcher to first evaluate their production functions, and only after that calculate indicators of production factors and growth of TFP.

This fact rationalizes the choice of the translog production function for calculating TFP. The function allows one not to make prerequisites about absolute elasticity of substitution between factors of production and perfect competition in the markets of these factors [22]:

$$\ln Y_{it} = \alpha_0 + \alpha_L \ln L_{it} + \alpha_K \ln K_{it} + \alpha_t t + \alpha_{LL}(\ln L)^2 + \alpha_{KK}(\ln K)^2 + \alpha_{tt}t^2 + \alpha_{LK} \ln L_{it} \ln K_{it} + \alpha_{Lt} \ln L_{it} t + \alpha_{Kt} \ln K_{it} t + \varepsilon_{it} \quad (3.1)$$

where Y_{it} denotes value added at the enterprise *i* for the period *t*; K_{it} is fixed assets of the enterprise *i* for the period *t*; L_{it} is wage at the enterprise *i* for the period *t*; t denotes a time factor ranging from 1 to N (where N is the number of observed periods).
Based on the proposed production function, the growth of TFP is calculated by formula:

$$A_{i,t} = \ln\left(\frac{Y_{i,t}}{Y_{i,t-1}}\right) - \bar{\sigma}_L \ln\left(\frac{L_{i,t}}{L_{i,t-1}}\right) - \bar{\sigma}_K \ln\left(\frac{K_{i,t}}{K_{i,t-1}}\right) \quad (3.2)$$

where A denotes a total factor productivity; $\bar{\sigma}_L$ is average elasticity of value added of labour; $\bar{\sigma}_K$ is average elasticity of value added of capital.

Average elasticity is calculated as average value of the elasticities of the added value of labour and capital for the periods (t – 1) and t, which in turn are measured as a partial derivative of the corresponding factor:

$$\bar{\sigma}_{L,t} = \frac{\partial \ln Y_{it}}{\partial \ln L_{it}} = \hat{\alpha}_L + 2\hat{\alpha}_{LL} \ln L_{it} + \hat{\alpha}_{LK} \ln K_{it} + \hat{\alpha}_{Lt} t, \quad (3.3)$$

$$\bar{\sigma}_{K,t} = \frac{\partial \ln Y_{it}}{\partial \ln K_{it}} = \hat{\alpha}_K + 2\hat{\alpha}_{KK} \ln K_{it} + \hat{\alpha}_{LK} \ln L_{it} + \hat{\alpha}_{Kt} t, \quad (3.4)$$

To estimate value added and factors of labour and capital, it is required to use the following indicators: fixed assets, the revenue volume, total costs and wage. Value added was calculated using formula:

$$\mathrm{Y_{it}} = \mathrm{Vol_{it}}\text{-}(\mathrm{TC_{it}}\text{-}\mathrm{Wage_{it}}) \quad (3.5)$$

where Vol_{it} is the revenue volume of the enterprise *i* for the period *t*; TC_{it} is total costs of the enterprise *i* for the period *t*; $Wage_{it}$ is labour cost borne by the enterprise *i* for the period *t.*

The amount of capital was estimated as the average annual value of fixed assets, and labour – as the enterprise’s costs incurred in labour remuneration.

4. EVALUATING TFP OF INDUSTRIAL ENTERPRISES IN RUSSIA: SMALL VS. LARGE ENTERPRISES

The study aims at primarily identifying the contribution of small enterprises to the economic growth of the Russian industry. In accordance with the Federal law no. 209-FZ “On the development of small and medium-sized entrepreneurship in the Russian Federation” of July 24, 2007, a small enterprise is that which employs no more than 100 people and its revenue is below 800 million rubles.

The empirical testing of the proposed method for calculating TFP was divided into several stages (Fig. 4.1).

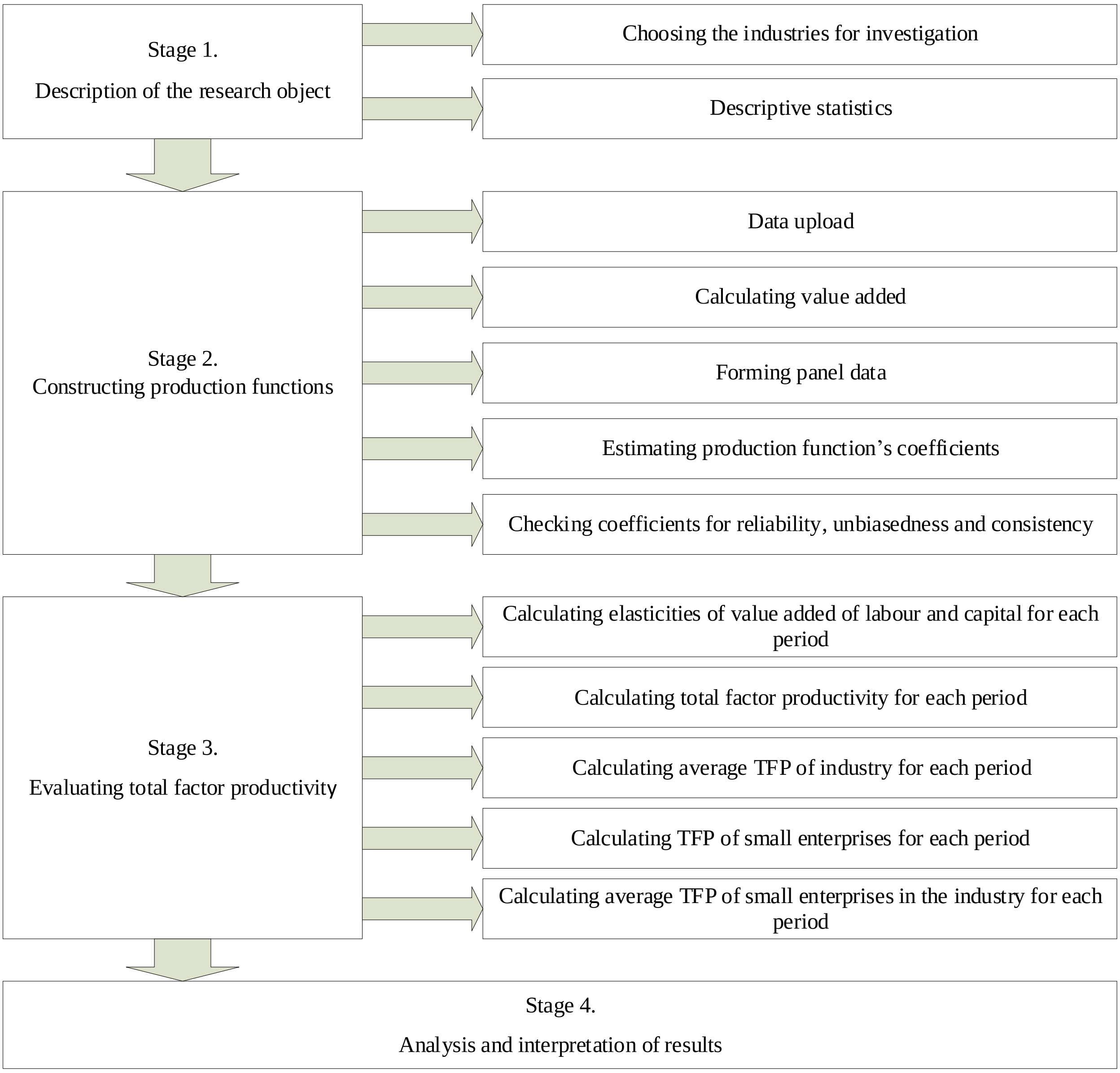


Fig. 1. Algorithm for comparative evaluation of TFP of small and large businesses

Hence, the authors use SPARK-Interfax database to assess production functions; the period under study was from 2013 to 2017. The research object was industrial sectors of the Russian Federation. The entire set of industries is combined into 10 industrial sectors (tab. 4.1). This grouping is based on similar industry characteristics within groups.

The group "small enterprises" embraces all the companies meeting the aforementioned criteria (micro-enterprises included). Since TFP is an average of the indicators' values for two years, TFP was calculated for 4 periods.

Table 4.1. Number of enterprises in the study sample

Industry	2014		2015		2016		2017	
	Enterprises							
	Large and medium-sized	Small and micro	Large and medium-sized	Small and micro	Large and medium-sized	Small and micro	Large and medium-sized	Small and micro

Mining	501	432	537	518	502	608	510	666
Food industry	886	995	933	1223	1012	1489	1064	1817
Light industry	77	317	83	373	87	428	94	497
Woodworking, pulp and paper	240	464	242	574	260	664	264	817
Petrochemical industry	525	570	569	742	591	913	697	1033
Mineral industry	266	618	288	736	308	840	306	998
Metallurgy	365	475	395	633	384	798	391	993
Mechanical engineering	693	912	725	1099	749	1304	790	1622
Industrial service	79	321	102	435	100	537	99	662
Energy industry	631	2167	360	1927	850	1696	1296	1502
Total	**4263**	**7271**	**4234**	**8260**	**4843**	**9277**	**5511**	**10607**

At Stage 2, production functions were constructed for each enterprise belonging to the 10 industrial sectors. The data were retrieved from SPARK-Interfax database and included the following details: company size, fixed assets, revenue, total costs and wages for 2013–2017. Calculation of value added for each enterprise was carried out according to formula (3.5).

To construct the production function, the authors used panel data, which contain statistical information about the same number of enterprises for several consecutive periods of time (2013–2017). The use of panel data allowed us to enhance the size of the sample under review, which provided greater efficiency in estimating the regression model's parameters. To construct the production function, we applied the method of least squares. The obtained results were checked for reliability, unbiasedness and consistency through calculating the expected value, the Durbin–Watson statistic, constructing the correlation matrix and holding the White test.

We obtained a total of 10 production functions for various groups of industries. It is worth noting that for different groups of industries the indicators' coefficients vary significantly. Nevertheless, we can notice that in all production functions, coefficients with cross-section indicators have a negative value, and in more than half of them – the coefficient with a logarithm of the labor factor. All the rest coefficients have a positive value. For example, for mechanical engineering enterprises, the production function is as follows:

$$\ln(Y) = 9.65 - 0{,}10\ln(L) + 0{,}17\ln(K) + 0.04(\ln(L))^2 + 0.01(\ln(K))^2 + 0.01t^2 - 0.03\ln(L)\ln(K) - 0.01\ln(L)\,t + 0.01\ln(K)\,t \quad (4.1)$$

Once the production functions are constructed, we proceed to Stage 3: calculating total factor productivity. Based on the coefficients of production functions, we calculate the elasticity of value added of labour and capital for each period through identifying partial derivatives (formulas (3.2) – (3.3)). The result is presented in table 4.2.

Table 4.2. Elasticity of value added of labour and capital for industrial sectors for 2013–2017

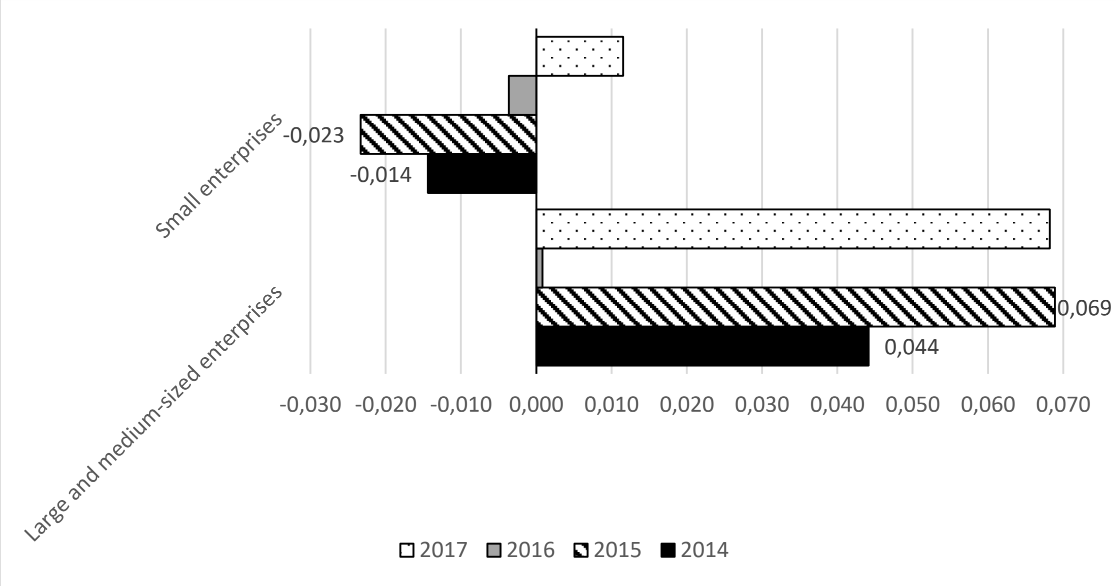
Year / Industry		Mining	Food industry	Light industry	Woodworking, pulp and paper	Petrochemical industry	Mineral industry	Metallurgy	Mechanical engineering	Industrial service	Energy industry
2013	$\bar{\sigma}_L$	0,605	0,916	0,848	0,846	0,912	0,889	0,854	0,884	0,844	1,04
	$\bar{\sigma}_K$	0,222	0,134	0,132	0,143	0,1	0,112	0,099	0,036	0,03	0,008
2014	$\bar{\sigma}_L$	0,51	0,902	0,84	0,83	0,899	0,863	0,829	0,869	0,819	1,015
	$\bar{\sigma}_K$	0,31	0,135	0,128	0,151	0,099	0,111	0,1	0,041	0,041	0,019
2015	$\bar{\sigma}_L$	0,519	0,906	0,84	0,838	0,892	0,854	0,809	0,855	0,808	1,003
	$\bar{\sigma}_K$	0,297	0,131	0,12	0,147	0,097	0,104	0,101	0,045	0,047	0,025
2016	$\bar{\sigma}_L$	0,522	0,904	0,852	0,839	0,89	0,836	0,798	0,845	0,794	0,998
	$\bar{\sigma}_K$	0,294	0,13	0,108	0,148	0,095	0,099	0,101	0,048	0,053	0,028
2017	$\bar{\sigma}_L$	0,523	0,886	0,794	0,798	0,852	0,787	0,742	0,792	0,702	0,993
	$\bar{\sigma}_K$	0,29	0,118	0,13	0,153	0,092	0,078	0,103	0,063	0,093	0,027

Over the entire period, the greatest elasticity of value added of capital was typical of the industrial sectors, such as energy, food and petrochemical industries. For the mining industry, on the contrary, this indicator varies between 51–60%. Most industries exhibit the same level of the elasticity of labor value added – 9–15%. However, in 2013, this indicator for the mechanical engineering and industrial service was quite low; but by 2017, there was a positive trend, i.e. an increase of 6% and 9% respectively. The lowest level of labor elasticity was observed in the energy sector.

Taking into account the elasticity values, we used formula (3.1) to calculate a rise in TFP for the industrial sector as a whole, as well as for large/medium-sized enterprises and small enterprises taken separately.

TFP growth rate was analyzed using the indicator of simple average TFP growth rate. The method developed by Bessonova [9] also implies the calculation of another indicator, i.e. weighted average TFP growth rate by the volume of value added. However, within the scope of the present research, the calculation of this indicator does not make sense. One of the study’s tasks is to compare TFP growth rates for large and small industrial enterprises. At the same time, the volume of value added of large and medium-sized enterprises will be greater, which means a strong preponderance of such businesses and, as a result, a distortion of the TFP indicator. For this reason, we deliberately exclude the calculation of this indicator from our research.

Dynamics of average TFP growth rates for 2013–2017 illustrates that their values for large and medium-sized enterprises significantly exceeds similar values for small enterprises (Fig. 4.2).

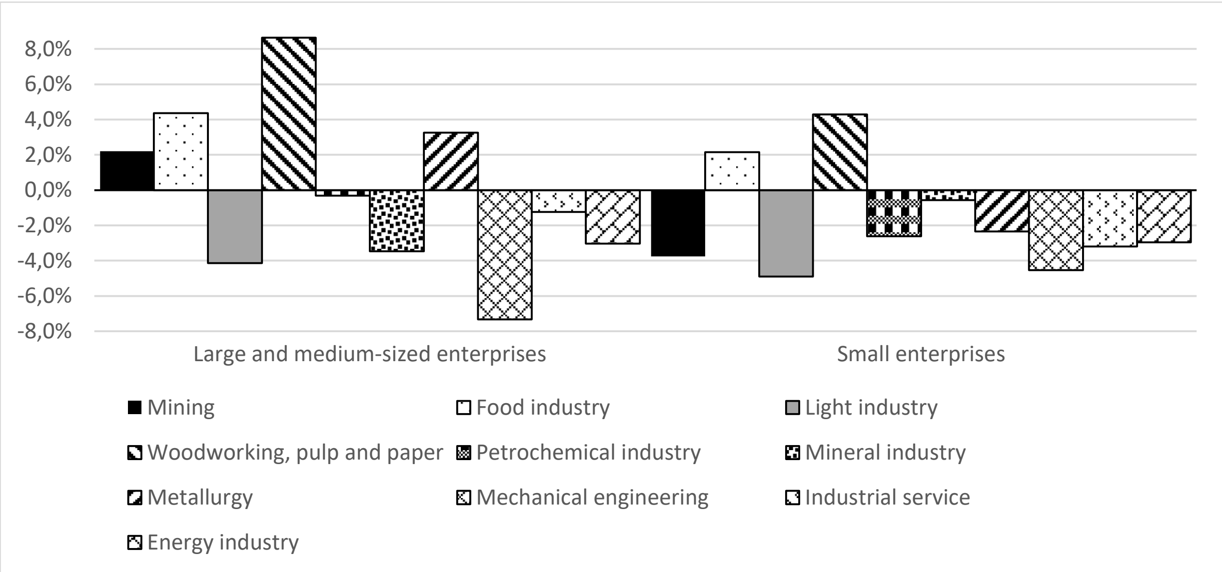


Note: based on the authors' calculations.

Fig. 4.2. Average TFP growth rates by size of enterprises

In comparison with 2013, large and medium-sized enterprises' TFP growth rates in 2014 was 4.4%, whereas small companies demonstrated a 1.4% drop in growth. In the post-crisis period (after 2014), small industrial enterprises experienced an increase of up to 1.2%, but it was still significantly lower than that of other enterprises.

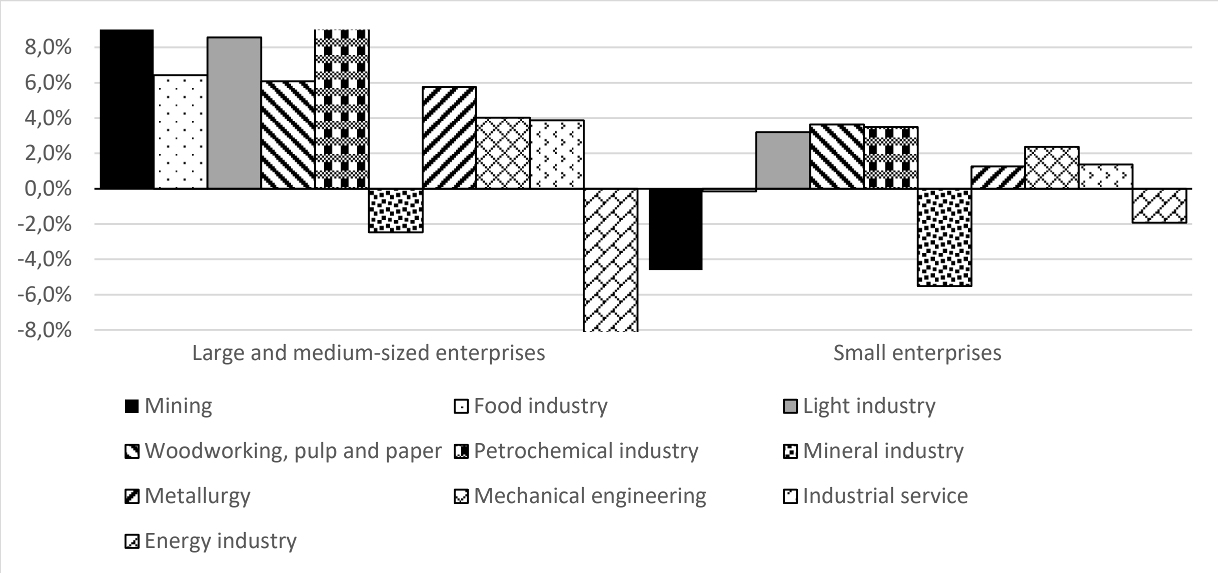
Let us look at the dynamics of changes in TFP for the 10 industries. Figure 4.3 shows the values of TFP average growth in 2014.



Note: based on the authors' calculations.

Fig. 4.3. TFP average growth in 2014

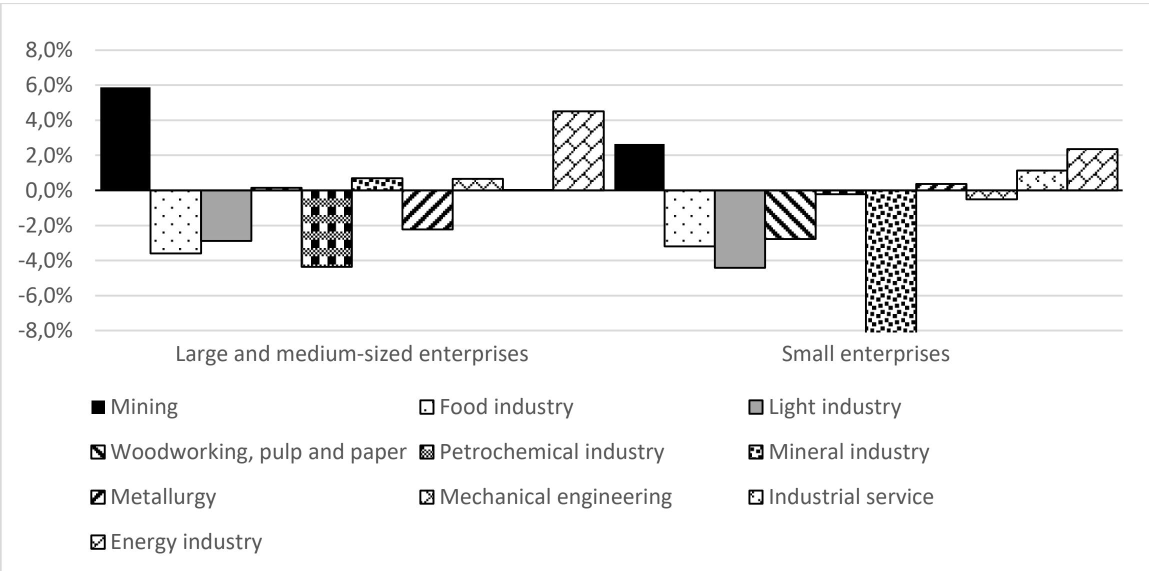
The period under consideration is characterized by both the decline in the global economic situation and the worsening national institutional environment in Russia. This results in the fact that more than 50% of the industries experience a negative TFP growth rate, regardless of the size of enterprises. However, for the mining, food, woodworking, pulp and paper industries and metallurgy, TFP growth of large and medium-sized industrial enterprises significantly exceeds that of small businesses. It is also noteworthy that TFP decline rate of large enterprises operating in industrial service and petrochemical industry are much lower than that of small ones. In general, in 2014, small enterprises of two industries only had a positive dynamic of TFP growth.



Note: based on the authors' calculations.

Fig. 4.4. TFP average growth in 2015

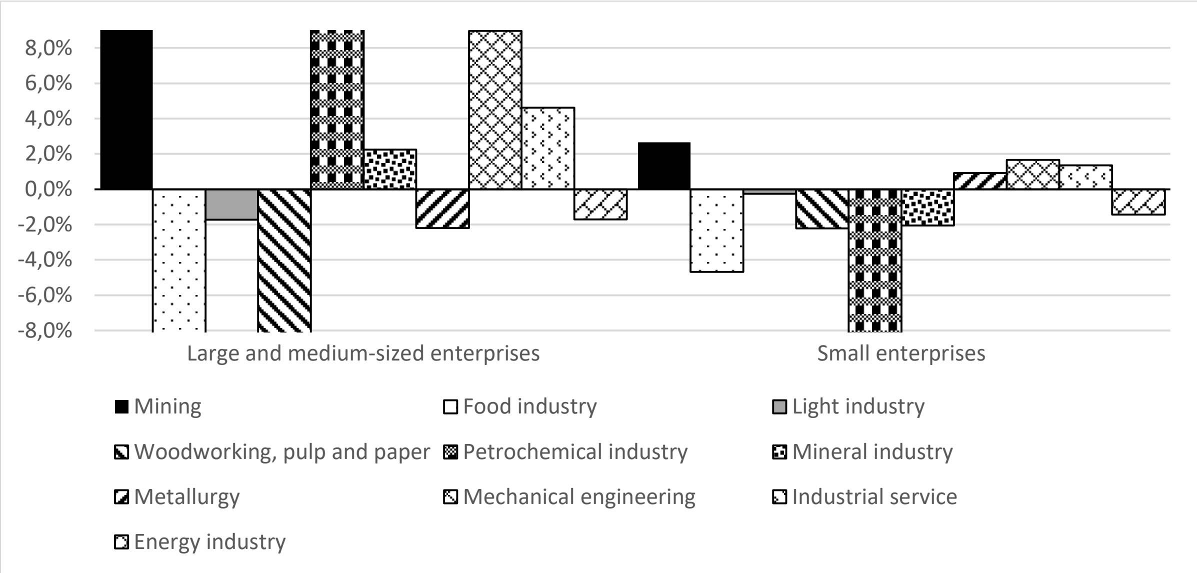
Figure 4.4 demonstrates that, compared with the previous period, TFP growth rate in 2015 changed dramatically. For all the industries, with the exception of energy production, TFP growth rate of large and medium-sized enterprises significantly exceeded that of small enterprises. The biggest gap – from 6 to 14% – was characteristic of mining, food, light and petrochemical industries. In 2014–2015, the strongest TFP growth was achieved by small enterprises engaged in woodworking, pulp and paper industry – 3.6%, petrochemical industry – 3.5% and light industry – 3.2%. The same indicators for large and medium-sized businesses equaled 6.1%, 9.1% and 8.6% respectively.



Note: based on the authors' calculations.

Fig. 4.5. TFP average growth in 2016

In 2016, the absolute growth of average factor productivity of large and medium-sized enterprises was typical of only 6 out of 10 industries under study (Fig. 4.5): mining, woodworking, pulp and paper, mineral industry, mechanical engineering, industrial service and energy industry. Moreover, in all sectors, excluding industrial service, the growth exceeded that of small and micro-enterprises. Other industries experienced a decline in TFP, but only in light industry this decline was greater for small enterprises. The greatest TFP growth among small enterprises was observed in mining (2.6%), energy industry (2.4%) and industrial service (1.1%).



Note: based on the authors’ calculations.

Fig. 4.6. TFP average growth in 2017

In 2017, only 50% industries encountered an increase in TFP of large and medium-sized enterprises, which dominated over the same indicator for small businesses. Only small enterprises operating in metallurgy demonstrated a positive dynamic of TFP growth (0.9%), in contrast to total factor productivity of large businesses (–2.2%).

The research results indicate that small industrial enterprises are characterized by *low TFP growth rates. The general trend for such businesses is a decline in total factor productivity*. In 2017, the decrease in TFP for small enterprises in the petrochemical industry was 11.3%; food industry – 4.7%; woodworking, pulp and paper industry – 2.2. However, in 2016–2017, small enterprises of some industrial sectors exhibited a slight gain in TFP (mining – 2.7%; engineering – 1.7%; industrial services – 1.3%; metallurgy – 0.9%).

Most industrial sectors experienced an increase in total factor productivity of large and medium-sized enterprises. A sharp fall in TFP growth rates in 2017 was recorded only for large enterprises engaged in food and woodworking industries.

Having compared the data, we found that small enterprises’ TFP growth exceeded that of the rest of the enterprises only in 2016–2017 in metallurgy (small businesses’ TFP growth was 0.4 and 0.9% respectively). In all other cases, even if TFP growth rate of small businesses in absolute value is greater than that of large and medium-sized enterprises, the value of this indicator is negative, that is, only if there is no TFP growth per se.

5. CONCLUSION

The period under consideration is not long enough to project further TFP dynamics. However, it is possible to draw a number of important conclusions.

Firstly, the hypothesis that large enterprises develop faster than small ones was confirmed. There are several possible explanations for this phenomenon and each of them has to be checked and verified in further studies.

On the one hand, there are objective reasons behind poor efficiency of small businesses. One of them is a vague possibility to get increasing returns due to economies of scale. Since we only examine the industrial sector, this factor can be of considerable importance. In addition, industry in Russia is vertically or horizontally integrated structures, where auxiliary production is outsourced. Thus, small industrial enterprises in Russia are poorly performing divisions of large businesses.

On the other hand, there are subjective factors associated with small industrial business in Russia lagging behind in terms of technology and innovation. It means that the technological factor of TFP growth is more attributed to the development of technical equipment, rather than technological innovation. Large businesses possess more advanced and productive types of fixed assets, which supports the conclusions about the rental, extensive growth of the Russian industry.

Secondly, the industrial sectors under review are characterized by a significant companies differentiation, which leads to a slowdown in the economic growth of the entire industrial production, and consequently, the processes of re-innovation of the Russian economy.

The results obtained are confirmed by other studies on total factor productivity of the Russian industry. However, the previous research made conclusions “about a large group of inefficient enterprises that continue functioning in the market ...” [8, p. 31], but failed to reveal what kind of enterprises they were and what features they had. We suppose that the current paper lays the foundation for the study of such enterprises’ behavior.

According to our study, small enterprises are among those companies forming the inefficient segment of the Russian economy. Yudin and Cherkasov [39] state that “in Russia, small business [...] does not fulfill the functions of diversifying production and introducing effective innovation processes. Small enterprises develop primarily in the sphere of rapid capital turnover and are not involved in research and development”. The reason behind this is that flexibility and entrepreneurship skills are insignificant resources unable to provide competitive advantages in the Russian institutional space.

Assessing institutional traps in the development of small business is the primary avenue for the authors’ further studies.

REFERENCES

1. Aghion, P. & Howitt, P. (1992) A Model of Growth Through Creative Destruction, *Econometrica*, 60(2), 323–351.

2. Akberdina V.V. (2018) Digitalization of industrial markets: Regional characteristics, *Upravlenets – The Manager*, 6, 78–87.

3. Almus M. & Nerlinger E. A. (1999) Growth of new technology-based firms: Which factors matter? *Small Business Economics*, 13(2), 141–154.

4. Arrow K. (1962) The Economic Implications of Learning by Doing, *Review of Economic Studies*, 29(3), 155–173.

5. Audretsch D. B., Carree M. A., van Stel A. J. & Thurik A. R. (2000) *Impeded Industrial Restructuring: The Growth Penality, Research Paper, and Center for Advanced Small Business Economics*. Rotterdam: Erasmus University.

6. Beccetti L. & Trovato G. (2002) The determinants of firm growth for small and medium sized firms. The role of the availability of external finance, *Small Business Economics*, 19(4), 291–306.

7. Bessonov V.A. (2004) *O dinamike sovokupnoj faktornoj proizvoditel'nosti v rossijskoj perekhodnoj ehkonomike* [On the dynamics of total factor productivity in the Russian transition economy]. Moscow: Institut ehkonomiki perekhodnogo perioda. [in Russian].

8. Bessonova E.V. (2007) Ocenka ehffektivnosti proizvodstva rossijskih promyshlennyh predpriyatij [Assessment of production efficiency of Russian industrial enterprises], *Prikladnaya ehkonometrika*, 2(6), 13-35, [in Russian].

9. Bessonova E. V. (2018) Analiz dinamiki sovokupnoj proizvoditel'nosti faktorov na rossijskih predpriyatiyah (2009-2015 gg.) [Analysis of the dynamics of total factor productivity at Russian enterprises], *Voprosy ehkonomiki*, 7, 96-118, [in Russian].

10. Davidsson P., Kirchoff B., Hatemi A. & Gustavsson H. (2002) Empirical analysis of business growth factors using Swedish data, *Journal of Small Business Management*, 40(4), 332–349.

11. Djankov S., Glaeser E., La Porta R. & Lopez-de-Silanes F., Shleifer A. (2003) The New Comparative Economics, *Journal of Comparative Economics*, 31, 595–619.

12. Domar E. (1946) Capital Expansion, Rate of Growth and Employment, *Econometrica*, 14(2), 137–147.

13. Dunne P. & Hughes A. (1994) Age, size, growth and survival: U. K. companies in the 1980s, *Journal of Industrial Economics*, 42(2), 115–140.

14. Easterly W. & Levine R. (2001) It`s Not Factor Accumulation Stylized Facts and Growth Models, *The World Bank Economic Review*, 15(2), 177-219.

15. Fishman A., Don-Yehiya H. & Schreiber A. (2018) Too big to succeed or too big to fail? *Small Business Economics*, 4, 811-822.

16. Fuentes R. & Morales M. (2011) The Measurement of Total Factor Productivity: A Latent Variable Approach, *Macroeconomic Dynamics*, 15(02), 145-159.

17. Gebremeskel H. Gebremariam G. H., Gebremedhin T. G. & Jackson R.W. (2004) The role of small business in economic growth and poverty alleviation in West Virginia: an empirical analysis, *Research Paper*, 2004-10.

18. Grossman G. M. & Helpman E. (1991) *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press.

19. Hall R. & Jones C. (1999) Why Do Some Countries Produce So Much More Output Per Worker Than Others, *The Quarterly Journal of Economics*, 114 (1), 83-116.

20. Harrod R.F. (1939) An Essay in Dynamic Theory, *Economic Journal*, 49 (March), 14–33.

21. Hulten C. (2001) Total Factor Productivity: A Short Biography. In Charles R. Hulten, Edwin R. Dean and Michael J. Harper (eds.), *New Developments in Productivity Analysis* (pp. 1-54). University of Chicago Press.

22. Klacek J., Vošvrda M. & Schlosser Š. (2007) KLE Translog production function and total factor productivity, *Statistika*, 4, 261–274.

23. OECD Productivity Manual (2001): A Guide to the Measurement of Industry-level and Aggregate Productivity Growth. Washington, D. C.: OECD.

24. Orekhova S. (2017) Economic growth quality of metallurgical industry in Russia, *Journal of Applied Economic Science*, 5, 1377–1388.

25. Prescott E. (1997) *Needed: A Theory of Total factor productivity*. Research Stuff Report, Federal Reserve Bank of Minneapolis. Minneapolis.

26. Rodric D., Subramanian A. & Trebbi F. (2004) Institutions Rule: The Primacy of Institutions Over Geography and Integrations in Economic Development, *Journal of Economic Gro*wth, 9, 131-165.

27. Romer P.M. (1986) Increasing Returns and Long-Run Growth, *The Journal of Political Economy*, 94 (October), 1002–1037.

28. Rothstein B. (2012) Good Governance. In David Levi-Faur (Ed.). The Oxford Handbook of Governance, 143–154. Oxford, Oxford University Press.

29. Smith A. (2008) *An Inquiry into the Nature and Causes of the Wealth of Nations*. Oxford: Oxford University Press.

30. Solow R. M. (1956) A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economic*, 70, 65–94.

31. Solow R. M. (1957) Technical Change and the Aggregate Production Function, *The Review of Economics and Statistics*, 39(3), 312–320.

32. Sukharev O. S. (2018) Strukturnyy analiz tekhnologicheskikh izmeneniy i strategiya ekonomicheskogo rosta [Structural analysis of technological changes and the strategy of economic growth], I*zvestiya Uralskogo gosudarstvennogo ekonomicheskogo universiteta – Journal of the Ural State University of Economics*, 3, 26‒41, [in Russian].

33. Swan T. W. (1956) Economic Growth and Capital Accumulation, *Economic Record*, 32 (November), 334–361.

34. Timmer M. & Voskoboynikov I. (2016) In mining fuelling long-run growth in Russia? Industry productivity growth trends in 1995-2012. In: D. Jorgenson, K. Fucao, M. Timmer (eds.) The world economy: growth or stagnation? (pp. 281-318). Cambridge: Cambridge University Press.

35. Uzawa H. (1965) Optimum Technical Change in An Aggregative Model of Economic Growth, *International Economic Review*, 6(1), 18–31.

36. Wagner J. (1992) Firm size, firm growth, and persistence of chance: Testing Gibrat’s law with establishment data from Lower Saxony, 1972–1989, *Small Business Economics*, 4(2), 125–131.

37. Wagner, M. & Zidorn, W. (2017) Effects of extent and diversity of alliancing on innovation: the moderating role of firm newness, *Small Bus Econ*, 4, 919–936.

38. Yang J.S. (2017) The governance environment and innovative SMEs, *Small Business Economics*, 48, 525-541.

39. Yudin N.S. & Cherkasov V.A. (2016) Analiz specifiki razvitiya malogo predprinimatel'stva v Rossii v ramkah razrabotki metodologii ocenki social'no-ehkonomicheskoj ehffektivnosti malyh predpriyatij [Analysis of the specifics of small business development in Russia in the framework of the methodology for assessing the socio-economic efficiency of small enterprises], *Social'no-ehkonomicheskie yavleniya i process,* 3, 117-123, [in Russian].

