

FORMATION OF DIFFERENTIAL LAND RENT AND DIFFERENTIAL RENTAL INCOME ON SOILS OF UKRAINE

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Abstract

The article examines the essence, peculiarities and factors of forming differential land rent and differential rental income, as well as the methodological aspects of their determination on individual soils by economic indicators of growing small-grain crops (without corn) in the current economic conditions of agricultural production in Ukraine. These economic categories are allotted important role of land relations regulation and the effectiveness of agricultural land use assessment. Differential land rent and differential income it is necessary to install market value of agricultural land. The possibility is shown of using the standards of small-grain crops, production costs for their cultivation and the stock-exchange price of grain sales for a specific year as input data in determining the earning yield of arable land. Identified are the parameters and patterns of the formation of differential land rent (I and II) and differential rental income (I and II) for soils of different genetic nature according to yield standards and production costs for growing grain and leguminous crops in case of natural and potential fertility. The paper presents methodological aspects of distinguishing forms of differential land rent (I and II) obtained during the cultivation of crops with applying fertilizers in accordance with current standards. Differential rent income II under the studied conditions is formed only on soils with higher fertility, and differential rent II — on the least fertile soils.

Key words: *differential rental income, differential land rent, natural soil fertility, potential soil fertility, standard yield*

INTRODUCTION

Differential land rent is a regulating factor of land relations and an economic form of realization of land ownership rights. Understanding of the nature, methods for determining and distinguishing various forms of differential land rent and differential rental income, which is considered in its context, is necessary to ensure the effective development of agricultural land use. This includes improving the methodology for monetary valuation of agricultural land, justifying measures to improve land relations and increase the environmental and economic efficiency of land use. The rental nature of land relations is also important to consider when developing ways of regulating the agricultural land market, fiscal and budgetary policies of the state at the present stage of market transformations.

The study of the causes and role of differential land rent in pricing for crop

production was started by representatives of the school of physiocrats. Thus, W. Petty [11] considered rent (excess profit) in monetary terms as the difference between the cost of product produced on a land plot and the total cost of its production, including the rate of payback, the rate of return on capital and the profit of the producer. A. Smith [13] and J. Anderson (1777) [1] revealed a significant dependence of the value of land rent on the price of agricultural produce. D. Ricardo [12] pointed out the important role of land fertility level in the rental value.

Differential land rent by fertility level is based on the income that the landowner receives when his land plot is used for growing agricultural crops. The size of income will be lower with extensive farming and higher in the case of systematic implementation of intensification measures [4]. The classical theory of rent relates its emergence to the land scarcity, the monopoly of ownership of it, as

well as to the specific features of agricultural products pricing [10].

According to modern ideas, the nature of differential land rent by fertility as a difference in income determines the existence of its forms I and II. With equal production costs, on the land plots of the best and medium natural fertility, a surplus product is created which, in the case of its realization, takes the form of differential land rent I. In the process of intensification of agriculture, with the growth of additional investments in the land plot, differential rent II arises which is based on differential rent I [2].

The relationship between these types of rents lies in the use of natural and artificial soil fertility. Differential rent II differs from differential rent I in that it arises not because of differences in the level of natural soil fertility of land plots, but because of the artificially achieved difference in fertility between the soils of individual land plots due to successive investments.

Differential rental income and differential land rent are regarded as identical concepts [16], or from the standpoint of their conditionality, in particular differential rental income - as the material basis of differential land rent [18], and differential land rent I and differential land rent II - as its constituents [14]. Thus, differential land rent (rental income) by fertility is considered to be as additional net income which is associated with the use of medium and best quality soils for cultivation of crops.

In Ukraine, while working on the economic (1988) and regulatory monetary valuation (1995) of agricultural lands, differential rental income was determined by the economic indicators of agricultural enterprises for growing grain and leguminous crops [3]. In modern conditions, to obtain initial values for calculating differential rental income on agricultural lands, it is proposed to use data on the standard crop yields and technological costs for their cultivation on individual soils [8].

Thus, according to the results of economic activities for growing crops, it is possible to determine the actual values of differential land rent and differential rental income, and by the

standards of crop yield and costs of crop cultivation - their standard values. Natural, organizational, economic and other factors are responsible for the differences between their actual values and the standard ones.

The purpose of the article is to establish the formation patterns for differential rental income and differential land rent for natural and potential soil fertility of different genesis.

The subject of the study is the processes of origination of differential land rent and differential rental income on arable land according to current standards for growing grain crops.

MATERIALS AND METHODS

To study the processes of formation of differential land rent and differential rental income, soils of various genesis and fertility levels were selected: Retisols - sandy, clay-sandy, sandy loam and light loamy; Phaeozems - sandy loam, light loamy, medium loamy, heavy loam, and light clayey; Chernozems - light loamy, medium loamy, heavy loam, and light clayey [17].

As the initial data for calculating the differential rental income and differential land rents, we used the standard (reference) yield of grain crops which is formed on a particular soil due to its natural fertility and the yield formed with the application of mineral fertilizers, that is, due to potential soil fertility. These yield standards for different types of soils were obtained by research institutions of Ukraine based on the results of field experiments conducted in different natural and climatic zones [7]. Production costs were determined according to standard flow process chart for growing grain crops [15].

The differential rental income most comprehensively quantitatively reflects the difference in economic effect from the use of land of varying quality, taking into account both the quality of the land and the level of agricultural intensity. It was determined by the difference between the cost of agricultural produce and the total cost of its production and standard profit:

$$D=Y \cdot P - C - C \cdot Kr \dots\dots\dots(1)$$

where:

D - differential rental income, EUR·ha⁻¹;

Y – crop yield, t·ha⁻¹;

P - the price of product sales, EUR·t⁻¹;

C - production costs for cultivation of crops, EUR·ha⁻¹;

Kr – profitability rate ratio (0.35).

To convert the differential rental income measure into physical terms, as well as to determine gross output, the average grain selling price for the corresponding period is used - 120 EUR·t⁻¹.

The value of differential rental income, determined by the actual indexes of crop yield and production costs for their cultivation reflects the efficiency of the economic activity of the producer. The calculation of this indicator according to the standards of productivity and production costs for growing crops allows determining the value of the land plot potential with natural and potential fertility. Involvement of soils to economic use leads to the introduction of artificial fertility. In this case, the differential rental income includes both form I and form II.

The calculation of differential rent I (for natural fertility) and differential rent I + II (for potential fertility) on soils of different genesis was carried out according to the method of consumer value on the basis of normative initial data. It involves determining the amount of crop yield on the worse quality soil, which is considered a normal yield. On any other soil, differential rents I and I + II were calculated by the difference between its standard and normal yield.

RESULTS AND DISCUSSIONS

The current production cost standards in the case of natural fertility differ significantly between soils of different genetic nature and are quite close in the case of potential fertility. It was found that the application of fertilizers on different soils in accordance with current standards increases the yield of grain crops by 16-99% compared to the natural fertility level (Table 1). Its greatest increase was observed on Retisols - by 52 - 99%, depending on the

textural composition. On more fertile soils Phaeozems, this increase is 21-41%, while on Chernozems the yield increase was the lowest - 16-24%. This difference is due to unequal fertilizer application rates which depend on the value of standard additional costs on different soils. In particular, the standard costs for potential soil fertility (i.e. fertilizer application) exceed the norms for natural fertility on Retisols by 84-136%, and on Chernozems - by only 28-54%.

Table 1. Standards of economic indicators for growing grain crops on soils of different genesis, EUR·ha⁻¹

Textural soil composition	Natural fertility		Potential fertility	
	gross output	production costs	gross output	production costs
Retisols				
Sandy	199.4	135.6	397.7	320.6
clayey sand	224.6	148.8	402.5	321.3
sandy loam	249.9	162.2	408.5	321.9
light loam	275.1	175.9	419.3	322.9
Phaeozems				
sandy loam	267.9	169.1	377.3	311.3
light loam	301.6	189.5	398.9	320.6
medium loam	328.0	203.2	422.9	322.9
heavy loam and light clayey	370.1	230.6	448.1	323.5
Chernozems				
light loam	341.2	210.0	422.9	322.9
medium loam	378.4	230.6	452.9	323.5
heavy loam and light clayey	416.9	256.4	484.2	323.6

Source: Standards in force in Ukraine, published by Solovyanenko [15].

It is found that attributable profit grows with an increase in the level of natural soil fertility, and within each group of soils - with an increase in the weight of soil particles. Its minimum value was noted for Retisols, and the maximum - for Chernozems (63.8 and 160.5 EUR·ha⁻¹, respectively). However, it is inappropriate to argue that such an increase occurred only due to the difference in the natural fertility of various soils. On soils with heavier textural soil composition, according to the current standards, the cost of growing crops also increases.

With the application of fertilizers (that is, in the case of potential soil fertility), growing crops turned out to be less profitable than without applying them. The only exceptions are the least fertile soils - sandy and sandy loamy Retisols, as well as heavy-loam Chernozems, where profit growth was noted by 20.7, 6.5, and 0.001%, respectively. On

other soil varieties, its value is lower by 1.4 - 33.5% compared to natural fertility.

The differential rental income for natural fertility normally increases with an increase in the standard yield of grain crops, which occurs with weight increase in textural soil composition within each reference soil group. From sandy to light loamy varieties of Retisols, its value increases by 0.17 t·ha⁻¹, from sandy loamy to heavy loamy and light clayey varieties of Phaeozems - by 0.16 t·ha⁻¹, and from light loamy to heavy loamy and light clayey varieties of Chernozems — by 0.32 t·ha⁻¹ (Table 2). This is due to the high natural potential of heavier granular composition of the soils. On typical medium-humic heavy-loam chernozems and light clayey soils, the highest normative differential rental income (0.797 t·ha⁻¹ of grain) is obtained.

Table 2. Standard indexes of grain crop yields, differential rental income and differential rent for natural soil fertility, t·ha⁻¹

Textural soil composition	Yield	Income	Differential income	Differential land rent I
Retisols				
sandy	1.66	63.8	0.135	-
clayey sand	1.87	75.8	0.197	0.100
sandy loam	2.08	87.6	0.256	0.199
light loam	2.29	99.2	0.313	0.295
Phaeozems				
sandy loam	2.23	98.8	0.330	0.292
light loam	2.51	112.0	0.379	0.401
medium loam	2.73	124.8	0.446	0.507
heavy loam and light clayey	3.08	139.4	0.487	0.629
Chernozems				
Light loam	2.84	131.2	0.479	0.561
Medium loam	3.15	147.8	0.558	0.699
heavy loam and light clayey	3.47	160.5	0.797	0.966

Source: Own calculation on the basis of data the table 1 and standards of yield, which are force in Ukraine [7].

The size of the land rent by fertility can be influenced by both natural and historical factors (quality and level of cultivation of soils, hydrothermal conditions of the growing season), as well as economic (achieved level of economic intensity).

The level of production costs, the amount of the crop yield and the sell price determine the

value of differential land rent. The economic condition for the realization of land rent is considered to be the same price level for agricultural produce from land plots of different quality. Fertility differential land rent will increase in case of crop yield growth, reduction of production costs for its cultivation and increase in sell prices.

When setting purchase prices for crop products taking into account the price of their production on land plots with poorer soil quality and worse location, the price of products obtained from medium and best quality land plots becomes artificially inflated in terms of its value [5]. The worse lands on which, at a given grain price, its production is expedient are called marginal lands. Differential land rent is defined as the difference between the income from the sale of crop products obtained from non-marginal lands and income from marginal lands [12].

In our case, differential land rent I is not formed on Retisols on sandy sediments, where grain yields are the lowest – 0.166 t·ha⁻¹. It was found that the value of rent within each reference group of soils naturally increases with an increase in the weight of granulometric soil composition, and hence with an increase in the level of natural fertility. The highest differential rent I is formed on Chernozems of heavy loamy and light clayey soils – 0.804 t·ha⁻¹ of grain. Thus, the different values of differential rent I and differential rental income on the same soil types is due to differences in calculation methods. At higher natural soil fertility, the differential rent I value is higher than the differential rental income I, but at a lower natural fertility - vice versa.

Differential rental income for potential soil fertility, according to current standards, is formed only on heavy loamy and light clayey varieties of Phaeozems, as well as on medium loam and heavy loam and light clayey varieties of Chernozems - 0.09, 0.13, and 0.39 t·ha⁻¹, respectively (Table 3). It is several times lower than for natural fertility. Differential rental income, as well as differential rent, determined by index of standard yield, reflect the natural potential of

the land, and not the ability of the land user to farm.

With additional capital investment in a land plot, differential rent II arises. Unlike differential rent I, it can also be obtained on land plots with a low level of fertility. It is believed that the formation of differential rent II is due to differences in the levels of return on successive costs for the same land plot [9]. The amount of this rent is limited by the operation of the law of diminishing soil fertility [6]. It is advisable to increase investment in the intensification of land cultivation until the moment when the next investment of capital increases the gross profit, that is, as long as the marginal cost of capital is less than the price of the product.

Table 3. Standard indexes of grain crop yields, differential rental income and differential rent for potential soil fertility, t·ha⁻¹

Textural soil composition	Yield	Income	Differential income	Differential land rent I
Retisols				
sandy	3.31	77.1	-0.294	0.093
clayey sand	3.35	81.2	-0.262	0.127
sandy loam	3.40	86.6	-0.219	0.171
light loam	3.49	96.4	-0.139	0.254
Phaeozems				
sandy loam	3.14	66.0	-0.360	-
light loam	3.32	78.3	-0.294	0.103
medium loam	3.52	100.1	-0.109	0.284
heavy loam and light clayey	3.73	124.6	0.093	0.489
Chernozems				
Light loam	3.52	100.1	-0.109	0.284
Medium loam	3.77	129.4	0.133	0.528
heavy loam and light clayey	4.03	160.6	0.393	0.788

Source: Calculated by the author using data the table 1 and standards of yield, which are force in Ukraine [7].

In our opinion, the return on one-time investments (those that exceed the cost of growing crops when using only natural soil fertility) in the land plot also leads to the formation of differential rent II - differential rental income. It was determined by the current standards of yield and the costs of growing cereals with potential soil fertility. The application of mineral fertilizers on medium and high quality soils provides an increase in the crop yield above the level

which is formed due to the natural fertility of the soil. Thus, differential rent for potential fertility includes the first and second forms. In this case, according to current regulations, the Phaeozems sandy loam turned out to be rentless soil, since the yield on it is the lowest of all options – 3.14 t·ha⁻¹. On soils of the Retisols group, the total rent value, depending on the textural soil composition, is 0.093-0.254, the Phaeozems group – 0.103-0.489, and the Chernozems group -0.284-0.788 t·ha⁻¹. It should be noted that the value of rent for potential fertility exceeds rent for natural fertility only on two soils (sandy and clayey-sand) of the Retisols group which have the lowest level of natural fertility among the soils of the entire sample. This may be due to the high level of standard costs for fertilizing precisely on these soil types - 185.0 and 172.5 EUR·ha⁻¹, which caused a high increase in the yield of grain crops – 1.65 and 1.48 t·ha⁻¹.

CONCLUSIONS

Based on the outcome of the study, according to the standards of economic indicators for growing grain crops in Ukraine.

The concept of land rent, which is the basis of the entire system of land relations and methodology for assessing agricultural land, makes it necessary to address the problem of its definition. Under current conditions for agricultural production in Ukraine, the initial data for establishing differential rental income and differential land rent can be the standards of yield and production costs for growing crops on individual soil types and the exchange price for selling grain.

According to the current standard indicators, the differential income for natural fertility is formed on all the soils under investigation, and its value increases with the increasing level of their fertility. The standard differential rental income for potential fertility is formed only on soils with higher natural fertility, but its values are several times lower than in the case of natural soil fertility.

The values of differential land rent I, calculated according to standard indicators of yield and production costs for natural fertility by the method of consumer value, are close to

the values of differential rental income in magnitude and have a similar growth trend in the case of increasing weight of textural soil composition.

The increase in production costs for cultivating crops, which is stipulated by the current standards, on most soil types does not provide adequate increase in yield and the formation of differential rental income II and differential rent II. The standard differential rental income for potential soil fertility (Form I + Form II) is formed only on highly fertile Phaeozems heavy-loam, Chernozems medium-loam and Chernozems heavy-loam and light clayey, however, its values are several times lower than on the corresponding soils in the case of natural fertility. The standard differential land rent II is formed only on soils with a low level of natural fertility - Retisols sandy and clay-sandy on sandy sediments.

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