Cadastral valuation of agricultural land: regional practice

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Abstract. The article discusses the methodology for determining the cadastral value of the permitted use first type agricultural land, used in the assessment in 2012 in the Samara region conditions. It was based on the income valuation method. The considered method made it possible to more accurately determine the cadastral value in comparison with the methods used earlier. The purpose of the study is to improve the methodology for the agricultural land cadastral valuation, taking into account the potential yield, soil varieties, plots individual technological properties and other factors. The average cost of one square meter of the use first type agricultural land, calculated according to the proposed methodology, is more than the average indicator determined in 2006 by 1.35 times (by 35%). The study results indicate that the method for determining the cadastral value of the use first type agricultural land works quite correctly. It effectively fulfills the most important task: a land plot with the worst fertility and having a minimum indicator of agroclimatic potential costs less than a land plot with a fertility higher level and the value of an agroclimatic potential indicator. In addition, the proposed methodology is based on data from the Federal State Statistics Service, which ensures their reliability. These factors determine the merits of the proposed methodology for the state agricultural land cadastral valuation.

1. Introduction

Agricultural land cadastral valuation performs a number of important functions. In the Samara region conditions, it was carried out in 2012 according to the methodology below. The lands of the first type permitted use include agricultural land suitable for arable land, hayfields and pastures. They can be occupied by fallows, perennial plantings, on-farm roads, communications, forest plantations designed to ensure the lands protection from the impact of negative (harmful) natural, anthropogenic and man-made phenomena, as well as water bodies intended to ensure on-farm activities. Thus, these are lands that provide agricultural products direct production, most of which are agricultural land [1-5].

The market value of agricultural real estate, like any other commodity, is created and maintained by four conditions ratio: its usefulness, natural limitation (scarcity), the need for it and the ability to acquire it [6, 7]. These conditions combination fully expresses supply and demand [9-11]. Thus, demand will always be based on the particular object utility and the need for it. However, the demand volume will be regulated by the agricultural land natural scarcity and the purchasing power of buyers. The supply in the same way will be determined by the agricultural land usefulness and the need for
them. At the same time, the supply volume will be limited by their relative scarcity and the buyers' income real level [12-18].

The general ratio of supply and demand for agricultural land is determined by many factors, which can be conditionally divided into four categories:

- Economic factors that reflect the general state of the economic situation in the country and in the region and are described by such indicators: the employment level; the amount of wages and income; solvency; availability of funding sources; bank interest rate; market price for agricultural products; traditional area of specialization, management level and the degree of agricultural production intensity; the production costs volume for obtaining agricultural products; the profit level in agriculture;
- Social factors that make it possible to explain the land use nature, the population's demand for land and its price. These include local traditions in agriculture and animal husbandry, gender and age structure of the population and its education level, ownership sense, etc.;
- Legal, administrative and political factors associated with privatization, fiscal and monetary state policy, which can equally stimulate or restrain demand for land;
- Physical factors, environment and location characteristics, which are determining the agricultural land value. These include: natural factors (climatic, geomorphological, soil); factors of the territory organization (the plots mutual arrangement, their size and shape, crop rotation, convenience of approaching the plot), amelioration factors associated with land improvements; location factors (distance from economic centers, from settlements) [19-26].

Considering that the cadastral assessment of the permitted use first type agricultural land is based on an assessment in the productivity terms, the factors that ensure the land productivity are brought to the fore:

- Integral indicators of soil fertility - bonitet score, yield for zoned crops;
- Climatic features - natural humidity of air, soil, temperature regime, etc.;
- Production costs and soil fertility maintenance [27].

2. Materials and methods

The technique is based on the following assumption. The land plot value, which depends on natural fertility, is determined by the following indicators: humus content in the arable layer; the thickness of the humus horizon; physical clay content in the arable layer; negative soil properties.

Thus, each land plot has only its inherent quality indicators of value.

The soil varieties list, the crops list, the normative yield of each agricultural crop are determined on the basis of soil survey data and the territory agroclimatic zoning materials of the Russian Federation subject.

The soil varieties areas in the land plot composition are determined by correlating the soil varieties boundaries, established on the soil maps basis, and the land plots boundaries in the agricultural land composition, established on the basis of data from the State Land Cadastre.

Income approach. The approach is based on the expectation principle, which says that the land plot value is determined by the magnitude of its owner future benefits. This method is implemented by recalculating the future cash flows generated by the property into present value. The approach is used to determine the value of an appraised site that can generate income in the future over its operation certain period. Cost is the current expected future income sum. Within the income approach framework, the method of land rent capitalization, the land residual method and the intended use method are used for valuation [28-36].
3. Results

This cadastral valuation of lands’ first type use establishes the procedure for determining the unit indicators of the lands cadastral value, according to which the entire plot cadastral value will be considered in the future. This recommended method implements a variation of the classical method for capitalizing land rent [37, 38].

The calculating unit indicators sequence of the land cadastral value through land rent in this assessment framework is as follows:

- Designation of the soil varieties list and the area occupied by each of them;
- Determination, in the soil varieties context, by all agricultural crops list that can be grown [39];
- Selection in the soil varieties context on the crops list basis of permissible crop rotation, characterized by a set of crops, their alternation, the fields number occupied by each crop, and the crop rotation fields total number;
- Definition in the soil varieties context of each agricultural crop normative yield from the crops list;
- The market price determination for each crop from the crops list;
- Gross income calculation per unit area for each crop from the crops list as the product of its normative yield and projected selling price;
- Costs designation per area unit for cultivation and harvesting of each crop from the crops list;
- The gross income calculation per unit area for each crop rotation by summing the products of the agricultural crops unit gross income in the crop rotation and the fields number occupied by agricultural crops, and dividing the result by the crop rotation fields total number [40-42];
- Costs calculation per area unit for each crop rotation by summing the unit costs products for the agricultural crops cultivation in the crop rotation and the fields number occupied by agricultural crops, and dividing the result by the crop rotation fields total number;
- Appreciation in the soil varieties context of costs per unit area for maintaining soil fertility for each crop rotation;
- Estimation in the soil varieties context in the land plot composition of the land rent unit indicator for each crop rotation is carried out by subtracting from the unit gross income value of the unit costs value for cultivation, unit costs for maintaining soil fertility and the profit of a person conducting entrepreneurial activities in agriculture;
- Determination in the soil varieties context in the land plot composition of the land rent unit indicator maximum value from the land rent unit indicators in crop rotations;
- Estimation of the land rent capitalization coefficient value;
- The unit indicator calculation of the each soil variety cadastral value in the land plot composition by dividing the soil variety land rent unit indicator by the capitalization coefficient;
- The unit indicator calculation of the land cadastral value in the land plot composition as a weighted average over the unit indicators soil varieties area of the soil varieties cadastral value;
- The land cadastral value determination [43-45].

Thus, the unit indicator of the land cadastral value on the ground is calculated by the formula:

\[ UK_s = \frac{D_a}{R_o} \]  

Where: \( Ro \) - capitalization ratio, \( Da \) - income from crop rotation (soil) [46-47].
Unit costs calculation. To calculate the growing crops costs, technological maps were drawn up. The calculation was based on the program for calculating technological maps in the plant growing industry.

4. Discussion
The soil cover survey was carried out in all districts of the Samara region. Several hundred types and subtypes of soils in various combinations have been identified. However, in practical agriculture, this is taken into account on the basis of arable or non-arable land. Costs for non-arable land equal to zero, because they can be used for natural pastures.

The costs (from the compiled technical maps for a certain set of crops, taking into account fluctuations in yield) are adjusted taking into account the manufacturability of soils (index of the soil technological properties). These costs are also further linked to the estimated parcels.

The unit costs for cultivation of the assessed land plots are taken equal to the unit costs for land plots located in the respective farms cadastral quarters. Such detailing is presented on the example of Bezenchuksky district land plots (table 1).

Table 1. Unit costs for land plots of Bezenchuksky district.

| №   | Cadastral number | Former farm               | Unit costs, rubles/ha |
|-----|------------------|---------------------------|----------------------|
| 1   | 63:12:00 00 000:0069 | collective farm "Druzhba" | 2939.5               |
| 2   | 63:12:01 02 004:0001 | collective farm "Druzhba" | 2966.0               |
| 3   | 63:12:03 01 001:0002 | collective farm named after Dzerzhinsky | 2886.5 |
| 4   | 63:12:04 05 005:0001 | state farm "Zarya Povolzhya" | 2913.0               |
| 5   | 63:12:00 00 000:0025 | Bezenchuksky state farm-technical school | 2833.6 |
| 6   | 63:12:07 08 002:0001 | state farm "Iskra" | 2833.6               |
| 7   | 63:12:09 01 001:0440 | subsidiary farm of "Chapaevskneft" | 2780.6 |
| 8   | 63:12:10 06 003:0002 | state farm "Osinsky" | 2833.6               |
| 9   | 63:12:11 09 001:0001 | state farm "Bezenchuksky" | 2886.5               |

The maintaining fertility cost. As mentioned above, the optimal crop rotation choice on any soil was based on maintaining the soil natural fertility. This is in line with the cadastral valuation idea, since it is the land current state, its fertility and its physical condition that are assessed [48].

From the point of economic theory view, the profitability from the land natural fertility provides the land owner with the so-called differential rent.

Differential rent exists in two forms: differential rent I and differential rent II. The differential rent I sources are more productive labor on relatively better and average fertile lands, differences in the land plots location (relief, microclimate), as well as in relation to sales markets, transport routes, etc. [49].

Differential rent II is associated with additional capital investment in one and the same area, providing additional profit. This is ensured by the intensive technologies use, i.e. additional investments in doing business [50-53].

In the cadastral valuation the differential rent I is calculated, i.e. with this approach there is no need to take into account the intensive technology costs and the maintaining fertility costs, depleted by improper crop rotation and worsens the soil condition. Thus, when calculating the cadastral value unit indicator, the soil fertility costs are taken to be zero.

Entrepreneur's profit. According to the official data of the Federal State Statistics Service territorial body for the Samara region, it follows that there are no statistical data on the profits distribution between the agricultural land owner and the entrepreneur in the industry in the Samara region.

Capitalization ratio. In accordance with the Methodological Guidelines for the State Cadastral Valuation of Agricultural Lands, the capitalization ratio is determined on the basis of the average market ratio of land rent and the land plots market price. In such data absence, it is recommended to determine the capitalization ratio by adjusting the return rate to maturity of the Russian Federation
government securities from the latest, in relation to the assessment date, the maturity date for risks associated with investing capital in the land acquisition, including natural climatic, agricultural, local risks.

As the return rate to maturity of the Russian Federation government securities, we take the value of 7.47%, which corresponds to the value of the long-term government treasury obligations (GKZ-OFZ) rate as of December 31, 2010.

The risks value associated with climatic, agricultural and local factors is taken at 2%.
In this case, the capitalization ratio is 9.47%.
Thus, for further calculation within the prescribed methodology, the required initial data:

- Soils types for agricultural land;
- The crops list with an optimal crop rotation on this soil type;
- Yield and price for each crop from the crop rotation;
- Costs of growing and harvesting each crop;
- The entrepreneur’s profit in agriculture;
- The capitalization coefficient of income from the agricultural sector.

Table 2. The cadastral value unit indicator calculation.

| Cadastral number | The soil   | Unit income, rubles/ha | Unit costs, rubles/ha | Entrepreneur’s profit, rub. | Estimated value of the rent unit indicator, rubles/ha | The income accepted value, rubles/ha | Unit indicator of the cadastral value, rubles/m² |
|------------------|-----------|------------------------|-----------------------|-----------------------------|------------------------------------------------------|-------------------------------------|---------------------------------------|
| 63:12:0000000:9002 | Others    | 1341.88                | 0.00                  | 0.00                        | 1341.88                                              | 1341.88                             | 1.42                                  |
| 63:12:0000000:9002 | Chernozem | 4585.70                | 2807.09               | 140.35                      | 1638.26                                              | 1638.26                             | 1.73                                  |
| 63:12:0000000:9013 | Others    | 1588.98                | 0.00                  | 0.00                        | 1588.98                                              | 1588.98                             | 1.68                                  |
| 63:12:0000000:9013 | Chernozem | 5318.99                | 2807.09               | 140.35                      | 2371.55                                              | 2371.55                             | 2.50                                  |
| 63:12:1709001:19  | Chernozem | 3978.60                | 2833.57               | 141.68                      | 1137.30                                              | 1137.30                             | 1.20                                  |

The baseline calculated above allows you to determine the net gross income from crop rotation on each soil. The net income required to calculate the unit cost for soil one type is obtained after deducting the costs and the entrepreneur’s profits.

5. Conclusion
As an example of determining the specific cadastral value, the calculation is given for the Bezenchuksky district several areas (table 2).
Most of the assessed plots have one soil type. However, some land plots are composed of soil several types. We know the total area of such sites. To determine the area under a specific soil type of this site, we used the Samara region soil survey maps, a duty cadastral map with the areas to be assessed and the MapInfo computer mapping system.
With the help of MapInfo the cadastral plot image is superimposed on a soil map and the soil types areas in this plot are programmatically calculated. Next, the weighted average unit indicator of the cadastral value is calculated and on the basis of it the land plot cadastral value is determined.
A high average unit indicator for the first type permitted use lands (agricultural land) is determined in the districts (Isaklinsky, Shentalinsky, Kinel-Cherkassky, Koshkinsky), where soil characteristics and climatic features provide a yield higher than the average for the region. A low unit indicator of the
land cadastral value has developed in remote agricultural areas of the steppe region southern part on poor chernozems and pastures.

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