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LABOUR PRODUCTIVITY IN RESOURCE-DEPENDENT AND NON-RESOURCE RUSSIAN REGIONS

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Abstract

The paper provides a comparative analysis of labour productivity in resource-dependent and non-resource regions of Russia. We focus on resource-dependent regions because they significantly contribute to Russia's gross domestic product and labour productivity is a driver for economic development. We also identify and estimate the determinants of labour productivity in resource-dependent and non-resource regions. We find that the aggregate indicator of labour productivity in resource-dependent regions is much higher than that in their non-resource counterparts. The regions with the dominant oil and gas sector have the highest labour productivity in Russia. The analysis revealed that, for non-resource regions, the key factors affecting labour productivity are fixed capital, real wages and innovations. In resource regions, the main driver of labour productivity growth is investment in fixed assets during deposit development while innovation does not play a significant role. However, the experience of Khanty-Mansi Autonomous Okrug shows that the use of new technologies and innovations can increase oil and gas production, extend the period of deposit development and improve labour productivity.

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1. Introduction

Many Russian regions have a heavily resource dependent economy. These regions contribute to more than two-thirds of Russia's gross domestic product. However, there is sufficient evidence in literature that resource-dependent economies tend to have slower growth rates than non-resource economies (Damettie & Serhir, 2018; Haggerty et al., 2014; Sachs & Warner, 2001). In this respect, detection and comparison of the main sources of economic growth for resource-dependent regions and their non-resource counterparts has become a crucial issue for the Russian economy.

A driver of economic growth is high labour productivity which provides a greater amount of gross regional product at a lower cost and determines long-term living standards. Accordingly, the study of factors affecting labour productivity is an important strand in economic literature. However, researchers have examined the differences in labour productivity between countries (Dua & Carg, 2019; Sakamoto, 2018; Tang & Wang, 2004) and sectoral contribution to labour productivity (Diewert, 2015; Roncolato & David, 2014) or have investigated the factors driving labour productivity in industries and companies (Kazaz et al., 2016; Muhammad et al., 2015; Tang, 2017; Ugur et al., 2016). Little attention has been given to the cross-regional differences in labour productivity within a country and their causes. This paper contributes to the literature by conducting a comparative analysis of labour productivity in resource-dependent and non-resource regions of Russia and explores the causes of differences in labour productivity and affecting factors.

2. Problem Statement

According to the Organization for Economic Co-operation and Development, in 2018, Russia lags significantly behind developed countries in terms of labour productivity.¹ Therefore, the problem of increasing labour productivity is essential for the Russian economy. However, there are only a few works studying the factors of labour productivity and providing a comparative analysis of labour productivity across Russian regions in economic literature. Gagarina et al. (2019) analyse labour productivity indices (growth rates) in Russian regions calculated by Rosstat for 2015-2017 and find that labour productivity has been steadily increasing in most regions. Lavrovsky (2017) compares the growth rate of labour productivity in Russian regions with the global average growth rate. He discovers that in most of Russian regions, labour productivity is growing much faster than in many countries. Therefore, the researcher makes an optimistic conclusion that labour productivity in Russia will exceed the global average level by 1.5 times by 2025 (Lavrovsky, 2017). However, using indices (growth rates) of labour productivity we can analyse the trend of labour productivity, but not its absolute indicator in Russian regions.

Mikheyeva (2015) and Mirolyubova (2016) calculate and compare the absolute indicator of labour productivity across Russian regions for 1997-2012 and 2005-2013. Both authors note a high differentiation of labour productivity across Russian regions and find that many regions have low labour productivity. Mirolyubova (2016) also finds a positive correlation between labour productivity and information resources

¹ <https://data.oecd.org/lprdy/gdp-per-hour-worked.htm>

for some Russian regions. Spasskaya and Kireev (2015) examine the impact of investment in fixed assets on labour productivity for Russian regions. However, their results are mixed.

Some papers focus on labour productivity in certain regions. For example, Ilyin et al. (2010) evaluate labour productivity for the regions of Northwestern Federal District for the period 2000-2007. They also identify the main factors determining labour productivity in the region, using the data of Volgograd Oblast. These factors include the residual value of fixed assets, real wages, electrical equipment and fixed capital-output ratio (Ilyin et al., 2010).

Thus, the absolute indicator of labour productivity across Russia has not been estimated since 2013. We do not have a comprehensive picture of the factors determining the regional level of labour productivity. We are unaware of any papers providing a comparative analysis of labour productivity in resource-dependent and non-resource Russian regions despite the importance of natural resources for the Russian economy and a wide discussion of the resource economy challenges in literature.

3. Research Questions

Two research questions follow from our study. How does labour productivity differ across resource-dependent and non-resource regions of Russia? What factors drive labour productivity in resource-dependent and non-resource regions?

4. Purpose of the Study

The purpose of our study is to conduct a comparative analysis of labour productivity across resource-dependent and non-resource regions and identify the determinants of labour productivity in Russian regions.

5. Research Methods

We divided all Russian regions into two groups: resource-dependent and non-resource regions. For this, we used the localization coefficient, which characterizes the concentration degree of extractive industry in a region. We calculated the average localization coefficient as the ratio of the extractive industry share in the region's added value to the share of this industry for the country in general for the period 2011-2018. We classified a region as resource-dependent if it has the localization coefficient value greater than one (Popodko et al., 2019). Thus, the resource-dependent region group includes 24 regions.

Next, we estimated labour productivity in all resource-dependent and non-resource regions and calculated its aggregated indicator for each of the two groups. We measured regional labour productivity as the amount of gross regional product (GRP) produced per hour worked. The aggregated indicator of labour productivity was calculated as the ratio of GRP to actual hours worked in all regions included in a group. We converted GRP in roubles to USD at purchasing power parity using the OECD data².

Then, based on the evidence of various studies, we identified the main drivers of labour productivity in a region. The factor affecting labour productivity can be divided into three groups:

² <https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm>

- fixed capital (Ilyin et al., 2010; Sakamoto, 2018; Spasskaya & Kireev, 2015);
- human capital (Chatzimichael & Tzouvelekas, 2014; Sakamoto, 2018);
- innovation (Chatzimichael & Tzouvelekas, 2014; Kılıçaslan et al., 2017; Mirolyubova, 2016; Ugur et al., 2016; Ulku & Pamukcu, 2015)

To measure how fixed capital contributes to labour productivity we used such indicators as fixed assets per worker and the value of investment in fixed capital per worker.

The indicators characterizing human capital in a region are the percentage of high-skilled worker with a college or university degree and incidence rate. We also included real wages in this group since wages create incentives to work and opportunities for professional development.

Given the availability of statistical data, we measured innovation factors by such indicators as the share of enterprises with technological, organizational and marketing innovations, the number of advanced technologies used, the cost of developing technological innovations per worker, and the number of computers per 100 employees.

We estimated the relationships between labour productivity and the contributing factors using correlation analysis. We calculated the coefficients of pairwise correlation between labour productivity and all the indicators above. The statistical analysis was performed using Microsoft Excel.

We obtained the data for our study from the website of the Federal State Statistics Service of the Russian Federation (Rosstat).³ We excluded the Republic of Crimea and the city of Sevastopol from our sample because some of the necessary data were missing. We also excluded the city of Moscow since it is the location of the headquarters of major Russian mining companies. Moscow receives great benefits from natural resource extraction without having any deposits. Thus, our dataset includes the data for 84 Russian regions from 2011 to 2018.

6. Findings

Comparing aggregated labour productivity across regions demonstrates that resource-dependent regions are significantly ahead of non-resource regions. This gap has widened in recent years (Figure 01).

We can see a growing trend for both resource-dependent and non-resource regions. However, in the past three years, the growth rate of labour productivity in resource-dependent regions has been higher than that in non-resource regions.

We also found that labour productivity greatly varies across resource-dependent regions. In 2018, the ratio of the maximum and minimum values of labour productivity was 14.8 for resource-dependent regions. For non-recourse regions, this ratio amounted to 4.1.

Nenets Autonomous Okrug and Yamalo-Nenets Autonomous Okrug have the highest labour productivity in Russia. We can also see high labour productivity comparable to the level of the world's leading countries in such resource-dependent regions as Khanty-Mansi Autonomous Okrug and Sakhalin Oblast. Chukotka Autonomous Okrug, Republic of Sakha (Yakutia), Magadan Oblast, Tyumen Oblast, Krasnoyarsk Krai, and Murmansk Oblast have higher labour productivity than that in any non-resource

³ <https://www.gks.ru/>

region. In other resource-dependent regions, the level of labour productivity is not much different from the level of non-resource regions (Table 01).

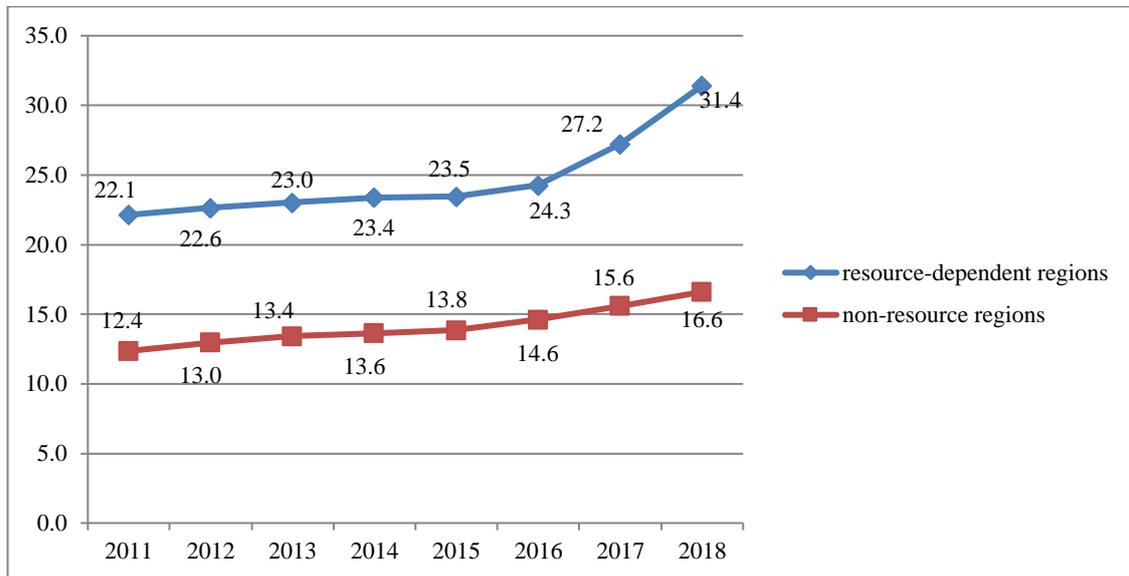


Figure 01. Aggregated labour productivity in resource-dependent and non-resource regions (in USD, PPP)

For all non-resource regions, we can see low labour productivity in comparison with the OECD countries. Such regions as Chechen Republic, Kabardino-Balkarian Republic and the Republic of Ingushetia have the lowest labour productivity, which does not exceed 8 USD produced per hour (Table 01).

Thus, in terms of labour productivity, the leading regions are those where oil and gas sector dominates the regional economy, generating more than 60% of the regional GRP. In the regions with the lowest labour productivity, the main sectors of the economy are agriculture and construction. Therefore, we can assume that one of the main causes of differences in labour productivity across resource-dependent and non-resource regions is different sectoral structure of economy.

Table 01. Labour productivity in Russian regions in 2018 (in USD, PPP)

Resource-dependent regions		Non-resource regions			
Nenets Autonomous Okrug	213.7	Kamchatka Krai	28.9	Tver Oblast	13.7
Yamalo-Nenets Autonomous Okrug	170.4	Leningrad Oblast	27.2	Zabaykalsky Krai	13.7
Khanty-Mansi Autonomous Okrug	87.1	St. Petersburg	27.1	Omsk Oblast	13.4
Sakhalin Oblast	85.5	Moscow Oblast	24.9	Republic of Adygea	13.2
Chukotka Autonomous Okrug	51.5	Sverdlovsk Oblast	20.9	Republic of Kalmykia	13.1
Republic of Sakha (Yakutia)	42.5	Arkhangelsk Oblast (without autonomous okrug)	20.8	Saratov Oblast	13.0
Magadan Oblast	39.5	Lipetsk Oblast	20.6	Vladimir Oblast	12.5

Tyumen Oblast (without autonomous okrugs)	31.2	Vologda Oblast	20.5	Tyva Republic	12.3
Krasnoyarsk Krai	31.2	Khabarovsk Krai	20.1	Penza Oblast	12.3
Murmansk Oblast	29.4	Kaliningrad Oblast	18.5	Bryansk Oblast	12.2
Republic of Tatarstan	24.0	Kaluga Oblast	18.1	Kostroma Oblast	11.8
Irkutsk Oblast	23.1	Republic of Bashkortostan	17.9	Ulyanovsk Oblast	11.6
Astrakhan Oblast	22.8	Tula Oblast	17.5	Republic of Dagestan	11.5
Tomsk Oblast	22.1	Krasnodar Krai	17.2	Republic of Mordovia	11.4
Belgorod Oblast	21.6	Novosibirsk Oblast	17.2	Kurgan Oblast	11.2
Republic of Karelia	21.6	Yaroslavl Oblast	17.1	Stavropol Krai	11.2
Perm Krai	21.3	Novgorod Oblast	16.8	Mari El Republic	11.1
Orenburg Oblast	20.9	Chelyabinsk Oblast	16.7	Altai Republic	10.3
Kemerovo Oblast (Kuzbass)	19.8	Voronezh Oblast	16.5	Kirov Oblast	10.2
Republic of Khakassia	19.1	Nizhny Novgorod Oblast	16.1	Republic of Buryatia	10.2
Samara Oblast	17.6	Primorsky Krai	15.8	Pskov Oblast	10.1
Udmurt Republic	16.3	Kursk Oblast	15.3	Chuvash Republic	9.9
Amur Oblast	15.2	Jewish Autonomous Oblast	15.3	Altai Krai	9.2
Komi Republic	14.4	Tambov Oblast	14.2	Republic of North Ossetia - Alania	9.0
		Ryazan Oblast	14.2	Ivanovo Oblast	8.4
		Rostov Oblast	14.2	Karachay-Cherkess Republic	8.1
		Volgograd Oblast	14.0	Chechen Republic	7.7
		Smolensk Oblast	14.0	Kabardino-Balkarian Republic	7.7
		Oryol Oblast	13.9	Republic of Ingushetia	7.0

Our finding revealed that the accumulation of fixed capital has a significant impact on labour productivity in Russian regions. The pairwise correlation coefficients between fixed assets per worker and labour productivity are 0.94 and 0.76 for resource-dependent and non-resource regions respectively (Table 02). Investments in fixed capital also make a considerable contribution to labour productivity growth. Meanwhile, for resource-dependent regions, the influence of this factor is greater than for non-resource regions.

There is a strong positive relationship between labour productivity and real wages. The pairwise correlation coefficients are 0.73 and 0.84 for resource-dependent and non-resource regions respectively. The difference in the coefficient values for resource-dependent and non-resource regions is probably associated with a higher percentage of labour force in non- extractive sectors. However, the quality of human capital is not a driving force of labour productivity for Russian regions. We also detected that

incidence does not greatly affect labour productivity. However, this result may be due to the fact that based on the available data, we used the general incidence indicator for all population and not the incidence indicator for the people of working age.

A comparative analysis of factors affecting labour productivity in resource-dependent and non-resource regions revealed noticeable differences. In non-resource regions, the main determinants of labour productivity are fixed capital, innovation, and also real wages. Technological innovations play a significant role in labour productivity growth.

In resource-dependent regions, labour productivity increase is mainly driven by accumulation and investments in fixed capital while innovation is not a statistically significant affecting factor (Table 02).

Table 02. Pairwise correlation coefficients between labour productivity and affecting factors

Factors	Correlation coefficients	
	For resource-dependent regions	For non-resource regions
Fixed assets per worker	0.94*	0.76*
Value of investment in fixed capital per worker	0.95*	0.50*
Percentage of high-skilled worker	0.10	0.28*
Incidence rate	-0.17	-0.19
Real average wages	0.73*	0.84*
Share of enterprises implementing technological, organizational and marketing innovations	0.06	0.31*
Number of advanced technologies	0.05	0.78*
Cost of developing technological innovations per worker	0.06	0.79*
Number of computers per 100 employees	0.09	0.68*

*Note: Coefficients are statistically significant at 1% significance level

Thus, in resource-dependent regions in general, high labour productivity and its increase are mainly due to the accumulation of fixed capital and investments in the development of new deposits. However, this situation will inevitably lead to a severe reduction in labour productivity in the future as deposits are exhausted and the quality of oil and gas resources deteriorates. The phenomenon of declining labour productivity in mining sector is observed in some countries such as Chile, Australia, and Canada (Fernandez, 2018). Investment in innovation and the use of new technologies can make a difference. For example, in Khanty-Mansi Autonomous Okrug, which experienced a decline in labour productivity due to deposit depletion, the use of new technologies and innovation have allowed the development of the Bazhenov Formation reserves and have resulted in increased oil and gas production and improved productivity (Figure 02).

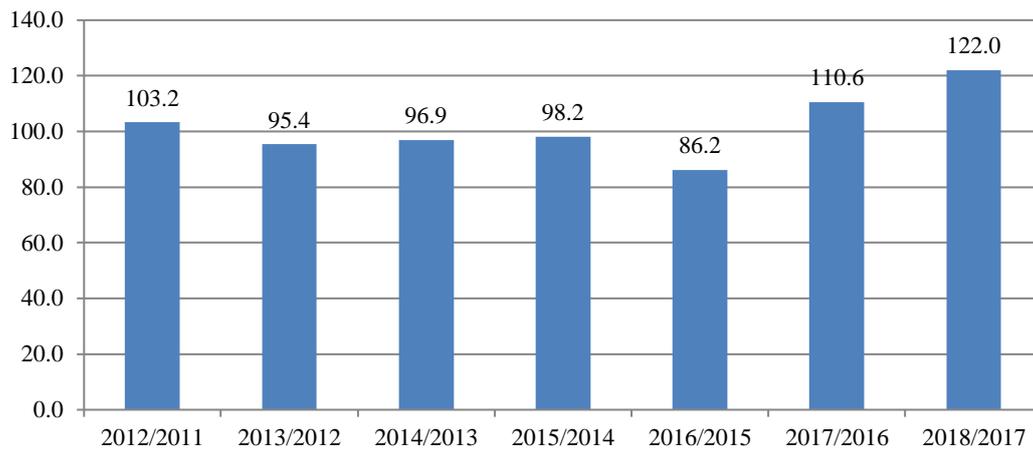


Figure 02. Growth rate of labour productivity in Khanty-Mansi Autonomous Okrug (in percentage)

7. Conclusion

Labour productivity is an important determinant of economic growth and the wealth of the national economy. The comparative analysis provided in this paper demonstrates significant differences in labour productivity between resource-dependent and non-resource Russian regions. The aggregate indicator of labour productivity in resource-dependent regions is significantly higher than that in non-resource regions and this gap has been widening.

Our results suggest that oil and gas sector is the main source of high labour productivity in resource-dependent regions. In terms of labour productivity, the lagging regions are those with dominant agriculture and construction. Thus, we can assume that the sectoral structure largely explains the differences in labour productivity across Russian regions.

The key determinants of labour productivity in Russian regions are accumulation and investments in fixed capital, and real wages. Innovation plays a great role in driving labour productivity in non-resource regions, while in resource-dependent regions innovation is not a statistically significant affecting factor. An explanation for this fact is low innovation activity in many resource-dependent regions. We also found that high-skilled human capital does not significantly contribute to labour productivity.

Thus, high labour productivity in Russian resource-dependent regions is mainly due to the accumulation of fixed capital and investment in the development of new deposits. However, productivity in mining sector decreases with deposit depletion. The use of new technologies and innovations allows extending the period of deposit development and avoiding a decrease in productivity. Therefore, we suggest that innovations should become a key driver for increasing labour productivity in Russian regions.

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