

State Support of Agro-Insurance of Agricultural Risks in the Market of Goods Derivatives of Ukraine

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ABSTRACT

The article deals with the model of state support for insurance of agricultural risks in the market of goods derivatives of Ukraine. Derivative instruments of agricultural risk allocation in the agricultural asset portfolio are identified, as well as compensation methods for insurance coverage of agricultural enterprises' production costs on forward purchases. A multicriteria model of insurance differentiation of agricultural risks is proposed, which allows ensuring their distribution in the portfolio of insurance coverage of agricultural assets and at the same time optimizing the expected profitability of agricultural enterprises, taking into account, the conditions of state support. The projected value of the portfolio of insurance coverage of agricultural assets under state support has been determined by combining the efforts of agro-insurance entities and state-owned companies focused on the guaranteed performance of forward purchases of agricultural enterprises' grain. Subsystems of agro-insurance objects with state support of the portfolio of insurance coverage of assets of agricultural enterprises have been developed and modified, with basic and additional factors of external macro- and microenvironment of the system.

Keywords: Government Support, Forward Purchases, Subjects of Agribusiness, Derivative Instruments

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1. INTRODUCTION

The main and budgetary sector of the economy of Ukraine is agriculture, which is a risky production (70% of income, which depends on the climatic conditions). This is explained by the peculiarity of the production process and the long period of ripening and growing of commodity products, during which the product of labor is exposed to natural processes. Crops are more dependent on climatic conditions than any other agricultural sector. For several months, crops are under the full influence of meteorological factors. In addition, land is the main resource for agricultural production, and its natural characteristics are closely linked to agro-climatic conditions. Unlike other sectors of the country's economy (Mishchenko *et al.*, 2016), land productivity cannot be accurately calculated, and its natural and economic nature is subject to change under the influence of various factors.

The main tool for reducing business risks and compensation for costs incurred in the event of force majeure is the system of agricultural insurance, which in today's domestic realities is underdeveloped and unpopular among agricultural producers. However, the country's territorial capabilities are increasingly exposed to a variety of natural disasters (drought, excessive humidity, hail, frost, wind), and agricultural producers need insurance protection.

Therefore, insurance is a necessary attribute of a civilized, modern and efficient system of agricultural protection, which requires an effective mechanism of state support and regulation in order to minimize the losses of farmers under the conditions of forward operations. Statistics show that agricultural insurance in Ukraine is underdeveloped, with only 5-7% of existing risks being insured, while in the EU Member States this figure reaches 80%. The slow development of the agricultural insurance market in Ukraine is explained by the lack of adequate legislative support, shortcomings in the coordination of agricultural risk distribution between the main actors of insurance services in the agricultural sector and the lack of financial instruments that would stabilize the functioning of the state insurance system in general and in the agricultural sector.

Some aspects of the nature and importance of agricultural insurance, services, insurance activities and the agrarian segment of the insurance services market, as levers of increasing the motivation of farmers to insurance have been reflected in the works. Adamchuk and Korenevsky (2010), Mynkina (2010), Tomashevsky (2010), Iturrioz (2009), Sholoiko (2010). The key issues of institutional transparency and efficiency of agricultural insurance, the formation of state support in order to counterbalance the impact of agricultural risks on the financial stability of agriculture are concentrated in the works. Aleskerova (2014), Gutko (2009), Pavlenko (2013),

Sobol (2010), Shubenko and Sus (2010), Kravchuk (2011), Lupenko and Feshchenko (2014), Martynova (2015), Shynkarenko (2012). Defining the latest regulatory models for ensuring an adequate level of profitability of agricultural production through a balanced mechanism of state support for insurance coverage of agricultural assets requires transparency and openness, which is a priority of our research.

2. MATERIALS AND METHODS

Agro-insurance is a component of financial and credit support of agriculture, which ensures the continuity of the process of reproduction and compensation of expenses of agricultural producers, real increase of their financial stability and creditworthiness, preservation of the level of profitability, taking into account the risk of an accident (Kravchuk, 2015; Lupenko and Feshchenko, 2014). Agricultural risks in the production process of agrarian enterprises, caused by insurance diversification of business, have long been emerging in the multidisciplinary technology of growing agricultural products (Aleskerova, 2014; Samoilyk, 2012). However, the arsenal of state regulators of agricultural risks in agribusiness, by reducing and subsidizing them, requires having an appropriate institutional environment that ensures vertical integration between the state and agro-insurance entities. Combining macro- and micro-level efforts allows reducing price risk pressures on agricultural products and partially compensating offset costs through goods derivatives transactions using forward contracts.

According to classical financial theory, forwards are usually concluded for the purpose of real delivery (purchase or sale) of the relevant asset (agricultural products) to insure against possible adverse price changes for that asset. Moreover, the positive effect of insurance diversification of agricultural risks is achieved through the combination of economic levers that stop fluctuations in prices for agricultural products, and stabilize the appropriate level of income of agricultural enterprises (Iatsukh, 2018). This tool is based on the theory of portfolio investment (Aleskerova, 2014), and causes a situational reduction of agricultural risks in the field of crop production, namely of the agrarian sector entities, which interact in diametrically different directions, but are likely to obtain a negative correlation of yield under dangerous conditions of influence of the external and internal environment. In this case, the distribution of agricultural risks in the production process is formed on the basis of adequate insurance coverage of the negative economic consequences of the operation of the combined enterprises (Martynova, 2015; Rusnak *et al.*, 2018).

On the basis of fundamental portfolio theory, we have proposed a multicriteria model of insurance diffe-

rentiation of agricultural risks, which allows to ensure their distribution in the portfolio of insurance coverage of agricultural assets and at the same time optimize the expected profitability of agricultural enterprises with the lowest possible value of risk, taking into account the instruments of goods derivatives. The mathematical formulation of the problem is:

- expected return on the portfolio of agricultural assets (average sample) (Eq. 1):

$$\bar{m}_p = \sum_{i=1}^n m_{pi} \times \bar{w}_{pi}, \text{ or } \bar{m}_p = M_{pi} \times W_{pi}^t \Rightarrow \max, \quad (1)$$

where, \bar{m}_p – the expected return on the portfolio of insurance coverage of agricultural assets within the existing agricultural risks; $m_{pi}(M_{pi})$ – the share of insurance coverage that offsets (reimburses) the costs of the i -th asset of agricultural products, taking into account instruments of goods derivatives; $\bar{w}_{pi}(w_{pi}^t)$ – probability of expectation of profitability of the i -th asset of agricultural products in the t -period; n – the number of agricultural assets in the portfolio.

- agricultural asset portfolio risk (variance) (Eq. 2):

$$s_p^2 = M_{pi} \times V_{pi} \times W_{pi}^t \Rightarrow \min \quad (2)$$

where, M_{pi} – the vector of the share of the yield of insurance coverage, which offsets the costs in the expected i -th portfolio of agricultural assets, taking into account instruments of goods derivatives; V_{pi} – covariance matrix of yield of insurance coverage of agricultural assets; W_{pi}^t – the vector of the expected rate of return on agricultural assets within the coverage of agricultural risks under restrictions (Eq. 3, 4):

$$\sum_{i=1}^n w_{pi} = 1, \text{ or } \sum_{i=1}^n V_{pi} = 1, \quad (3)$$

$$V_{pi} \geq 0, i = 1, \dots, n, \quad (4)$$

The multipurpose model of insurance diversification of agricultural risks can be either constructed graphically (with the transformation of one of the objective functions into a functional constraint), or by combining the two objective functions (1) – (2) into one, consolidated by utility function:

$$f(V) = m_p(V) - a \times S_p(V) \Rightarrow \max \quad (5)$$

where, a – the coefficient that determines the magnitude of the agricultural risk.

It is assumed that the values obtained as a result of solutions (3) – (5) (vector coordinates) will be optimal in the long run. The multipurpose model of agricultural diversification of insurance risks is also a model for forecasting the portfolio of insurance coverage of agricultural

assets under government support to combine the efforts of agro-insurance entities and state-owned companies focused on the guaranteed forward purchase of agricultural grain.

3. RESULTS AND DISCUSSION

The role of agro-insurance in protecting agricultural enterprises from dangerous economic situations is difficult to overestimate, as it is a powerful financial stabilizer that allows offsetting the costs of covering agricultural risks. It should be noted that in Poland, price risk insurance in agriculture provides 30% of the level of coverage of losses of agricultural enterprises, in Germany – more than 60%, in Italy – almost 80% (Adamchuk and Korenevsky, 2010). In Ukraine, according to expert estimates, agro-insurance of the crop sector can attract more than 4 billion UAH and redistribute about 0.08% of the country's GDP. But most agricultural producers have insurance policies to secure bank collateral while attracting credits (Agricultural Insurance Portal..., 2017).

In order to improve the agricultural insurance system in Ukraine, the Law on State Support for Agricultural Insurance was introduced (Law Project, 2017), which adjusted the mechanism of providing subsidies for cheaper insurance premiums to agricultural producers when concluding agricultural insurance contracts. On the basis of this agreement, the insurer pays only part of the insurance coverage, the other part is paid by the state through the newly built agricultural risk management institution – the State Agricultural Insurance Agency. In addition, it allowed to create an association of insurers in the Agricultural Agrarian Pool (AAP), the structure of which is as follows: 84% of the Ukrainian market – members of the AAP (IC “Dominant”, IC “Insurance Guarantee”, Ukrainian agro-insurance company); 16% of the Ukrainian market is companies that develop voluntary and bank (mortgage) agricultural insurance: IC “INGO Ukraine”, PSC “UJSIC ASKA”, IC “Oranta-Sich”, IC “Wired”, IC “PZU Ukraine”, IC “Brokbusiness Insurance” (Adamchuk and Korenevsky, 2010).

AAP in cooperation with state-owned companies Private Joint Stock Company “Agrarian Fund of Ukraine” (AFU) and Private Joint Stock Company “State Food and Grain Corporation of Ukraine” (SFGCU) developed state priority directions of compensation of costs of agricultural enterprises in the agricultural market. A mechanism of agrarian interventions was introduced through forward purchases and state regulation of prices for the grain group of crops of agricultural producers with high level of production efficiency, and private structures (grain traders) for the purchase of technical crops. This is a rational step towards the creation of civilized market relations in the agricultural sector (Resolution of the Cabinet of Ministers

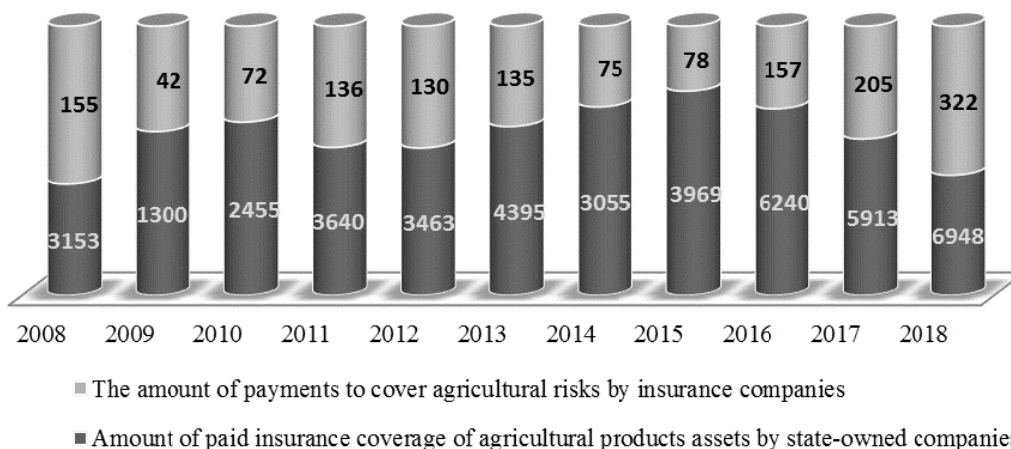
of Ukraine, 2007; Law of Ukraine, 2012; Law Project, 2017; Order, 2014).

In Ukraine, insurance companies provide, on average, 3.2% of the structure of the total portfolio of insurance coverage of the assets of the crop sector, including the grain group of crops – 2.8%. At the same time, the amount of state support for 2012-2018 increased by 2.3 times, and the level of providing coverage of agricultural risks on forward purchases through state-owned companies amounted to 96.8%. It should be noted that the increase in the amount of insurance payments to cover agricultural risks in 2.1 times made by insurance companies is almost equal to the level of state support (Figure 1). In 2017-2018, the amount of financial support for the AAP insurance coverage for the crop sector amounted to 425.8 million UAH, including 157.1 million UAH of the cereal crop group. In 2018, ASKA Insurance Company became the leader of compensation

payments – 90.8% of agricultural risks coverage of agricultural enterprises (Figure 2).

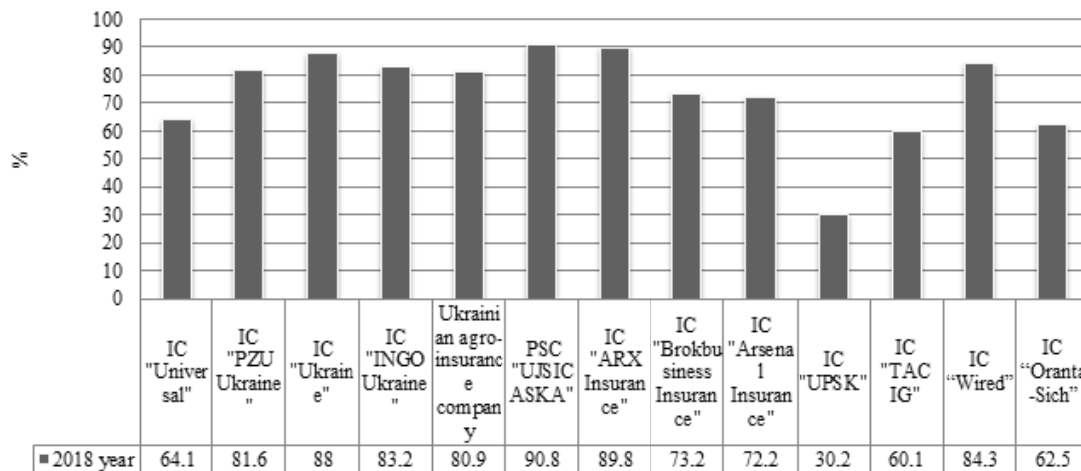
Today eight standard crop insurance products have been developed in Ukraine. The largest share in the structure of compensation for agricultural risks in forward purchases is soya (69.5%, the amount of damage – 4832.28 million UAH) and maize (13%, the amount of damage – 902 million UAH).

The payment of the state insurance subvention for losses incurred from the price disparity in the world winter wheat and rapeseed market in 2018 amounted to 9.5% (or 658.98 million UAH) and 4.5% (or 314.58 million UAH) (Table 1). The advantage of functioning of the state program of forward purchases of grain is a preferential lever, which provides a standard unconditional franchise of 30% when concluding insurance contracts. At the same time, the costs of servicing the forward purchases of PJSC “Agrarian Fund” and PJSC “SFGCU” in 2016-2017 were



Source: calculated by authors according to data (Agricultural Insurance Portal, 2017).

Figure 1. Insurance payments and insurance coverage of assets against threats agricultural risks of the Ukrainian crop sector, million UAH/



Source: compiled by authors according to data (Agricultural Insurance Portal, 2017).

Figure 2. The level of compensation for agricultural hazards risks by insurance companies of Ukraine in 2018, %.

provided on average at 22.5% per annum for using pre-payment funds. Excluding exchange rate fluctuations, their value was formed at 22.5-27.6%. The use of pre-payment funds, taking into account exchange rate fluctuations, was accounted for within 15-18%.

In 2017-2018, changes in exchange rate fluctuations in the structure of expenses under forward contracts were, respectively, 15% and 20-25% (Table 2).

State-owned companies, when determining the interest rate for the use of financial resources received as a pre-payment under agro-insurance contracts for the supply of products of the future crop, take into account the intervention price formed in the financial market. Thus, the cost of domestic government bonds at the level of 14.25 %, joins the administrative expenses of the banking institution and its planned costs (5%). Accordingly, the total interest rate is 14.5 % per annum. But in our opinion, it is the cost of servicing payments to the

state for using its financial resources when it buys the highest grade products at a reduced price, since the intervention prices on the stock exchange are always lower than market ones. We believe that this is a reserve for reducing the interest rate on attracting financial resources for forward purchases (Iatsukh, 2018; Kravchuk, 2015).

The procedure of entering into an insurance contract under a forward contract with or without state subsidy is presented in Figure 3. It should be noted that the procedure for transferring state subsidies between PJSC "Agrarian Union" or PJSC "SFGCU" to agricultural enterprises (compensation of up to 50% of the paid insurance coverage) creates a liquidity gap, since the production process of the sowing period requires 100% of the amount of insurance coverage, and the real cost is significantly below the cost of financial resources during the sowing phase.

Table 1. Compensation payments of the state insurance subvention of Ukraine by crop in 2018

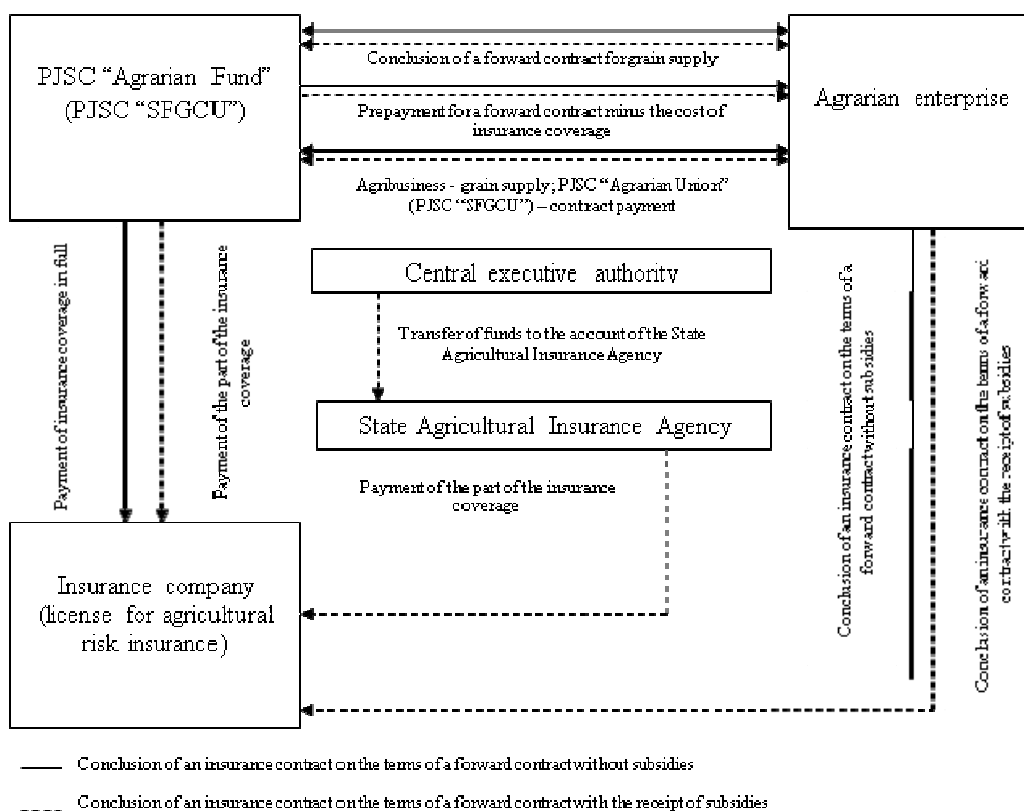
Crops	Payout amount (winter), million UAH	Payout amount (spring-summer), million UAH	Overall amount of payments, million UAH	Part of payments in the market, %	Level of payments, %
Soya		4832.28	4832.28	69.5	471.8
Winter wheat	274.63	384.35	658.98	9.5	6.5
Winter rapeseed	314.58		314.58	4.5	56.3
Flax plant		106.72	106.72	1.5	110.4
Sunflower		75.69	75.69	1.1	3.9
Maize		902.0	902.0	13.0	302.8
Buckwheat		45.95	45.95	0.7	76.8
Sugar beet		12.54	12.54	0.2	0.4
Total	589.21	6359.53	6948.74	100	44.2

Source: compiled by authors according to data (Agricultural Insurance Portal..., 2017).

Table 2. Formation of expenses for the service of forward purchases of PJSC "Agrarian Fund" and PJSC "SFGCU" at the level of agricultural enterprises

Types of costs	Period	
	2016-2017	2017-2018
Registration fee of the Agrarian Exchange	0.1% of the contract value is paid within 2 working days after the conclusion and registration.	
Brokerage services	0.1% of the contract value is paid within 2 working days after the conclusion and registration.	
Remuneration for the use of funds for 1 ton, UAH. (does not depend on price, type of product or date of agreement)	Taking into account exchange rate fluctuations – from 15-18%; without exchange rate fluctuations – 22-27.6%.	Taking into account exchange rate fluctuations – from 15%; without exchange rate fluctuations – 20-25%.
Costs of the contract collateral	0.1% of the amount of the collateral agreement	
Insurance rate, %	Tariff rate 4.7%; Franchise – 30-50%	
Total cost, %	14.4	14.5
Total cost per ton, UAH.	3100.88	3208.08

Source: compiled by authors according to data (Kravchuk, 2015; Law of Ukraine..., 2012; Law Project..., 2017; Order..., 2014)



Source: improved by the authors according to the data (Kravchuk, 2015; Rubtsova, 2018).

Figure 3. The procedure for concluding an insurance contract on terms of forward contract with (without) state subvention.

Therefore, under the agreement of agricultural insurance, agricultural companies pay only part of the insurance coverage, the other part is paid to the account of the insurance company through a specialized institution for agricultural risk management – State Agricultural Insurance Agency (SAIA) (Order, 2014). The likelihood of government support for the insurance coverage of agricultural assets of agricultural enterprises under the conditions of forward purchases should reflect the sequence of change in its value, and how this value will affect the expected return on the *i*-th asset of economic entities in the distribution of agricultural risks between insurance companies and government. Subsystems of agro-insurance with state support of the portfolio of insurance coverage of assets of agrarian enterprises having basic and additional factors of external macro- and microenvironment of the system were developed and modified, namely: budgeting of production of agricultural products, planning of sources of insurance coverage in the financial market, forecasting rational financing provision and budget financing. Their relationship with the factors of the internal environment is determined by the level of financial stability and breakeven production of economic entities (Figure 4).

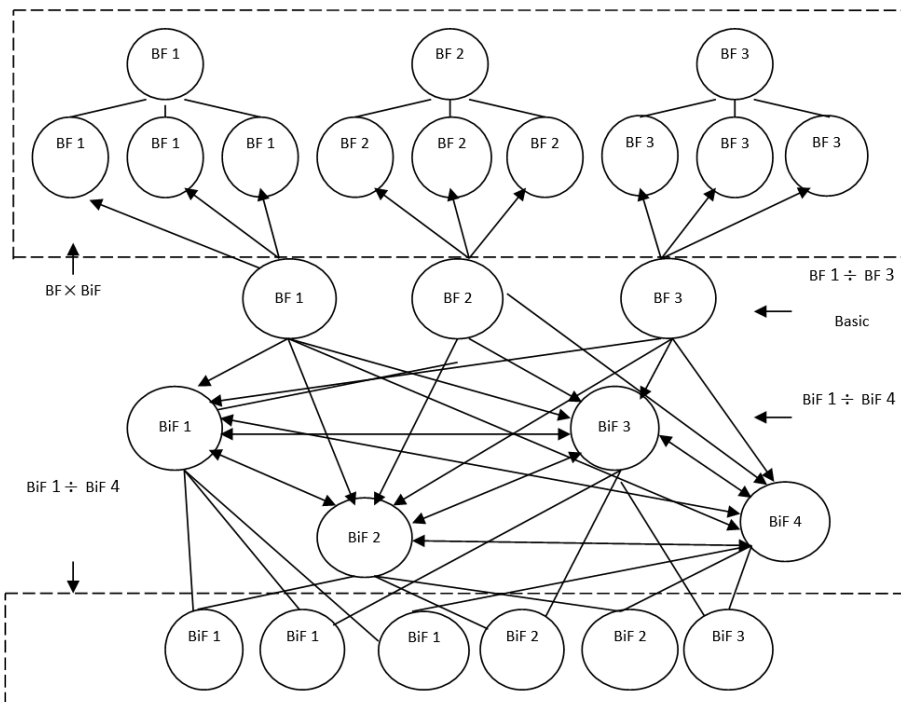
The constructed model reflects market, legal, natural-biological, economic and financial risks, and thus generates a scenario of financial, economic, social and tech-

nological developments for agricultural enterprises, which often operate in different directions of the macro-environment system. Their influence shapes the integrated capabilities of the system of factors of external microenvironment of economic entities through the parameters “consumers, competitors, suppliers, infrastructure, financial relations of the enterprise”. Together, the two systems form the block “external market signals” of the portfolio of insurance coverage of agricultural assets. The performance of derivatives (forward contracts) in this unit ensures the efficiency of formation and use of financial resources and balances the internal environment factors for making decisions about the generation of income for insurance coverage of agricultural risks with constant changes in environmental parameters.

The total number of observation objects subject to the choice of the optimal option of state support of the insurance coverage portfolio of agricultural products under insurance contracts, under the conditions of forward purchases, was 38 enterprises of Kherson and Zaporizhzhia regions. The projected distribution of agricultural risks in the portfolio of insurance coverage of assets of agricultural enterprises with state support, with the separation of components of the probable cycle of their assessment is presented in Figure 5.

The mechanism of state subvention under the agreement of agro-insurance under the terms of a forward contract provides the calculation of changes in the magni-

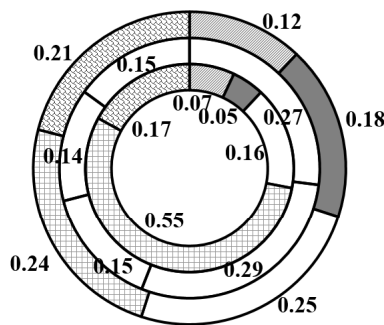
tude of insurance coverage of agricultural risks and the amount of compensation for losses for the economic entity (Table 3).



Note: BF 1 – External macro-environment of the portfolio of insurance coverage of assets of the agrarian micro-level at the forward; BF 2 – Internal environment of the portfolio of insurance coverage of assets of the agrarian micro-level at the forward; BF 3 – External microenvironment of the portfolio of insurance coverage of assets of the agrarian micro-level at the forward; BiF 1 – Subsystem of agricultural production budgeting; BiF 2 – Subsystem of planning of sources of insurance coverage in the financial market; BiF 3 – Subsystem of rational credit forecasting and budget financing forecasting; BiF 4 – Subsystem of forecasting the level of financial stability and breakeven production.

Source: authors' own development.

Figure 4. Activation of subsystem objects of agro-insurance under the conditions of state support of the portfolio of insurance coverage of assets of the agricultural products.



- Assessment of the environment
- Assessment of strategic guidelines
- Monitoring and diagnostics of commercial credit banking services
- The decision-making process on the generation of income for insurance coverage of agricultural risks

Source: authors' own development.

Figure 5. Estimated risk allocation with likely state support of the portfolio of insurance coverage of assets of the agricultural products.

Table 3. The best option for government support of the insurance portfolio coverage of agricultural products of agrarian enterprises under the terms of the insurance contract under forward contracts

Indexes	Insurance contract without state support		Insurance contract with state support	
	For the period of overwintering	for the period of overwintering (insurance product 2)	for the whole period of growing (insurance product 1)	
Area of crops, hectare	57300	57300		
Planned costs for sowing and growing winter crops, UAH/hectare	6000	6000		
Insurance sum of winter crops, bln. UAH	343.8	343.8		
Insurance rate, %	4.7	7.0		
Franchise, %	30	–		
Coefficient of coverage		0.8		
Insurance coverage, bln. UAH	16.16	24.07		
	For spring-summer period	For spring-summer period (insurance product 3)		
Area of crops, hectare	57300	57300	57300	
Average yield, hundred-weight on hectare	44.72	44.72	44.72	
Insured yield of winter crops, hundred-weight on hectare	33.54	31.31	31.31	
The cost of winter crops, UAH on hundred-weight	320.80	320.80	320.80	
Insurance amount of winter crops, million UAH	616.53	575.54	575.54	
Insurance rate,%	3.2	5.8	9.3	
Franchise, %	30	–	–	
Coefficient of coverage	–	0.7	0.7	
Insurance coverage, million UAH	19.73	33.38	53.53	
Insurance coverage – total, million UAH	35.89	57.45	53.53	
Payment under the conditions of 50% subsidy, UAH.	–	28.73	26.77	
Amount of prepayment for forward contracts, million UAH		549.64		
Amount of prepayment for a forward contract minus the amount of insurance coverage, million UAH	513.75	492.19	496.11	

Source: authors' own calculations.

Thus, under a forward contract for the purchase of grain, PJSC “SFGCU” withdraws the financial resources provided for payment to the agricultural enterprise from the future harvest. This amount is stated in the Voluntary Crop Insurance Contract and the Comprehensive Future Crop Insurance Contract, and is paid for by the state company as insurance coverage on the basis of invoices. Thus, the most optimal option of state support of the insurance coverage portfolio of agricultural assets of agrarian enterprises under insurance contracts in the condi-

tions of forward purchases is standard, which takes into account the probable cycle of covering agricultural risks for the whole period of growing and obtaining the future harvest of winter cereals. The amount of prepayment for forward contracts, less the amount of insurance coverage will be 492.19 million UAH, while for the whole growing period it will be 496.11 million UAH. Under these conditions, farmers will receive an additional 3.92 bln. UAH compensation for agricultural risks, which will amount to 103.16 thousand UAH per person.

4. CONCLUSION

Therefore, the model of agro-insurance with state financial support is characterized by the following key features: the state is actively involved in the activities of the system; government policies in the field of agricultural insurance are transparent and consistent; insurance is voluntary; special state institutions are created for elaboration and implementation of the state policy in the specified sphere; the state may provide insurance subsidies to both agricultural producers and insurance companies; the state is developing alternative forms of financing and insurance in case of negative impact of agricultural risks. The presented model provides, on the one hand, the required level of agricultural insurance in agriculture, and on the other – creates a certain interest of agrarians in strengthening the protection of property interests, since there remain a number of issues that need to be resolved in the forward purchase of state-owned companies, namely:

1. Forward transactions, as a state financial instrument for supporting agricultural enterprises, should be accessible to small businesses by reducing the size of the minimum batch of agricultural products;
2. PJSC “Agrarian Fund” and PJSC “SFGCU” are in fact the only intermediaries between agrarian enterprises and consumers of agricultural products, and independently set the deadline for its delivery – the beginning of October. At the same time, grain prices are the lowest in the market during this period, so they do not always cover the costs of the production process;
3. The costs of agrarian enterprises related to forward-looking agro-insurance services for the future crop are too high.

Bringing state regulators to the world level and implementing an effective program of state support for agricultural enterprises will help to meet the production potential of producers during the technological process of sowing winter crops, thus accelerating the delivery of the future crop at prices that take into account market conditions.

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