

## Crop Insurance as a Means of Increasing Efficiency of Agricultural Production in Russia

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### ABSTRACT

The authors tackle the question of the urgent need for changing the approach to agricultural insurance, with regard to cultivation of grain crops in particular. Having studied the changes in the structure of sown areas of Penza region (located in the central part of Russia) in the period from 1980 to 2013 with the aid of cluster analysis, the researcher found out that in rural areas one cannot diversify crop failure risks by planting several grain crops, by reason of the results for one culture being identical to the results for the other. Therefore, agricultural cereal growers should consider crop insurance, because their activities are exposed to agro-climatic factors. As a part of the investigation, a simulation modelling of performance of agricultural producers was carried out, which proves the effectiveness of insurance at low interest rates achieved through allotment of reserve funds by insurance companies. The analytical findings of the study help to provide additional possibilities for increasing the efficiency of agricultural producers of Russian regions.

### KEYWORDS

Grain crop raising, crop insurance, performance modeling, insurance rate, a reserve fund of an insurance company, risk management

### ARTICLE HISTORY

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## Introduction

Crop growing is much more exposed to climatic conditions than any other branch of agricultural production (Mahul & Stutley, 2010; Morgan, Marsden & Morley, 2010). This is explained by the very nature of the production process. The period of production when the product of labour is exposed to natural processes is particularly long. For several months agricultural crops are under the absolute influence of meteorological factors (Mario & Vedenov, 2001; Varangis, Larson & Anderson, 2002).

In addition, the main resource of production in agriculture is land, and its natural characteristics are closely connected to agro-climatic conditions. Unlike other sectors of economy, land productivity is not to be accurately calculated, and its natural and economic nature is subject to changes under the influence of

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various factors. In agriculture, different kinds of crops can be grown on the same land, but cereals are considered to be of the most important group (Anderson & Hazell, 1997; Barnett, Barrett & Skees, 2008).

In modern conditions, limitations of the resource potential of the majority of areas engaged in agricultural production calls for insurance of various risks. Introduction of agricultural insurance has been awakening a keen interest among scientists and politicians, as is evidenced by numerous publications aimed at assessing the value and effects of agricultural insurance in different parts of the world (Townsend, 1994; Vavrova, 2005; Wenner, 2005; Goodwin, 2001; Gurenko & Mahul, 2004).

It is difficult to overestimate the role of insurance in ensuring food security of Russia as a powerful financial stabilizer helping to compensate for the losses incurred by undesired natural and manmade events. Today, insurance of agricultural risks in Russia is a most complicated problem in agrarian business and still a necessary attribute of a civilized, modern and efficient system of management. (Rassadin et al., 2014)

In this context, the aim of the research was to explore the theoretical and practical bases of agricultural insurance, as well as to test the simulation model for assessing performance of companies involved in crop cultivation, taking the agricultural region of Central Russia for an example.

### Methods of investigation

Russia ranked first in the world as to the export amount of wheat and other grain products. In 2016 Russia harvested about 115 million tons of grain – 23% more than in 2015. Among the twenty best Russian regions as to grain harvest is Penza region. The share of the region in the total area of grain crops in the Russian Federation is 1.3%, and in Volga Federal District – 4.7%.

In order to analyze the changes in the structure of sown areas of Penza region, clustering of data from 1980 to 2013 was performed on the basis of agglomerative hierarchical algorithm of cluster analysis. Indicators for the assessment were the annual data on sown areas of 7 crops most common in Russia: oats, spring barley, millet, buckwheat, winter rye, winter wheat, spring wheat.

As a result, two clusters were obtained: the first cluster is the period from 1980 to 1995 inclusive, the second one – from 1996 to 2013. This division is explained by the transition to market regulation mechanisms. Winter wheat seems to rank first regarding the sown area size, which on average is 35% of the total crop-sown area, against 19% in 1980-1890-ies. Oats sown area has decreased 5.5 times by 2013 in relation to 1980, millet sown area – 5.2 times, winter rye area – 6.1 times. Cuts on oats can be attributed to a decrease in the number of horses thanks to introduction of technical agricultural equipment. Buckwheat and spring barley crops have undergone less significant changes.

The average yields for different crops correlate with each other and vary slightly while remaining about the level of 15 tons per hectare. From this we can conclude that it is impossible to diversify the risks of crop failures by means of planting different crops, because the results for different culture are similar. However, the main objective of agricultural producers is to optimize the use of resources and reduce risks while pursuing their activities (Hardaker, Hurine & Anderson, 1997).

For agricultural companies involved in the cultivation of cereals, insurance is an important component of risk management, as the activities of these companies is influenced by many factors impossible to avoid or to modify. First of all it is weather and agro-climatic conditions. One must not omit the fact that the territory of Penza region, like the most of Russian territory, is located in the zone of risky agriculture, which increases the probability of future crop loss. However, only a limited number of farmers resort to crop insurance. In 2013 the cost of spring crop cultivation in Penza region amounted to 1.977 billion roubles, including 15.5 million roubles of insurance cost, which makes 0.7% of the total cost, and on winter crops it makes 0.3% of the total cost.

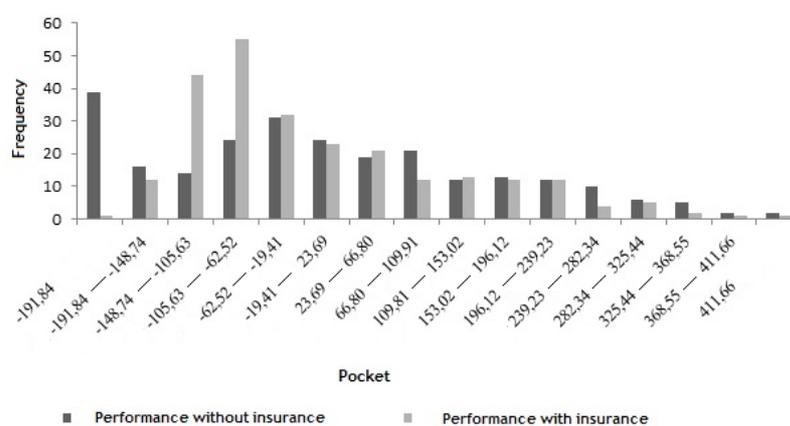
Most studies of the factors influencing the participation of agricultural companies in the insurance market show that it is large and high-yield farms acquire insurance policies, while small farms and those depending on deficit resources refrain from insurance because of their inability to pay their fees (Sherrick et al., 2003; Xavier, Townsend & Vickery, 2008).

One can suggest that the scope of insurance services in the market of agricultural insurance in Russia is negligible because of the lack of sufficient financial resources for paying insurance fees by agricultural producers. In order to verify the hypothesis, we use a simulation model of performance (Gujarati, 1992), built for the municipal districts of Penza region.

## Results

Let's consider the insurance process from the point of view of spring wheat producers. There is data on sown areas, cost of grain crops cultivation, total cost of crop growing for each district of Penza region. Using the results of simulation modelling (250 variants of the next year), we obtain the possible total yields and incomes from the harvest sale.

Figure 1 shows the financial results of all agricultural producers in the region both without taking insurance into account and considering insurance (by way of illustration, the financial results are divided into intervals), as well as the frequency of occurrence of a particular set of financial results.



**Figure 1.** Modelled financial performance of agricultural producers of Penza region without insurance and with insurance, mln. rub.

Without the use of security tools, in almost 40% of cases (the highest frequency) there are high losses of 191 million roubles and more. Low frequency is suggested for cases of significant profit of more than 411 million roubles.

The figure shows that insurance can reduce the variation (dispersion) of financial results. Most unprofitable projections are many times less probable, though occurrence of large profit projections seems also less probable.

In order to raise the efficiency of agricultural producers, crop insurance should be performed for main crops raised in specific natural and climatic zone and having an economic value for region development, in case of its destruction or damage by most probable in the area repetitive natural disasters and adverse weather conditions.

The study shows that the real interest insurance rate makes 35-47%; it is the percentage that enables an insurance company to comply with the commitment in 95 cases out of 100. For example, for spring wheat the interest rate in Penza region at a significance level of 0.05 was 35%, and for oats – 45%. At the same time, J. Duncan & R.J. Myers (2000) demonstrate by their insurance model that growth of risk fees reduces coverage of farms, and, under certain conditions, can lead to total collapse of the crop insurance market (Paris, 2008; Holzmann & Jorgensen, 2000).

Given that the profitability of grain crops makes 10-12%, and sometimes even less, agricultural producers just are not able to pay the said interest as contributions. The current average interest rate of 14% is far from 35-47%, hence the conclusion – insurance companies are most likely to bear the loss.

With the increase of risk degree, an insurance company can respond to the changed conditions by raising tariffs, refusing to insure high risks, limiting territorial coverage, transmitting risks of to the Government and reinsurers (Tucker, 1997; Mills, 2007; Khalafyan, 2007).

Another solution for an insurance company is to form a reserve fund. In Penza region, on average every 10th year is the bad harvest. This implies that the insurance company has 9 years of profit from crop insurance and there are potential means that can be directed to the establishment or replenishment of the reserve fund, which would reduce the interest rate on contributions down to 7-10%. This scheme confirms the basic principle underlying the insurance that the losses suffered in bad years are compensated from the funds accumulated in good years (Dandekar, 1976).

## Conclusion

In the context of Russia's accession to the WTO is governed by the size of state support for agriculture is regulated. If in 2013 the aid rendered to the agricultural sector amounted to 9 billion dollars, in 2018 this figure must be reduced to 4.4 billion dollars. This fact raises questions about revision of existing direct funding mechanisms in agricultural sector towards transition to the active use of security tools. A key task is to find the optimum insurance rates that will satisfy both insurance companies and farmers, as well as to outline the security procedure that would increase the efficiency of farmers.

Security strategy should imply development of innovative products and systems for introduction of insurance technologies that will reduce vulnerability

of agricultural producers in the face of natural factors and will provide support for sustainable agriculture (Mills, 2012; Batova & Rassadin, 2014).

Thus, Russian agrarian business asks not only for financial support, but also for creation of favourable, stable and long-term conditions for agricultural producers, both within the framework of the whole industry and in the field of insurance. In order to improve the efficiency of agricultural development it is suitable to develop and implement targeted programmes of agricultural insurance, based on the use of the optimum insurance rates that are generated with the aid of reserve funds of the insurance company.

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### Disclosure statement

No potential conflict of interest was reported by the authors.

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### References

- Anderson, J.R. & Hazell, P.B. (1997). Risk Considerations in Agricultural Policy Making. Risk Management Strategies in Agriculture. *Mansholt studies*, 7, 273-284.
- Barnett, B.J., Barrett, C.B. & Skees, J.R.. (2008). Poverty Traps and Index-based Risk Transfer Products. *World Development*, 36, 1766-1785.
- Batova, V.N. & Rassadin, V.V. (2014). Strategic management of enterprise labour potential as a tool for economic security. *Middle East Journal of Scientific Research*, 21(2), 401-405.
- Dandekar, V.M. (1976). Crop Insurance in India. *Economic and Political Weekly*, 11(26), 61-80.
- Duncan, J. & Myers, R.J. (2000). Crop Insurance under Catastrophic Risk. *American Journal of Agricultural Economics*, 82(4), 842-855.
- Goodwin, B.K. (2001). Problems with Market Insurance in Agriculture. *American Journal of Agricultural Economics*, 83(3), 643-649.
- Gujarati, D. (1992). *Essentials of econometrics*. New York: McGraw-Hill International Editions.
- Gurenko, E. & Mahul, O. (2004). *Enabling Productive but Asset-Poor Farmers to Succeed: A Risk Financing Framework*. Washington: World Bank Policy Research Working Paper 3211.
- Hardaker, J.B., Hurine, R.B. & Anderson, J.R. (1997). *Coping with Risk in Agriculture*. Wallingford: CAB International.
- Holzmann, R. & Jorgensen, S. (2000). *Social Risk Management: A New Conceptual Framework for Social Protection and Beyond*. Social Protection Discussion Paper 6. Washington: World Bank.
- Khalafyan, A.A. (2007). *Statistica 6. Statistical Analysis*. Moscow: Bean Press.

- Mahul, O. & Stutley, C.J. (2010). *Government Support to Agricultural Insurance*. Washington: The World Bank
- Mario, M. & Vedenov, D.V. (2001). Innovations in Agricultural and Natural Disaster Insurance. *American Journal of Agricultural Economics*, 83(3), 650-655.
- Mills, E. (2007). Synergisms between climate change mitigation and adaptation: an insurance perspective. *Mitigation and Adaptation Strategy for Global Change*, 12, 809–842.
- Mills, E. (2012). The Greening of Insurance. *Science: Policy Forum*, 338, 1424-25.
- Morgan, S.L., Marsden, T. & Morley, A. (2010). Agricultural multifunctionality and farmers entrepreneurial skills: A study of Tuscan and Welsh farmers. *Journal of Rural Studies*, 26(2), 116-129.
- Paris, R. (2008). Agricultural Insurance Market. *Paper presented at the annual meeting of the International Task Force*. Brussels, 245-253.
- Rassadin, V.V., Pavlov, A.J., Batova, V.N. & Kolesnikov, A.V. (2014). Evolutional-genetic approach to formation of sustainable development indicators of the agricultural territories. *Journal of Environmental Management and Tourism*, 2(10), 230-236.
- Sherrick, B.J., Peter J.G., Schnitkey, D., Ellinger, P.N. & Wansink, B. (2003). Farmers Preferences for Crop Insurance Attributes. *Review of Agricultural Economics*, 25, 415-429.
- Townsend, R.M. (1994). Risk and Insurance in Village India. *Econom*, 62, 539-591.
- Tucker, M. (1997). Climate change and the insurance industry: the cost of increased risk and the impetus for action. *Ecological Economics*, 22, 85–96.
- Varangis, P., Larson, D.J. & Anderson J. (2002). *Agricultural Markets and Risks: Management of the Latter, Not the Former*. Washington: World Bank Policy Research Working Paper 2793.
- Vavrova, E. (2005). The Czech Agricultural Insurance Market and a Prediction of its Development in the Context of the European Union. *Agric. Econ.-Czech.*, 51, 531-538.
- Wenner, M. (2005). *Agricultural Insurance Revisited: New Development and Perspective in Latin America and the Caribbean*. Washington: World Bank, 1-77.
- Xavier, G., Townsend, R.W. & Vickery, J. (2008). Patterns of Rainfall Insurance Participation in Rural India. *The World Bank Economic Review*, 1, 18-28.