



MODELLING OF LAND RELATIONS IN UKRAINE IN THE PERIOD OF INSTITUTIONAL TRANSFORMATIONS

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ABSTRACT

The complex process of land reform in Ukraine predetermined a specific approach to emerging land relations and the land market. The article discusses the main characteristics of land relations in Ukraine, the factors affecting their formation, and also identify the central and critical milestones on the path of the transition of land relations from the state monopoly to market relations.

The ongoing land reform and institutional transformations make the process of modelling land relations a non-trivial economic and mathematical task; therefore, the methodology is proposed in the article, which allows modelling the economic processes of land relations in the context of the real economic situation in the country.

The main objective of the proposed methodology is to enable the construction of an existing model that serves as a basis for modelling current processes and will become the basis for long-term forecasts.

Keywords: Administrative-Territorial Structure, Agricultural Land, Institutional Transformations, Land reform, Land Relations, Modelling, Ukraine

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1. INTRODUCTION

The indispensability of land as a natural resource, was determined by the fundamental law of Ukraine, its constitution, which predetermined the land as the basis of national wealth, protected by the state. The value of land in Ukraine in general, and as the basis of agriculture in particular, is also because 60% of the land area of Ukraine is black soil, which is the most fertile.

The approach to land relations inherited from the Soviet Union predetermined the state's monopoly on land ownership, however, since independence and the transition from a planned economy to a market economy, it has determined the need for land reform.

Since the beginning of land reform, and to this day, disputes have not ceased both about its feasibility in general and on its individual points, in particular. Nevertheless, today, we can confidently say about the implementation of some initiatives in the field of land policy of Ukraine:

- the state monopoly on land ownership has been eliminated;
- a system of payment for land use has been implemented;
- agricultural production was reformed, and new agricultural organizations were created;
- implemented and launched the underlying mechanisms of the land market;
- Created a system of market land legislation [1-6].

Transformation processes in the economy of land relations are an essential element of socio-economic development, a factor in increasing the competitiveness of the agricultural sector, which is a component of strengthening the food security of the state. Land relations are characterized by constant changes in the specifics of ownership, use and disposal as a result of historical changes, the transformation of the management system and reform in the agricultural sector [7-9].

The formation and development of a modern state are difficult to imagine without a well-thought-out and effective policy in the use and distribution of land resources. The importance of land reforms for Ukraine, both from the point of view of society as a whole and from the point of view of intensification and standardization of agriculture, can be illustrated by the summary data presented in Table 1.

The mechanisms of development of land relations combine the tools and methods of administrative-legal, financial, economic, organizational and socio-psychological mechanisms in a single environment of the economic, environmental and social aspects of sustainable development of society, which is shown in Fig. 1.

Table 1 Comparative characteristics of land use in European countries and Ukraine

Name of indicator	Ukraine	Europe	EU
Total area, million hectares	60,3	1016	437,5
Area of black earth, million hectares	28,3	84,8	20,2
Area of land destination, million hectares	42,6	47,4	178,3
Area of arable land, million hectares	32,4	278,2	115,8
Lease share in agricultural land use, %	96,8	64,7	55,1
Area of agrarian land certified as organic, million hectares	0,3	12,7	8,4
Irrigated area, million hectares	0,5	22,7	15,2
Investment amount, USD / ha	1448	4247	6795
Grain export, million tons	41,7	130,2	38,7
Area of agricultural land per capita, ha / 1 person	0,9	0,6	0,4
Price per hectare of agricultural land, thousand US dollars	–	4,7	8,2

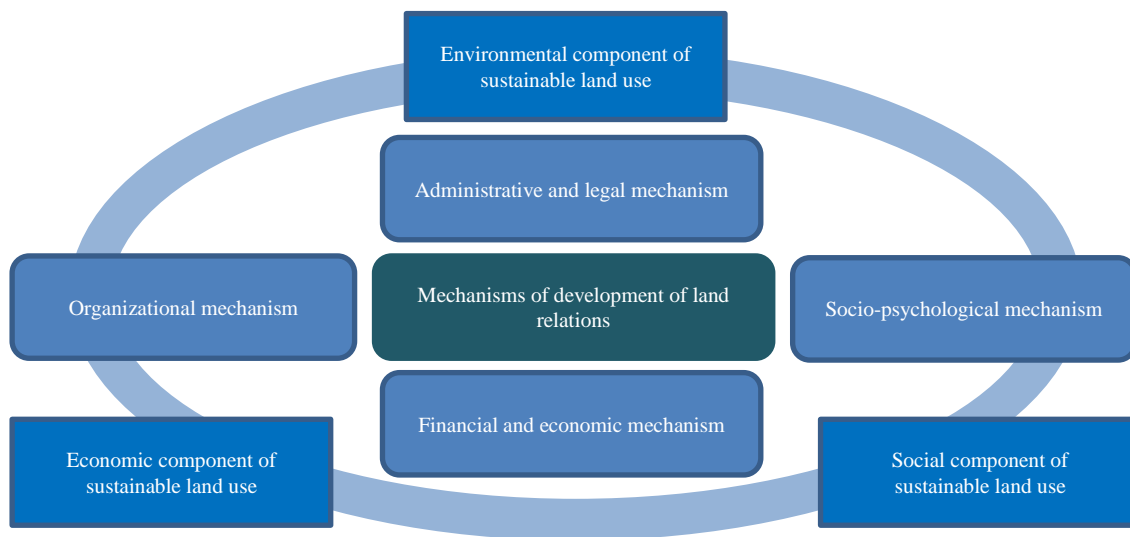


Figure 1 Conceptual model of mechanisms of development of land relations

The economic component is an increase in revenues to local budgets; the creation of alternative sources of filling the budget; changing the tax system for land users; the formation of an investment climate in rural areas; rural entrepreneurship development; Social creation of additional jobs; development of alternative types of employment; implementation of social standards of agricultural activity; development of social and recreational infrastructure; conservation of rural society; Environmental conservation of natural resources; conservation of agro landscape; transformation of unproductive lands; increased responsibility for violation of scientifically based requirements of the economy; the formation of environmental awareness of the population [10-19].

One of the most important tasks of the current stage of development of land relations and land reform in Ukraine is legislative and regulatory support and the completion of the full

formation of the land market, which, in the context of the institutional transformations of the whole society, becomes a very non-trivial task.

2. LAND REFORM IN UKRAINE: LEGISLATIVE ACTS ON THE CIRCULATION OF AGRICULTURAL LANDS AND THE PRINCIPLES OF ADMINISTRATIVE AND TERRITORIAL SYSTEM

On March 31, the Verkhovna Rada adopted a law on the circulation of agricultural land.

According to the updated version of the document, the moratorium on the sale of agricultural land will be abolished from the second half of 2021.

The opening of the land market was one of the requirements to continue cooperation with the International Monetary Fund.

What the law provides:

First. The first two years will limit the purchase of land - no more than 100 hectares at a time. From 2023, the limit will be up to 10 thousand ha in one hand, as foreseen by the latest project.

Second. From 2021 to 2023, the right to buy land will be for natural persons only. Legal entities are prohibited from buying agricultural land.

Third. In the first two years will be a ban on the sale of state land.

Fourth. Regarding the granting of the right to foreigners to buy land, the position has not changed - the issue will be resolved in a referendum.

Fifth. Foreigners are forbidden to buy land closer to 50 km from the state border of Ukraine, despite the results of the referendum.

Sixth. They assumed pre-emptive right of the tenant to purchase. The tenant has the opportunity to transfer the pre-emptive right to buy the land to another person, but the owner must be notified in writing.

Seventh. The minimum price is at least a regulatory monetary valuation by 2030.

3. METHODOLOGY

3.1. The structure of the land fund of Ukraine during the period of institutional transformations.

Speaking about modelling land relations in Ukraine, one should take into account the characteristics and legal status of the land, and one should not forget that a significant part of the land belongs to high-fertility agricultural lands, which is presented in the data in Table 2 and Fig. 2.

Table 2 Changing the structure of the land fund of Ukraine for 1991-2018 (thousand hectares)

Type of land	Years		Deviation
	1991	2018	+/-
Agricultural land	42030,3	41507,9	-522,4
Forested areas	10221,3	10633,1	+411,8
Built land	2161,2	2552,9	+391,7
Wetlands	884	982,3	-98,3
Open land without vegetation	1314,5	1020,6	-293,9
Water	2435	2426,4	-8,6
Other lands	1308	1231,7	-76,3
Total	60354,9	60354,9	0

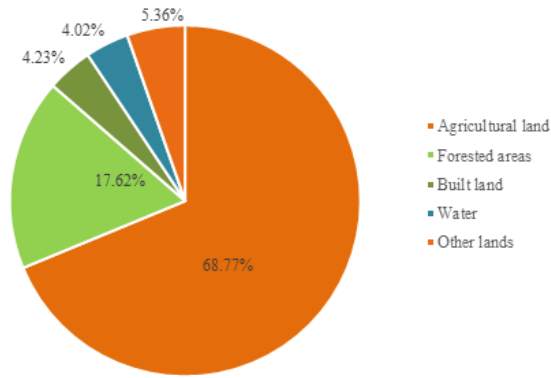


Figure 2 Structures of the land fund of Ukraine

The land reform carried out after the independence of Ukraine, primarily aimed at the restructuring of land use relations, the elimination of the state monopoly of land ownership, and the restoration of private property of land. The process of transformation of land relations, by years and patterns of purchase, is well traceable based on the data presented in Fig. 3. To the data shown in the diagram, one should also add the fact that at the time of independence, 100% of the land was in state ownership.

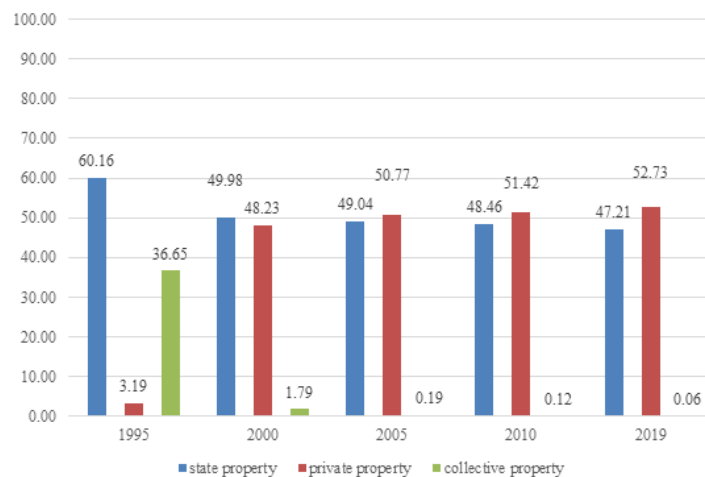


Figure 3 Change in land ownership in Ukraine

It should be noted that in the period 1990-1995 land was transferred to the collective ownership of agricultural enterprises, which became an intermediate stage of land reform in Ukraine. This ensured a gradual, maximum conflict-free transition from state to private ownership of agricultural land due to the allocation of land to shares and the issuance of certificates guaranteeing the right to a land share, which is in collective ownership.

In the process of land reform, more than 70% of agricultural land was transferred to private ownership, including 81% of arable land for intended use - agrarian production. The right to a land share was received by 6.9 million citizens of Ukraine.

At the next stage in the development of land relations, a dual agricultural structure was formed, in which two types of land users (landowners) were distinguished - corporate (agricultural enterprises) and individual (farms and personal peasant farms). It should be noted that only a small fraction of land shares are used by citizens for their own needs and

commodity production. The central part was leased to agricultural enterprises. A summary of rental land relations is presented in Table 3.

Table 3 Transformation of rental land relations in Ukraine by years

Indicator	Years			Deviation
	2010	2012	2017	
Area of leased agricultural land, million hectares	17,42	19,28	19,13	1,7
in % of the area used	94,45	91,77	90,38	-4,1
Rent of 1 hectare, UAH	276	343	982	706
Share of rent in the cost of primary production, %	6,78	6,42	7,21	0,43

The creation of appropriate institutional support contributed to the further transformation of land relations to a market type. Since 2008, there have been processes of industrialization and corporatization of agricultural production, and the concentration of agricultural land in integrated formations. At the same time, the land reform itself generated both social and economic tension, which was caused by the swiftness of the transformation, as well as certain inertia of society. The consequence of this was the adoption of a number of legislative initiatives temporarily preserving the transition to market relations in a number of controversial issues.

Since 2001, a temporary moratorium on the sale of agricultural land has been declared in Ukraine, which was initially supposed to be temporary, but is regularly extended.

The incompleteness of institutional transformations has led to the possibility of establishing shadow control over the distribution of the property of former collective farms and agricultural land.

To circumvent the moratorium, various schemes of "grey" transactions are implemented, such as:

- long-term lease agreements for a period of 30 years or more with prepayment;
- land exchange;
- long-term, alienated and inherited property right to another's property).

In such economic and legal conditions, a situation has arisen in which the primary option for land shareowners who do not have the ability or desire for sole management is the transfer of land rights for rent, and this situation is illustrated by the data presented in Fig. 4.

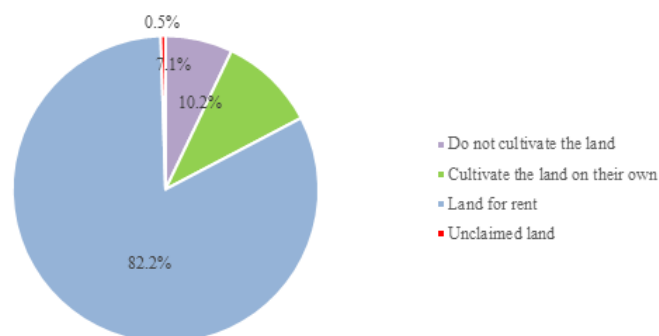


Figure 4 The current state of use of land shares (shares) in Ukraine

Summing up the intermediate result of the implementation of land reform, we can say that at present, it has generated four options for organizing land use:

1. Household management;
2. Obtaining land for permanent use (until 2001);
3. Leased land;
4. Acquisition of land on market conditions (purchase and sale after lifting the moratorium).

3.2. Methodological approach to modelling land relations and the principles of building a mathematical model.

In the context of institutional transformations, the current moratorium on land sales, as well as incomplete land reform, it is the land lease that is a real and cost-effective alternative to land acquisition.

Analyzing the dynamics of rents by years, there is a tendency towards a constant increase in the cost of renting land, which is shown in Fig. 5.

It is worth noting that the rental approach in Ukraine to the economic valuation of land as a pure annuity capitalization strategy is an ineffective tool for price and tax regulation of land relations through clearly underestimated indicators of valuation standards.

In addition to the market mechanism for land price formation, it is also influenced by institutional factors, when the land resource assessment takes into account the technological state of the use of the land resource potential, ecological and economic reproduction and development of the institutional components of the legal entity and the personality of land relations (limiting access to land for individual entities), transaction costs, the presence of shadowland turnover, the level of taxation, political and economic stability s, pricing, marketing infrastructures, economic security, state guarantees, the market localization, and so on (Fig. 6).

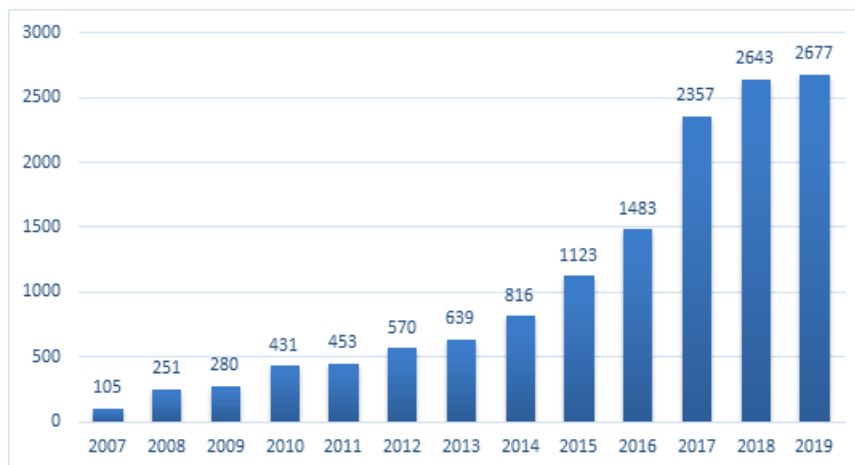


Figure 5 Dynamics of change of rent on land, UAH/ha

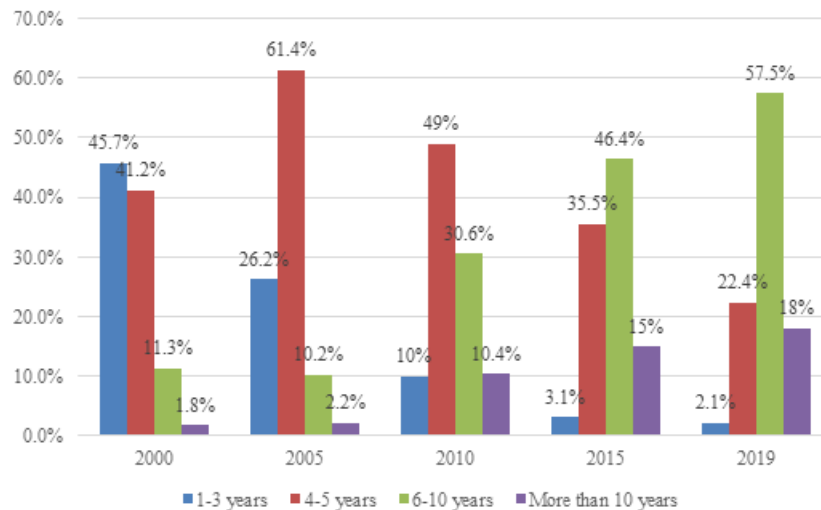


Figure 6 Duration of lease agreements in Ukraine

Also, based on the data of the State Agency of Ukraine, you can trace the change in the ratio of the number of lease agreements concluded for different periods, these data are displayed in fig.6. The graph shows that from year to year the share of long-term leases increases, while at the beginning of 2000, their stock did not exceed 12%, then in 2019 their share increased to 76%.

When modelling land relations, we will rely on the practical significance of the issue, in particular, proceed from the established trends in land relations.

In the field of land relations and the use of agricultural land, there are a set of crucial factors that determine the emerging economic and mathematical model. Possible land use options, as well as soil fertility, determine the value of agricultural land based on its physical characteristics (topography, soil, water balance).

Determining the use of land, taking into account its fertility, allows you to build a profitable model of the agricultural complex that realizes the potential of this plot. The formed model should take into account the costs of the owner to organize the production process and his income from the sale of manufactured products for a specified interval. On the other hand, there are expenses on agricultural machinery, remuneration of employees, interest in the use of borrowed capital, and the risk of this activity. The positive difference between income and expenses is discounted to current values, and this value is the market value of the land.

The main criteria for determining the amount of rent for used land in the created model will take into account:

- land area - R;
- rental interest rate - P;
- normative assessment of land value - ST;
- lease term - S;
- number of land lease agreements - N;
- gross production - V;
- possible force majeure circumstances - F;

All of these factors are based on normatively defined or calculated-forecasting ones. The variability of the elements of the model allows both current modelling processes and making a limited forecast of future transformations.

The objective function of determining the amount of rent combines formalized criteria - maximizing profits from leasing land, taking into account insurance against force majeure circumstances, and also takes into account the number of attracted investments from the tenant:

$$W = (1 + \mu) * i * \sum_{j=1}^N \sum_{k=1}^m \frac{a_{jk} * R_j * R_{jk} * ST_{jk}}{S_{jk}} +$$

$$\sum_{j=1}^N \sum_{k=1}^m In_{jk} - c \sum_{j=1}^N \sum_{k=1}^m a_{jk} * I_{jk} = \sum_{j=1}^N \sum_{k=1}^m \left[(1 + \mu) * i * \frac{a_{jk} * R_j * P_{jk} * ST_{jk}}{S_{jk}} \right] +$$

$$+ [In_{jk} - c * a_{jk} * I_{jk}]$$

$$W_{\mu \rightarrow 0} \overrightarrow{max}$$

The first fundamental factor of the model will be the term of the formula that determines the essential cost of rent; the second factor is the cost of compulsory insurance against force majeure, the third factor is the free investment cost of the tenant.

The formula illustrates the general simulated situation, the fundamental point of which is rent, as a factor in maximizing the objective function when the coefficient μ tends to zero.

The parameters of this model are: μ - the relative coefficient of influence of the human factor and the lack of a competitive environment in the rental land market. This factor determines the formation of rents by 85% and anthropogenic impact and zero competition account for 15%, and the relative coefficient of anthropogenic impact is $\mu = 15/85 = 0.18$, from the influence of the main factors.

Other underlying factors include:

i is the inflation coefficient;

N is the number of contracts concluded;

m is the number of possible development options for the j -th object;

a_{jk} - a logical variable that reflects the choice to implement a specific development option;

R_j is the area of the j -th plot;

P_{jk} is the interest rate for the rent of the j -th plot used for the k -th development option;

ST_{jk} is a normative assessment of the cost of the j -land plot, k -th development option;

S_{jk} is the validity period of the lease contract of the j -th land plot used according to the k -th development option;

In_{ol} is insurance cost for the j -th land plot of the k -th development option, against possible force majeure circumstances;

c is the coefficient of economic efficiency of investments;

I_{jk} is additional investment costs of the tenant of the j -th land plot of the k -th development option.

It should be borne in mind that the limitation of this model is

$$W + c \sum_{j=1}^N \sum_{k=1}^m a_{jk} * I_{jk} < \sum_{j=1}^N \sum_{k=1}^m \varphi_{jk} * V_{jk} < V$$

Which determines the maximum possible cost of the enterprise, where φ_{jk} and V_{jk} is the relative coefficient of the intensity of use of the j-th land plot of the k-th development option and its possible gross output, respectively, V is the total gross output of the enterprise.

4. EXPERIMENT AND ANALYSIS OF RESULTS

To carry out the experimental part of the study of the underlying problem, in determining the main factors under which the rent is formed, grouping was carried out, which showed that its growth is directly proportional to the increase in the area of leased land and their monetary value (provided that the normative assessment of land remains unchanged).

The data for the experiment and its results according to the given model parameters are clearly presented in Table 4.

Table 4 Correlation of the main factor in the economic-mathematical model of land relations

Land Area	Lease term, years	Volume of production, units	The number of lease agreements, units	Rental interest rate	Potential force majeure conditions	Production, UAH / ha	The amount of rent, %
R	S	V	N	P	F		
500	5	0,5	10	3	0,1	6250	3,7
750	10	1,5	25	5	0,12	9375	6,5
1500	15	2,5	35	7	0,15	18750	7,8
3500	20	7,5	45	9	0,18	43750	10,5
5000	25	12,5	75	11	0,2	62500	12,7

These parameters and the model of building land relations allow you to predetermine calculations to determine the optimal rent and to model the relationship of owners and lessors of agricultural land in Ukraine.

The given formula determines the intensive component for the future. In the case of lifting the moratorium on the sale of agricultural land, minimizing the prices of the primary market in the absence of effective state regulation mechanisms will give a speculative impetus to the secondary land market on a larger scale than maintaining a moratorium on the sale of land. Predictive calculations using the variability of factors and using the proposed model are presented in Table 5 and Fig. 7

Table 5 Correlation of the main factor in the economic-mathematical model of land relations

Year	Free circulation of the earth (optimistic forecast)	Free turnover of land (pessimistic outlook)	Trend line subject to maintaining a moratorium on land sales
2019	25	25	25
2020	50	40	13
2021	100	75	25
2022	125	80	30
2023	150	85	45
2024	175	90	50
2025	150	95	65
2026	150	100	75
2027	145	115	100
2028	135	120	115

2029	130	125	120
2030	130	130	125

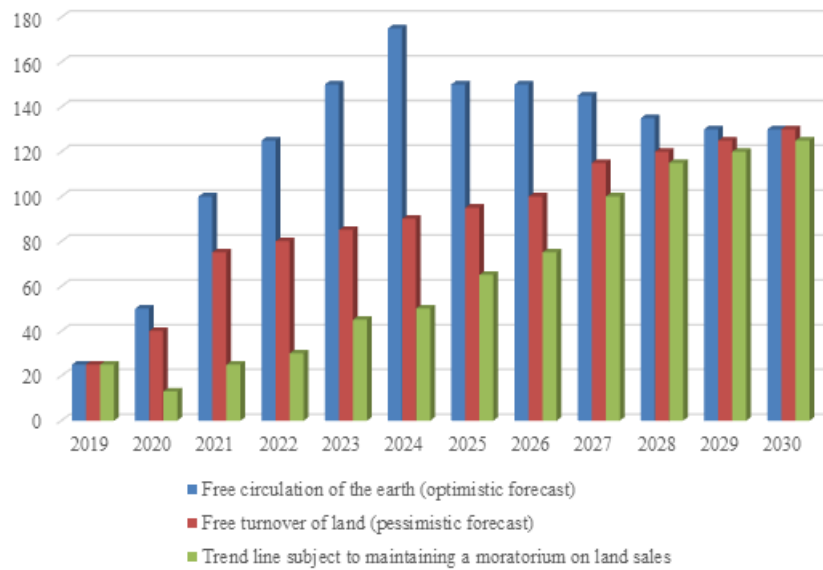


Figure 7 Schedule changes in rents for agricultural land in Ukraine

Although the general tendency for rent growth is observed for any combination of the initial factors, it is clear that if the moratorium is maintained, this growth will be delayed in time. Still, it will become most significant at the moment the moratorium is lifted.

From the perspective of analysis and modelling of land relations, the presented model has sufficient flexibility and variability, provided that it focuses on modelling relations in the plane of legal law on agricultural land.

5 CONCLUSIONS

Even though the topic of this article is presented as modelling land relations, it is worth recognizing that in Ukraine there is a situation of a sensation of the apparent completeness of land reform, in reality, this situation is not yet completed. Both the reform itself and the formation of the relevant institutions are still far from complete, the multiple totalities of both economic and social factors determining the course of land reform progress remained unresolved. The moratorium on the sale of land and legislative acts regulating relations in the field of land ownership proved to be poorly applicable in practice, the temporary moratorium smoothly transformed into a permanent one, but this did not improve the situation.

Land reform, as well as the transformation of relevant institutions in Ukraine, are far from complete. It is necessary to develop, create institutions and institutionalize:

- national program of land relations, which will indicate the path of further rational development;
- land, agricultural and environmental codes,
- private economic opportunism of land users will be minimized;
- obligatory cadastre and mandatory land management; land market valuation, European level of land payments (taxes)
- the national system of land turnover infrastructure: Land Bank, State Land Fund, State Land Agency;

- fair redistribution of ownership of natural resources and land, which will reduce transaction costs to a minimum, especially corruption, and land relations put on the path of sustainable self-development and self-improvement.

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