E CONF SERIES

International Conference on Multidisciplinary Sciences and Educational Practices
Hosted online from Rome, Italy
Website: econfseries.com 27th January, 2025

ECONOMETRIC ANALYSIS OF THE INFLUENCE OF RISK FACTORS ON FARM ACTIVITIES

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Abstract

This article discusses issues related to yield risks that arise in the activities of farms. The factors causing crop risk in farms were assessed and analyzed based on econometric methods. It is established that the regions of Namangan region of the Republic of Uzbekistan correlate with the indicators of cotton and wheat yields. The territorial interrelation of risks was analyzed. A proposal and recommendations have been developed to reduce the risk to productivity on farms.

Keywords: risks, agriculture, risk management, yield risk, farms, production (or yield) risk, price or marketing risk, agricultural sector.

As is known, agricultural production is carried out under the influence of various levels of risks. This is due, first of all, to the fact that the production process is carried out on open land areas and directly depends on weather, climate and soil conditions, on the other hand, the uncertainty of the supply of agricultural products in relation to changes in market prices creates risks associated with the market or pricing for farms. In addition, a sharp decline in prices for agricultural products during the ripening period, labor shortages during harvesting, breakdown of agricultural machinery and equipment when necessary or shortage of fuel and lubricants, limited access to them, various livestock diseases, unforeseen changes in the regulatory framework governing the agricultural sector are the main sources of risks in farms. The above situations reflect the risks that farmers often face when managing farms. All these risks negatively affect the profitability of farm production.

Agriculture occupies a special place in the economy of the Namangan region of the Republic of Uzbekistan. In 2023, the region produced agricultural products (services) in the amount of 30015.6 billion soums. The growth rate compared to

2022 was 104.5 percent. In the production of agricultural products, the share of crop production was 57.1 percent, livestock products 42.9 percent, and in terms of farm categories, the share of farms is 27.5 percent, dehkan (personal subsidiary) farms 70.3 percent, organizations engaged in agricultural activities 2.2 percent. The role of farms in agricultural production in the region is very high, in 2023 it was 39.4 percent, they grew 489.6 thousand tons of wheat, 220.7 thousand tons of cotton raw materials, 341.3 thousand tons of potatoes, 238.1 thousand tons of vegetables, 32.3 thousand tons of forage melons, 129.8 thousand tons of fruits and berries. They account for 88.7 percent of wheat and 93.4 percent of cotton raw materials grown in the region.

In order to quantitatively assess the risks affecting the crop yields of farms, a regression model of natural factors (maximum, minimum and average temperature levels and precipitation) affecting the yield of winter wheat grown in the Namangan region in 1997–2023 was compiled.

$$Ln(y) = 2{,}62 - 0{,}47x_1 - 0{,}68x_2 + 1{,}18x_3 + 0{,}19lnx_4$$

Where: y – wheat yield, c/ha; x_1 – maximum temperature, ^{0}S; x_2 – minimum temperature, ^{0}S; x_3 – average temperature, ^{0}S; x_4 – amount of precipitation, mm.

According to the regression model, the factors influencing the yield depend on 87.7 percent. The regression model showed that the increase in the yield of winter wheat is positively affected by average air temperatures and the amount of precipitation during the growing season.

Therefore, when growing winter wheat, the influence of natural factors is strong, and ensuring high yields when growing wheat in areas of the region that are unfavorable for agriculture is a difficult task.

One of the most serious obstacles in the economic activity of farms is the risk of production (yield). Production risk affects the change in the yield of agricultural crops. This type of risk, simultaneously covering large areas, to a high degree of dependence leads to a decrease in yield, the death of agricultural crops in most farms.

The main reasons for such yield fluctuations can be explained by the influence of production risk. In addition, fluctuations in prices for agricultural products occur under the influence of market risks. Therefore, as the main sources of quantitative

expression of risks in the activities of farms, it is advisable to recognize two main variables: yield fluctuations and prices.

A correlation analysis of yield indicators for the main types of agricultural products, including wheat, grown on farms in the Namangan region in 2000–2023, showed the presence of varying degrees of correlation between the regions (Table 1).

Table 1 **Grouping of districts of Namangan region by wheat yield indicators by correlation coefficients**[1]

№	Districts	Classification of correlations by region			
		Weak (0,1 ÷ 0,3)	**Average (0,3 ÷ 0,65)**	**Above average (0,65 ÷ 0,80)**	**High (0,80 ÷ 0,99)**
1.	**Mingbulak district**	Yangikurgan	Uchkurgan, Turakurgan, Chartak	Norin, Kasansay, Namangan	Uychi, Pop, Chust
2.	**Kasansay district**	-	Yangikurgan, Uchkurgan, Turakurgan	Uychi, Norin, Namangan, Pap, Chust, Mingbulak	Chartak
3.	**Namangan region**	-	Yangikurgan, Chartak	Norin, Uchkurgan, Kasansay, Turakurgan, Pop, Chust, Mingbulak	Uychi
4.	**Norin district**	-	Uchkurgan, Yangikurgan, Turakurgan, Pop, Chust, Kasansay, Namangan,	Chartak, Mingbulak	Uychi
5.	**Pop district**	Yangikurgan	Uchkurgan, Chartak, Turakurgan, Norin	Namangan, Kasansay	Uychi, Mingbulak, Chust
6.	**Turakurgan district**	Chartak, Yangikurgan	Kasansay, Norin, Mingbulak, Pop, Chust	Uychi, Namangan, Uchkurgan	
7.	**Uychi district**	-	Yangikurgan, Chartak	Uchkurgan, Kasansay, Turakurgan	Pop, Norin, Mingbulak, Chust, Namangan
8.	**Uchkurgan district**	Chartak	Kasansay, Yangikurgan, Mingbulak, Norin, Chust	Uychi, Namangan, Turakurgan	
9.	**Chartak district**	Uchkurgan, Turakurgan,	Uychi, Yangikurgan, Pop, Chust, Namangan	Mingbulak, Norin	Kasansay
10.	**Chust district**	Yangikurgan	Uchkurgan, Chartak, Turakurgan, Norin	Namangan, Kasansay	Uychi, Mingbulak, Pop
11.	**Yangikurgan district**	Mingbulak, Chust, Pop	Turakurgan, Kasansay, Uychi, Uchkurgan, Namangan, Norin, Chartak	-	-

Natural, climatic and soil conditions, melioration status and fertility of lands, the level of water supply of regions and the specificity of the geographical location

[1] Developed by the author.

create various connections between the regions of the region in terms of wheat yield (or other agricultural crops). In particular, the connection between Chust and Pop, Chust and Mingbulak, Uychi and Namangan districts of the region is relatively high, which indicates that the agrotechnical characteristics of agricultural production in these areas are very close to each other and demonstrate a single strategic approach to production risk management.

In world practice, the method of alternate cultivation is recognized as one of the effective ways to mitigate production risks in farms.

Diversification of production based on the successive cultivation of agricultural crops, taking into account negative correlations, will mitigate yield risks and stabilize farm incomes. Growing various agricultural crops is considered an important area of strategic risk management in farms. Achieving a direct correlation between crop yields allows increasing farm incomes based on the high yield of each crop type in a season. However, such a close correlation between crop yields puts them at risk of risks inherent in one category.

A correlation analysis of the yield of cotton and wheat grown in farms in the Namangan region in 2000–2023 showed the presence of different correlations between the yields of these crops.

While a close direct correlation between crop yields in the regions of the region allows farms to obtain equally high yields from both types of crops in a certain season and increase their income, however, in an unfavorable season (for example, adverse weather conditions), such a risk is created as obtaining equally low yields from both types of crops in these years. Consequently, a direct (positive) correlation between crop yields indicates insufficient diversification of production in farms and the need for further improvement of risk management mechanisms in farms in these areas.

When studying the risks associated with production (or yield) and price, variation coefficients based on statistical data of individual farms are used. Based on the calculated variation coefficients of the yield of wheat and cotton grown in the farm in 2018-2023, the districts of the Namangan region were divided into a group by the variation level. The result of this grouping made it possible to estimate the

degree of fluctuations (risks) in the yield of wheat and cotton grown in farms in each district of the region (Fig. 1).

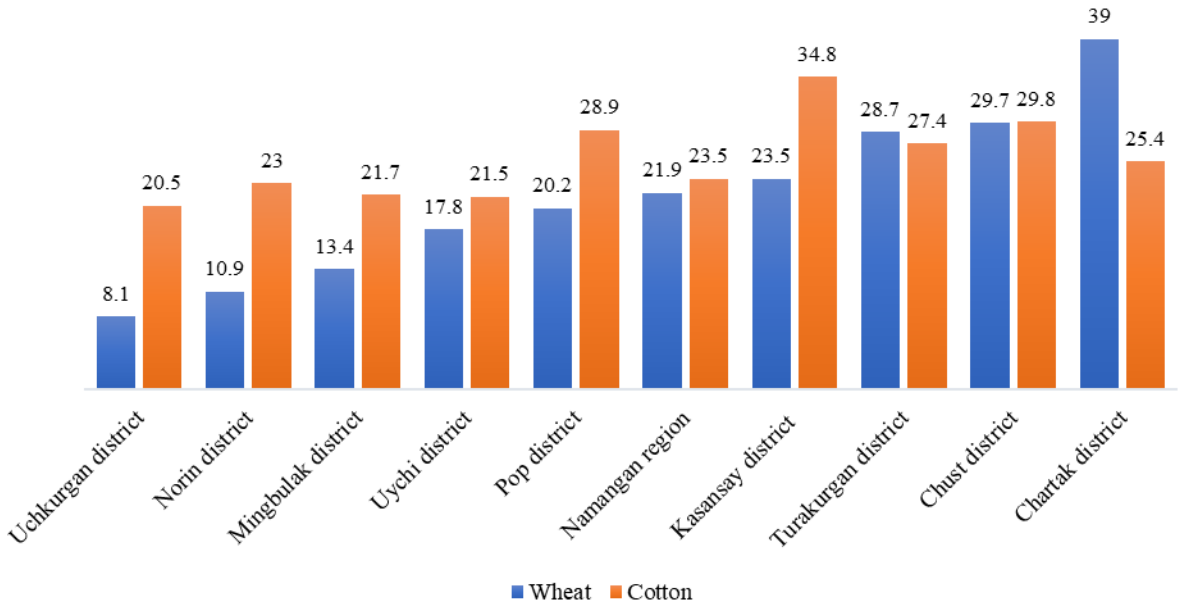

Fig. 1. Grouping of districts of the Namangan region by levels of variation in wheat and cotton yields [2]

As a result of the conducted research, the following conclusions and recommendations were made:

1. The main sources of risks in farms are natural, climatic and weather conditions, biological processes, seasonality, implementation of agricultural production in different geographic zones, end consumers, as well as frequently recurring natural disasters, fluctuations in crop yields and prices for agricultural products, imperfections of the agricultural market and financial services, including credit and insurance, rapid growth in prices for industrial resources necessary for agriculture, as well as changes in legislation.

2. The high dependence of the production process in farms on natural, climatic and soil conditions necessitate the widespread use of insurance opportunities in risk

[2] Developed by the author.

management. The development of public-private partnership models will allow for effective risk management in the "farm - insurance company - state" system.

3. Diversification of production in farms plays an important role in mitigating productivity risks. Growing two or more types of crops can increase farm income. However, a positive (tight) correlation between crop yields puts them at risk of production (yield) risk. An analysis of the correlation between the yield of cotton and wheat grown in cotton and grain farms in the Namangan region revealed areas with a relatively positive (tight) relationship and insufficient diversification of production. This dictates the need to improve risk management mechanisms in farms in these areas.

4. Risks in the sphere of agricultural production and food security of the country affect the activities of all economic entities in the agricultural sector, including farms. Therefore, it is advisable to divide the risk management system in agriculture into lower, middle and upper links, based on the degree and scale of their impact.

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