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# Rental analysis of innovation component in resource productivity

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**Abstract.** At present, the conditions and challenges of the new stage of development of the Russian economy dictate the importance of solving the strategic tasks of import substitution, require long-term competitive development based on the modernization of all industries, formation of growth institutions. At the same time, the allocation of state funds to support innovations is not tied to the increased dynamics in the movement of rental income, which leads to large gaps in the rental incomes of participants in economic relations. Therefore, it becomes necessary to use rental approaches to regulation. However, the calculation of the volume and structure of rental income is always accompanied by certain difficulties and lack of clarity of estimates, which reduces the demand for rental approaches. In order to solve these problems, a concept has been developed in the article for building production models of enterprises according to appropriate industry based on a correlation-regression analysis, which will allow determining with sufficient accuracy the size and sources of rental formation for each enterprise. The developed methods can be widely used to assess the resource potential of enterprises, analyze the effectiveness of the use of received state subsidies and identify enterprises that are prioritized to support their innovation activities. The proposed concept will allow achieving greater impact of government measures in the economy.

## 1. Introduction

Currently, the Russian economy is demonstrating growth in production in many industries. However, the potential of this growth is largely exhausted due to the limitations of the technological and technical basis. Lack of innovative activity, low efficiency of budget funds in support of innovative development of enterprises hinders the processes of import substitution [1, 2]. At the same time, the macroeconomic instability, the investment and financial problems necessitate a new model of support for innovative activity based on more rational methods of state support, designed for a long-term period, but, at the same time, with constant tactical adjustment due to changing conditions. In addition, the allocation of public funds to support the innovative development of enterprises does not take into account the existing structure of rental income both at the micro level and at the meso-level, which leads to large gaps in the rental incomes of participants in economic relations. At the methodological and practical levels, the complexity and ambiguity of rent categories, their transcendence, dynamism greatly complicates the quantitative allocation of the amount of rental income among other incomes of owners. The solution of



these problems is necessary, since the effectiveness of the innovation process of the country's economy directly depends on the formation and distribution of rental income both within the state and beyond its borders. This is substantiated in detail in works [3–5] on the example of the agrarian sphere. Accurate information on the volume and structure of actual rental incomes is important for state regulation [6] in order to prevent both the possible transformation of innovative rent into monopoly forms of rental income, and for the efficient allocation of public funds to support innovative enterprises.

## 2. Theory

According to the neoclassical and Paretian approach, rent is the difference between the actual payment of the production factor and the minimum amount for which this factor can still be used [7]. In this context, the rent can be interpreted as the super profit of any nature, which is expressed as an increment over the normal profit of an enterprise in a given industry [8, 9]. Actually, this increment in some cases may be just that hidden component, which is formed due to more efficient use of resources at the particular enterprise. This efficiency is due to the use of innovative technologies, new ways of organizing production, the release of a rare innovative product, and, accordingly, reflects a higher productivity of such economic resources as labor, land, capital, entrepreneurial ability [10–11]. Unfortunately, it is possible to obtain super profits only at the expense of the innovation component only under conditions of an ideal model of economy characterized by the lack of differentiation of the quality of natural resources, equal external conditions for enterprises, lack of opportunity and the desire of economic agents to receive negative forms of rental income. In this regard, it is important to determine the actual structure of rental income received by each enterprise in the industry for the purpose of government incentives and regulation of innovation.

## 3. Methodology

Currently, most of the developed quantitative indicators of land rent were based on expert assessments of scientists. These estimates were given as a result of generalization of the existing agrarian relations for that period. For example, W. Petty estimated the size of land rent as the one-fourth part of the total product [12]. Similar ranges can be found in other scientists' works – the founders of the rental theory [13, 14]. Therefore, the opinions expressed by the first theorists and developers of the rental theory [15] about the complexity and impossibility of calculating rent as such are still supported. V. I. Danilov-Danilyan [16] notes that the calculation of real rent cannot be carried out with sufficient accuracy, and, therefore, rental theory has no practical value. At the same time, other researchers argue the need for and the possibility of calculating rental categories, noting that calculating the total amount of rental income is not very difficult [17-19]. However, for the complete calculation of the structure of rental income, at present, the necessary statistical data is still lacking, as noted by R. R. Yarullin [20]. This is due to the fact that government regulation and the associated economic forecasting and monitoring in the Russian Federation are not set up to work in a “rental format”. It must be said that the entire experience of Russian scientists is saturated with attempts to search for quantitative indicators of rental income. For example, the development of a quantitative assessment of rental income in accordance with K. Marx's rental theory was carried out. B.I. Paskhaver [21] proposed to calculate the differential rent based on the calculation of the individual and social price of production. E. S. Karnaukhova proposed a method for calculating only differential land rent without dividing into rent I and II, stating the impossibility of separating artificial and economic fertility [22]. A significant breakthrough in the principles of land rent calculations was made by G. A. Efimova, who showed, using the correlation models, the role of absolute rent, differential rent I and II in shaping the socio-economic essence of agrarian relations [23]. At the same time, the available statistical material in the State Statistics Committee of the Russian Federation is currently sufficient to illustrate the basic laws that prove the possibility and necessity of using it in government regulation of the economy. For example, V. A. Mescherov notes [18] that at present the Russian science still has no systematic approaches to rent calculation, however, the available theoretical approaches and the statistical basis allow not only to carry out illustrative calculations, but also to perform operational analysis of changes in rental estimates.

That being said, qualitative estimates have not been calculated at all. In addition, in science, normative analysis, that makes it possible to take into account changes not from period to period, but from a given standard, is used insufficiently. I. N. Buzdalov [24] notes that regulatory approaches should have priority in the formation of methods for calculating rental indicators. B. M. Rabinovich [25] writes about the same approaches using the macro rent method, in which the price of land, rent, land tax act as normative parameters. In this regard, it is worth noting the possibility and necessity of applying in this case the correlation and regression analysis. In particular, D. B. Epshtein [26] introduces methods into scientific use for assessing a relationship between the economic performance of enterprises and the calculated data obtained using regression analysis. A. P. Zinchenko [27] proposes production efficiency criteria based on the same principles. Therefore, it is possible to calculate the innovation rent based on the assessment of difference between the actual return from the resources used by the enterprise and the calculated return based on the regression model. In addition, in this model it is also necessary to take into account the non-innovative factors of the received super-profit.

#### 4. Results and discussions

Let us consider how we can distinguish the innovative component in the productivity of resources used by economic agents as exemplified by the agro-industrial complex, and dairy cattle breeding in particular. Let us try to analyze the formation of differential rent II and differential rent I using the example of milk producing enterprises of Leningrad region. To do this, it is necessary to build a model using correlation-regression analysis for assessing the influence of various factors on the normal productivity of cows in agricultural farms. All factors were divided into three groups: economic, soil and infrastructure. As economic factors, we used the assessment of the contribution of fixed and circulating assets, as well as labor resources to the value of final products. The aggregate soil indicators: ball-bonitet (quality score), potassium content, and phosphorus content in the soil, were qualified as soil factors. The cadastral assessment of land and population density in the area, and distance from St. Petersburg were qualified as infrastructure factors. Since these conditions differ in different places, the structure of rental income will change accordingly.

16 factor signs were selected in the model based on an assessment of the depth of the connections between the effective and factor signs using the pair correlation. After taking into account the mutual influence of factors, the key ones were left with the maximum level of correlation, at the same time reflecting the most important regularities:  $x_1$  – the average annual number of cows, animals;  $x_2$  – the total cost of a dairy herd per cow, rubles;  $x_3$  – cumulative soil indicator, score;  $x_4$  – remoteness of the farm from St. Petersburg, km. Later, the multiple regression equation was constructed. The statistical results of the regression analysis confirm the reliability of the obtained model. The Shapiro-Wilk test for residual normality does not reject the hypothesis of normality with  $\alpha = 0.05$ . These calculations allowed us to obtain a linear equation, on the basis of which it is possible to determine the theoretical productivity of cows with a different set of initial factors.

$$y = -2494.4106 + 0.7580x_1 + 0.0899x_2 + 69.2320x_3 - 2.5038x_4 \quad (1)$$

The land rent is calculated in table 1 as an increase in average annual milk yield per cow per annum due to economic, soil or infrastructure factors. The values of differential rent I are obtained by comparing the normal productivity on the worst and the best lands both in fertility and location under the worst and the best economic conditions. Differential rent II reflects an increase in normal productivity due to an increase in the volume of economic factors, first of all, such as the cost of maintaining a dairy herd and the cost of fodder.

At the same time, if the increase in productivity is not due to fertility and the location of the enterprise, and not due to the use of economic factors corresponding to the intensity of the average level, then this indicates a higher productivity of resources at the particular enterprise. The resource productivity exceeding the average level expresses the contribution of the hidden innovation component expressed in the use of more efficient production technology or its more efficient organization.

**Table 1.** Modeling the normal productivity of cows in Leningrad region (example).

Variants	Economic factors							
	Minimum values				Maximum values			
	Infrastructure factors				Infrastructure factors			
	Minimum		Maximum		Minimum		Maximum	
	Soil factors		Soil factors		Soil factors		Soil factors	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Estimated average annual yield per cow, kg	1455.12	3726.62	2481.66	4753.17	7103.45	9374.95	8129.99	10401.49
Average annual number of cows	104.00	104.00	104.00	104.00	1451.00	1451.00	1451.00	1451.00
Cost of dairy herd per cow, rub	21048.00	21048.00	21048.00	21048.00	72516.00	72516.00	72516.00	72516.00
Cumulative soil indicator, score	44.85	77.66	44.85	77.66	44.85	77.66	44.85	77.66
Distance from St. Petersburg, km	450.00	450.00	40.00	40.00	450.00	450.00	40.00	40.00

Proceeding from our correlation-regression model table 2 shows a comparative analysis of the calculated and actual productivity of cows at the enterprises of Leningrad region, where the first four of the best farms are shown in terms of growth potential of production efficiency based on the innovation component. Differential rent I is obtained as a difference between the estimated productivity with the actual number of economic, soil and infrastructure factors and the estimated productivity with the minimum number of soil and infrastructure factors. Differential rent II here is calculated as the difference between the calculated productivity of cows with the actual number of economic, soil and infrastructure factors and the estimated productivity with a minimum number of economic factors. Innovation rent is obtained as a difference between the actual and estimated productivity of cows.

**Table 2.** Ranking of enterprises by priority of state support for innovative activities thereof (example).

Reference number of enterprise	Average annual yield, kg per 1 cow per annum (actual productivity)	Estimated productivity, kg per cow per annum	Estimated productivity with minimal infrastructure and soil factors, kg per cow per annum	Differential rent I, kg per 1 cow per annum	Estimated productivity at minimum economic factors, kg per cow per annum	Differential rent II, kg per 1 cow per annum	Innovation rent, kg per 1 cow per annum	Enterprise rank	Innovation potential coefficient
71	7749.00	5299.09	3251.57	2047.52	3502.64	1796.45	<b>2449.91</b>	<b>1</b>	<b>0.64</b>
23	5890.00	4416.83	2409.14	2007.69	3462.81	954.02	<b>1473.17</b>	<b>2</b>	<b>0.50</b>
89	6753.00	5232.06	3796.22	1435.83	2890.95	2341.10	<b>1520.94</b>	<b>3</b>	<b>0.40</b>
77	7672.00	5997.13	3927.01	2070.12	3525.24	2471.89	<b>1674.87</b>	<b>4</b>	<b>0.37</b>

The enterprises are ranked by the proposed innovation potential coefficient:

$$RP_{nf} = \frac{IR_{nfi}}{DRI_{nf} + DRII_{nfs}}, \quad (2)$$

where  $RP_{nf}$  is the coefficient of innovation potential for product  $n$  at the enterprise  $f$ ;  $DRI_{nf}$  is a differential rent I by the  $n$  product at the enterprise  $f$ , rub;  $IR_{nfi}$  is an innovative product rent  $n$  at the agricultural enterprise  $f$ , rub;  $DRII_{nfs}$  is a differential rent II by the  $n$  product at the agricultural enterprise  $f$ , rub.

This coefficient reflects the ratio of innovation rent to the sum of differential rent I and differential rent II, that is, it shows an increase in the performance indicators due to more efficient internal

organization of the resources used and, accordingly, shows the potential increment of efficiency in the future.

## 5. Conclusions

The analysis of the structure of the rental income received by this enterprise, including both annuities due to external factors and internal ones, should become a universal tool for assessing the innovative potential of an enterprise. The acquisition of an increased rental income minus rents from external factors by the enterprise testifies to a more efficient use of resources and a high potential for further development; it characterizes the volume of innovation rent at the enterprise at the expense of better technology and organization of production. The developed approach can be widely used to analyze the innovation activities of organizations, assess the effectiveness of the use of subsidies received by them, identify enterprises that are priority for supporting their innovation activities. The proposed concept will allow achieving greater impact of government measures in the economy.

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