

CURRENT SITUATION, PROBLEMS AND DIVERSIFICATION OF INSURANCE MODEL IN THE SPHERE OF CROP PRODUCTION IN AZERBAIJAN

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Abstract

Climate change has a significant impact on agricultural productivity, particularly crop production. Research has been focused on the examination of a traditional insurance model applied since 2020 based on state support for the management of agricultural risks. Based on the study of substantial statistical data, the advantages, challenges, and drawbacks of this model in the process of crop insurance are discussed. The study focuses on the frequency of covered risks occurrence, as well as the interrelationships between them based on the country's geographical and climatic characteristics. Risk assessment allows farmers to determine the most likely directions of behavior that may arise in the process of insuring their products. Drought risk was particularly emphasized that is not covered by Agrarian Insurance Fund. Droughts are becoming more frequent as a result of climate change, and their uniform role in crop loss necessitates that the need to address this problem be recognized in current times. The authors substantiate that an index-based insurance model based on weather parameters is a viable alternative to the traditional insurance model for assuring drought coverage, and they advocate using it to diversify the insurance system.

Key words: *climate change, drought risk, index-based insurance, risk assessment, traditional insurance*

INTRODUCTION

Azerbaijan, like many other countries, has designed and executed several actions plans such as procurement prices, tax incentives, direct subsidies, concessional loans in order to compensate agricultural farmers for losses and damages incurred as a result of natural catastrophes and market calamities. Measures to ensure agricultural products have recently risen to the top of the list. On June 18, 2002, Azerbaijan passed the Law of Stimulating Insurance in Agriculture. The law's goal was to encourage the development of insurance in the agricultural sector by insuring the state's involvement in the insurance of agricultural producers' property and to strengthen the economic basis of the guarantee for indemnification of the damage caused by the insured event [15].

It seems from the name of the law that the main goal was to insure the property of agricultural producers. This law has had a

significant impact on the agriculture sector's development.

However, it should be noted that the goal of agricultural producers is to make a profit. From this perspective, the problem of minimizing the probability of income decline or loss of productivity caused by natural risks in the insurance mechanism of producers should be a priority.

In this context, the purpose of the paper is to analyze the insurance system adopted in Azerbaijan, its advantages and disadvantages as well as its development prospects.

MATERIALS AND METHODS

The National Hydrometeorological Service of Azerbaijan, the Ministry of Economy of the Republic of Azerbaijan, and the Agrarian Insurance Fund provided data for the article that was used for official reasons but not published in official statistics. The National Hydrometeorological Service's data on the parameters of hail, storm, hurricane, frost, and

other catastrophic occurrences during the previous 20 years allows for the determination of the frequency of these events in the administrative areas (districts), as well as the link between them. The Ministry of Economy's statistical data on land balance was utilized as the major evidence in pinpointing the source of the crop insurance development concerns. The Agrarian Insurance Fund's categorization data of insurance premiums written and claims paid in 2021 based on the size of land owned by farms plays a significant role in the evaluation of catastrophic risks.

Furthermore, connecting the information supplied by these authorities to current economic data and statistics aids in the investigation of many of the traditional insurance system's flaws.

According to official data from the Central Bank of the Republic of Azerbaijan, the place of agriculture insurance in the general insurance system was determined by defining the share of insurance premiums written and claims paid in agriculture in total insurance premiums and claims paid in all areas of the country [5].

RESULTS AND DISCUSSIONS

The current situation in agricultural risk insurance

Although agriculture insurance in Azerbaijan is carried out by private companies until 2020, the insurance industry seems to have very little interest in this area. It is no coincidence that such a condition has been noticed in

Azerbaijan in conjunction with the slow growth of agricultural insurance.

Even in previous years, the funds allocated from the budget to subsidize the agricultural insurance were not completely utilized. According to the Ministry of Finance of the Republic of Azerbaijan, despite the fact that the subsidies allocated for this purpose in 2013 and 2014 amounted to 1 million manats, its use was in 2013 amounted to 19 thousand manats (0.9%), and 23 thousand manats (2.3%) in 2014. Only 5 out of 26 companies in the insurance market offered their services for crop and livestock insurance during those years. In 2014, 82% of agricultural insurance premiums were on livestock and 18% on crop production. It is noteworthy that during those years share of crop products in claims paid was 64% of insurance premiums while livestock accounted for 8.6% [9]. These statistics have not altered considerably in recent years. Agricultural activities were naturally unappealing to private companies, as the number of insurance claims paid was more than insurance premiums in crop production, more than half in livestock.

Agriculture is one of the leading sectors in Azerbaijan. This sector accounts for 6-7 percent of the gross domestic product and employs around 36% of the population [21]. As a result, the agricultural insurance mechanism has a lot of potential and internal prospects for broad adoption and development. Despite this, agricultural insurance capacity has not expanded to the expected level. However, based on the current potential, this amount might be multiplied several times over.

Table 1. Share of agricultural insurance premiums in total premiums written in the Republic of Azerbaijan (thousand manats)

Indicators	2018		2019		2020		2021	
	Premiums	Claims paid	Premiums	Claims paid	Premiums	Claims paid	Premiums	Claims paid
livestock insurance	2,040.3	574.7	1,438.8	936.7	2,842.0	613.0	6,408.0	574.6
Share in total, %	0.42	0.24	0.21	0.31	0.39	0.0	0.76	0.13
crop insurance	639.8	180.3	183.8	0	9.2	0	6.171.0	28.7
Share in total, %	0.13	0.07	0.03	0	0.001	0.0	0.73	0.006
Total	486,074.2	237,250.6	556,866.6	257,109.6	728,634.1	465,153.1	843,897.3	458,726.3

Source: Data obtained from Central Bank of the Republic of Azerbaijan and processed by authors [5].

The distribution of agricultural insurance - premiums in total premiums written in the Republic of Azerbaijan in the period 2018-2021 is shown in Table 1.

According to the analysis of the table, the share of crop products accounted for 0.13 percent of total insurance premiums received in Azerbaijan in 2018, while livestock accounted for 0.42 percent.

These data have altered with the implementation of the Agrarian Insurance Law in 2019. Following a dramatic drop in insurance premiums in 2020, rates will rise significantly in 2021. Agriculture premiums amounted for 1.5 percent of overall insurance premiums, with 0.76 percent in livestock and 0.73 percent in crop production, respectively. Despite the rise in insurance premiums, claims paid were a fraction of what they were in 2018. In livestock, claims paid was 8.9% of the premiums collected, while crop production received just 0.5 percent. It should be noted that in 2021, total claims paid in the country contains for approximately 62 percent of total insurance premiums collected [21]. This figure of 0.14 percent is unsatisfactory in agriculture.

The growth of the agricultural insurance industry is effective as a result of long-term and large-scale government support, according to systemic risk analysis. Otherwise, the insurance market in the agricultural sector is weak and unsystematic.

The President of Azerbaijan signed a decree on the adoption of the Law of the Republic of Azerbaijan on Agriculture Insurance and establishment of the Agrarian Insurance Fund in 2019 in order to promote and publicize the insurance system in the agricultural sector. The law recognizes agricultural crops and crop production products, live stock, and aquaculture products as the primary subjects of agricultural insurance and outlines the state's primary obligations in this field. Agricultural producers' risks in terms of agriculture insurance were also determined at the same time. The law specifies the following - risks [16]:

- Natural disasters: hail, earthquake, storm, hurricane, landslide, fire - these risks are known as systemic risks.

Plant diseases and pests, infectious diseases and poisonings, attacks by wild animals, the spread and attack of especially dangerous pests, the actions of third parties - these risks are idiosyncratic risks.

According to the adopted law, the terms of the insurance contract are determined by the Agrarian Insurance Fund and implemented under its control. The President of the Republic of Azerbaijan issued a decree on the formation of the Agrarian Insurance Fund which is the key entity in charge of assuring the agricultural insurance system's organization, development, and long-term viability [2].

As a governmental organization, the Agrarian Insurance Fund is a non-profit legal entity that carries out insurance payments bearing agricultural risks. According to the terms of the insurance contract, 50% of the sum insured is paid by the insurer and 50% by the state. Only 14 crop products were intended to be insured by the Fund in 2019. The law was revised by Cabinet of Ministers Decision No. 398 of December 21, 2021, which included 27 additional crops to the list, bringing the total number of insured crop products to 41 [25]. Mudflow and flood, downpour, significant snowfall, and frosts have all been included in the systemic risk covered by insurance since about 2021. Systemic risks such as mudflow and flood, downpours are expected to be applied to all crop products, and significant snowfall and frosts will be applied to only 19 types of crop products [26].

It is important to highlight that the draft law is based on the Republic of Turkey's experience (TARSIM). The insurance system's mechanism is based on public-private partnership principles in conformity with this practice.

Without a doubt, this regulation will have a significant impact on the future growth of Azerbaijan's agriculture insurance sector. The advantages of the newly established agrarian insurance system are:

Using agricultural insurance companies as intermediaries. The involvement of private enterprises in the agricultural insurance system could boost the insurance market's

activity and speed up the protection of agricultural producers from risk occurrences.

- Involvement of independent experts. Independent experts can ensure flexibility, time shortening, and improving the impartiality of the damage assessment procedure in the case of an insurance event. Because an expert is unable to engage both in risk assessment or evaluating the extent of the damage.
- Differentiation of insurance tariffs for different products and application of discounts. The 5% insurance discount for young farmers (aged 29 and under) seeks to engage and encourage young people in rural regions to participate in the agricultural sector's growth [24].
- Entry into force of the insurance contract for wheat crops and insurance coverage (hail, storm, hurricane risks) begins from the date of the sprout of the crop. Formerly, once the crop sprouted, all risks were covered by insurance.
- Establishment of the Board of Appeal of the Agrarian Insurance Fund.

In any country, however, the operation of the economic system and the techniques used to regulate it are not faultless. The conditions and rules of agricultural insurance cannot be deemed flawless from this perspective.

The applied insurance mechanism may face certain shortcomings, as it belongs to the traditional insurance system. These shortcomings are determined both by the characteristics of Azerbaijan's agricultural sector and by the internal contradictions of the

traditional insurance system inherent in other countries. Azerbaijan's agricultural peculiarities arise from the country's territorial and geographical variety, and are shaped by variables such as climatic circumstances, farm activity structure, land reclamation system development, producer mindset, and so on. In our opinion, a detailed analysis of these features, the study of their impact on the development and diversification of the insurance market is of considerable scientific and practical relevance.

The source of problems in the process of applying the traditional insurance model

The overwhelming domination of small farms in Azerbaijan's agriculture is the cause of the traditional insurance system's slow development. According to statistics, the number of landowners with more than 10 hectares of land in 2020 was only 0.9%. This scenario is significantly more evident when measured in absolute numbers. The total number of landowners in the country in 2020 was 432,004 people and the total amount of land owned by producers was 1,288,703 hectares. The number of landowners with up to 3 hectares of land was 383,341 people (88.7%), and the total amount of land they owned was 720,639.2 hectares (55.9%). The number of the largest landowners (more than 50 ha) was only 298 people (0.1%), the total area of their land was 230,411.8 ha (17.9%). The remaining land plots were distributed among the owners of 3-10 hectares (Table 2) [27].

Table 2. Land ownership and distribution for 2020

	Owners by size, ha	Number of landowners	Land size owned by producers, ha	Share by numbers, %	Share by land plot sizes, %
1	≥ 50 ha	298	230,411.8	0.1	17.9
2	20-49.9 ha	1,027	44469.1	0.2	3.5
3	10-19.9 ha	2,634	51,873.4	0.6	4.0
4	5-9.9 ha	9,900	86,989.3	2.3	6.8
5	3-4.9 ha	34,804	154,320.2	8.1	12.0
6	≤ 3 ha	383,341	720,639.2	88.7	55.9
Total	+	432,004	1,288,703.0	100.0	100.0

Source: Data obtained based on the the reference “on submission of land balance” with the service number 02/16-08-18-859 issued by the Ministry of Economy of the Republic of Azerbaijan dated 10.04.2020. May 22, 2020 [27].

As it can be seen from the figures, smallholders definitely dominate the total share of landowners. It is no coincidence that

currently 90% of agricultural production is accounted for by small farms (family farms, households and individual entrepreneurs), and

10% by agricultural farms with relatively large landowners [21]. According to the Agrarian Insurance Fund's figures, larger farms had a complete edge in terms of insurance premiums collected by the number of farms producing crop goods in 2021. Medium-sized farms with land between 10 and 100 ha accounted for 26.4 percent of the total, while tiny farms with property under 10 ha accounted for only 0.52 percent [10]. As it can be seen from the figures, large farms are usually interested in obtaining insurance policies. Because of the positive scale effect on large farms, high productivity, large cash flows and, accordingly, extensive financial resources make it necessary to obtain an insurance policy. Unlike large farms, small farms avoid traditional insurance. They claim that the absence of scale effect on tiny arable land has little impact on production, hence insurance is unnecessary. Simultaneously, small farmers' operations, along with their financial limits, make it difficult for them to pay insurance payments. On the other hand, traditional insurance of 2-3 hectares has no beneficial impact on the activities of insurance companies. Small farms are typically spread out over the region's villages, with a significant distance between them. The expense of signing insurance contracts is multiplied by the small size of farms and their distance. This is because, in the case of a risk occurrence, a large number of small farms need to be visited by independent experts to assess the damage. This significantly increases the cost of expert services. In most situations, however, insurance premiums do not fully cover the expenses of signing insurance contracts due to the modest quantity of insurance premiums for small farms. Small farms may be excluded from the insurance system due to the high degree of service and transaction expenses of contracts with small farms, which are not cost-effective for insurance companies. Such a structure of land ownership is one of the main obstacles to the sustainable development of the insurance market in agriculture.

Assessment of risks included in the agrarian insurance package

The occurrence of traditionally insured system risks usually depends on the geography, climatic conditions and sea level of the economic regions. The prevalence of hail occurrences in the Republic's regions during the last ten years (2011-2020), which are considered systemic concerns, demonstrates that this event is more often in the north-western areas. This is a rare occurrence in the central and south-eastern parts of the country. For example, last 12 years, hailstorms occurred 57 times in the Ganja-Dashkesan and Tovuz-Gazakh economic areas, 40 times in the Sheki-Zagatala economic region in the northern zone, and 25 times in the Guba-Khachmaz economic region. The economic regions of Baku and Absheron-Khizi, which are part of the eastern region, have never experienced anything like this. In the last 12 years, it has occurred 6 times in the Shirvan-Salyan and Central Aran economic regions, but only three times in Lankaran-Astara. Hailstorms hit the northwest's mountainous and foothill regions at the same time. Hail is uncommon in the lowlands. For example, hailstorms occurred 23 times in the northern territory of Sheki in May-September over the previous 9 years (2012-2020), and 10 times in Ganja and nearby territories in the same months of 2010-2020. Hail has only been seen three times in the previous ten years in the Kurdamir region, which is part of the Central Aran economic region - in 2013, 2014, and 2016 [19].

Analysis of the frequency of storms and hurricanes shows that these events vary depending on the region's geographical layout. Their frequency almost coincides with the areas with the highest hail. Stormy days were noticed almost every year in March in the Gadabay region, which is located in hilly terrain when the crop's vegetation phase began in the previous 20 years (2000-2019). The most recent hurricane, however, occurred in March of 2013. These occurrences are uncommon in the districts of Imishli and Sabirabad. Imishli witnessed hurricane in March 2006, May 2008, and June 2009, while Sabirabad had hurricane once in February, March, and May 2016, as well as twice in April. The occurrence was extremely

infrequent in subsequent years and did not coincide with the crop's growth cycle [19]. Natural disasters, such as hurricanes, coincide geographically with climatic storms. In the previous 20 years, however, the number of hurricane days has been lower than the number of stormy days. The Ganja-Dashkesan and Tovuz-Gazakh economic regions have the most hurricane days, and they frequently occur during the growing season of agricultural crops. Hurricanes have hit the region 21 times in March-May during the last 20 years, but just twice in June and July in 2013, 2019. In March 2013, a hurricane struck the Gadabay district, which is part of the Ganja-Dashkesan economic region.

The classification and analysis of storm and hurricane threats pose certain concerns. A storm is defined as wind speeds ranging from 20.8 m/s to 32.6 m/s, according to meteorological science. It becomes a hurricane when the wind speed surpasses 32.6 m/s [19]. It's difficult to see how the Agrarian Insurance Fund will pay for storm risk insurance. This occurrence is regarded as follows in terms of insurance: Storm risk coverage includes damage caused by rain, snow, and hail with or without precipitation, as well as damage caused by the impact of objects overturned, dragged, or thrown by the wind at a height of 10 m and a speed of more than 25 m/s [24]. It is understood that if a wind with a speed of more than 25 m/s blows below a height of 10 m and damages the product, it is not considered an insured event. The question arises: Which crops and fruit trees have a height of more than 10 meters? Second question: By what criteria is a wind considered to be a storm only when the speed is more than 25 m/s? However, according to the accepted normative rule, the storm occurs when the wind speed exceeds 20.8 m/s. It should be noted that the insurance terms of the Agrarian Insurance Fund were approved by the Cabinet of Ministers. It's easy to see how insurance firms may take advantage of this type of storm risk assessment. As a result, a situation like this between insurers and insureds might dramatically raise moral hazards, resulting in an unresolved controversy. In our opinion, these insurance

terms should be reconsidered and adjusted to properly determine the storm risk coverage.

Let's return to our topic's analysis. Farmers in various geographical and climatic zones of each economic region can forecast the frequency of hail, storms, and hurricanes in their areas based on personal experience. Accordingly, farmers could estimate the possibility of high or low risk as a result of these occurrences in their climate and geographical location. The probability of these catastrophes is minimal for farmers operating in the region's plains but high in the mountainous and foothill regions. As a result, producers in low-risk locations may refuse insurance, despite the fact that the average tariff rate for the economic region is reasonable. In this light, we argue that the differentiation of insurance tariffs by economic regions is ineffective. In our opinion, insurance tariffs should be differentiated according to geographical and climatic conditions within each economic region. The amount of the tariff rate in the high-risk portions of the economic region (mountainous and foothill) should be different from the low-risk areas (lowland) where the risk event is less likely to occur due to the hail event.

Local farmers commonly consider losses caused by fires, earthquakes, and landslides to be an emergency. They believe that since the government will assist them in an emergency and reimburse them for their losses, why should they invest money to insure such events? Furthermore, consider that earthquakes and landslides cause property damage (buildings and structures). Farmers see the expenditure as a loss or non-refundable charge because it is already covered by property insurance due to earthquakes and landslides. The expense of insuring such disasters is referred to as a "loss" or an "additional tax."

The occurrences that may arise as a consequence of the acts of third parties included in the insurance package and deemed an idiosyncratic risk are the most dubious in terms of the insurance. In terms of insurance, such an event is described as follows: The term "actions of third parties" refers to

damage caused by other people's actions or inactions, excluding family members of the insured or beneficiary [24]. The classification shows that the insurance terms do not accurately explain this event and do not identify the particular events it covers. The general description of the damage caused by the actions of third parties can be interpreted differently by both the insurer and the insured. By resulting in diverse interpretations, such a generalization might generate a moral risk for both parties to the insurance contract. Damage caused by the actions of a third party occurs when one person's livestock enters and graze on the insured land. This occurrence will be considered a third-party act by the insured. However, the insurance company may assess the incident as either intentional or as an act of the insured's family members. As a result, the formation of a large dispute and mistrust between the insurer and the insured, as well as the requirement for a court-ordered resolution of the case, might result in a rise in transaction costs on both sides and can lead to the emergence of moral risks. In our opinion, clarifying the repercussions of third-party actions plays a significant role in resolving difficulties that may develop in many forms.

Farmers are intensely interested in the insurance package that covers crop disease and pests, the spread and assault of particularly severe pests, and frost risks. Incorporating these risks into the insurance of other systemic risks by making additional payments and combining them into a single package, on the other hand, dramatically raises the insurance tariffs for farmers. For example, in this case, the additional tariff payment of the insurance package for wheat producers is 3.84 percent in Ganja-Dashkesan and Gazakh-Tovuz economic regions, 3.59 percent in Sheki-Zagatala economic region, 8.1 percent including frosts and showers on grape products and in other locations, percentages range from 3.7 percent to 9%, depending on the product line [24]. When these additional tariffs are added to the base tariffs, the general insurance policy's cost rises even higher. Insurance tariffs for other crops that are the subject of the insured event have also been increased in this interval. This, in

turn, may raise the overall amount of insurance payments while discouraging farmers from entering into package insurance contracts. The statistics on insurance payments support this viewpoint. According to AIF, payments for insurance events such as crop diseases and pests accounted for 87 percent of total claims paid in 2021 [10]. We consider that either the extra premium should be eliminated or the risks should be addressed separately in the insurance package. Individual risk coverage can help diversify the insurance market.

The analysis of risks included in the insurance package shows that farmers will not be interested in tariff rate differential based on economic areas. Because every farmer is primarily concerned with the dangers that are likely to arise in his locality and climate. If catastrophic occurrences such as hail, storms, hurricanes and etc. are rare in the territory where it operates, it will not require an insurance contract since the risk and likelihood of losses are minimal. On the other hand, policyholder experience indicates that the danger of moral risks is quite high. Farmers have a high level of distrust for insurance companies due to independent experts' assessments of systemic risks and competent authorities' confirmation of the existence of the event. Because there are serious issues about the objectivity of the experts' judgments and the accuracy of the risk assessment. At the same time, the insurance of crop diseases and pests, pest dispersion, and similar events such as frost can be an obstacle to the development of the insurance system, as the insurance coverage of risks arising from natural disasters doubles the amount of payment. For the reasons stated above, this indicates that anti-selection in the agriculture insurance market will become more intense. This process can be hastened since insurance of systemic risks in the agriculture industry is structured on a voluntary basis rather than being mandated by legislation. As a result, putting the rule of large numbers into practice in the insurance industry will be tough. In our opinion, it may be more efficient and rational to separate the insurance of crop diseases and pests, pest

dispersion, frost-like events from the general insurance package and apply them independently. At the same time, it might be a significant step toward diversifying the insurance market and providing farmers with more options.

The inclusion of spring frosts, which are distinctive of Azerbaijan, in the insurance package as insurance risks in 2021 should be seen as a very beneficial development in the insurance regulations and conditions adopted by the Cabinet of Ministers. In agriculture, the spring season, which runs from March through April, is noted for crop germination and fruit tree blossom. During this time, even

the tiniest spring frosts can result in significant losses of blossoming fruit trees and sprouting crops. However, it is remarkable that just 19 species of fruit are frost-protected, and other plant items are not insured. It's worth noting that the damage caused by spring frosts varies depending on the kind of crops and the degree of frost. For example, in order for cotton to germinate, the soil must have a positive temperature of 12-14 degrees in April. Temperatures of 1-2 degrees below zero and even frosty weather for a day cause a large loss of cotton. Grain is not adversely affected by frost up to 15 degrees.

Table 3. Number of frosty days during the growing season in seven administrative regions of Azerbaijan

Districts	Barda		Shamkir		Tartar		Ismayilli		Shaki		Gadabay		Kurdamir	
	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr	Mar	Apr
2000	7		7		4		17		9		26	1	5	
2001							1				12	2		
2002	3		1				3		3		12	11		
2003	5	1	1		3		15	2	16	1	31	14	3	
2004	2	3	1				12	6	7	3	16	12		
2005	3		3		2		13	4	4	2	23	7		
2006	1		1				5		1		15	5	1	
2007	2		1		1		11	2	3		31	26	2	
2008			0				7				6	0		
2009	2	1	3				11	3	4	1	15	13		
2010	3		2		2		5		3		18	10		
2011	4		1		2		15	2	8		21	9		
2012	8		6		9		23				28	0	6	
2013	1		2		2		7		3		14	9	2	
2014		2	2		2		2	2	2	1	20	5		
2015	2		0				6		4		26	7		
2016	1		1				2		4		12	4		
2017			0				9	4			15	2		
2018			0						1		8	2		
2019	0	0	1				4	1	1	2		5	1	

Source: Data obtained based on the reference of the Azerbaijan Regional Hydrometeorology Center 20/326, dated 16.03.2021 and processed by the authors [19].

The 20-year analysis by month shows that frosty days in March, April, and in some mountainous areas, even in May, are typical for Azerbaijan. For example, spring frosts in March are common in the Ganja region. Even in April, this phenomenon may be seen in the mountainous Gadabay district. During the vegetative phase, frosty days have been noticed in the lowlands. However, there were relatively few frosts compared to mountainous areas. From 2000 to 2016, spring frosts were noticed regularly in March in the Barda

district of Central Aran Economic Region, where cotton is widely grown, and again in April 2014 for the last time. Even in the Kurdamir region, which is located in the warmest zone of the country, this happens about every 4-5 years. Sheki region is one of the most widespread regions of grain production in the country. As can be seen from the table, the number of frosty days in the Sheki region is repeated every year in March, and occasionally in April. In general, a statistical investigation of the frequency of

spring frost days reveals that this phenomenon is more prevalent in locations where hail, storms, and hurricanes occur and that there is a link between their occurrence. As a result, having frost in the insurance package, along with other products other than fruit, might raise agricultural producers' interest in signing an insurance contract and make it more appealing. This idea is confirmed by world experience. It is legitimate for risks connected with frostbite to cover all insured items in virtually all nations where conventional insurance is practiced, and it is considered that this phenomenon plays a significant part in inflicting losses to farmers. We believe that increasing the supply of frost-sensitive crops will improve the effectiveness of the agricultural insurance system.

An alternative to drought risk management

Climate change has increased the frequency of mudflow, floods, and droughts throughout the world in recent years, owing to the "greenhouse effect" on the earth. These occurrences are increasingly becoming one of the leading causes of agricultural output loss. In addition to the conditions adopted in 2021, the provision of mudflow and floods by the Agrarian Insurance Fund is commendable. However, on the other hand, drought was not included in the insurance coverage as a risk under the Agrarian Insurance Fund's terms. According to the study of risks covered in the package the selection of risks is based on three key factors: a) area coverage, b) frequency of occurrence, c) amount of loss or damage. Our study suggests that the main types of risks (hail, storm, hurricane) covered by the area coverage and probability of occurrence are usually typical for mountainous and foothill areas. As a result, farmers in these locations face significant losses. Despite the fact that farms are insured, they will not be able to obtain money in the case of a drought since the drought is not covered by the insurance package. Droughts, on the other hand, can occur regionally or even nationally, unlike localized dangers. Agricultural farmers, regardless of their location, might suffer significant losses as a result of this. Given that non-irrigated croplands account for 40 percent of the sowed

area of agricultural crops in Azerbaijan, with 60 percent of the sown area in the Sheki-Zagatala and 78 percent in the Lankaran economic region, it's not difficult to see how critical it is to tackle this issue [11].

Drought insurance through the traditional insurance system, on the other hand, has shown to be a major problem and inefficient. The fundamental reason is that the drought is homogeneous, unlike the local hazards covered by typical insurance. Local risks generally arise in a specific area of the economic zone, and only those farms involved in agricultural production in such regions experience losses as a result of their negative effects. Local risks are short-term (one or more days) and the damage occurs during a certain period of the product's vegetation process. It is not difficult for experts to precisely quantify farmers' losses as a result of this. Insurance company payments for the covered event have no substantial effect on their financial situation. Because the risks are spread among a vast number of farms, according to the law of large numbers.

However, a homogeneous drought can affect several economic regions at the same time and due to its longevity (several months), it can have different levels of losses depending on the intensity of the product during the growing season. In purely economic terms, there is a correlation between drought and crop vegetation, and the intensity of drought is correlated with the level of productivity. In this case, the intensity of the drought changes, and the level of productivity becomes a dependent parameter. The intensity of drought can be mild, strong, or severe. Its level of intensity is formed under the influence of factors such as temperature, wind speed, soil moisture, humidity, and even the location, quality and slope of the soil. For example, prolonged lowering of the temperature during the growing season will keep the soil moist by reducing the level of evaporation. Even if the amount of precipitation is modest in this situation, it will have no effect on productivity, and vice versa. During a drought, the various impacts of different combinations and changes in meteorological parameters on productivity make it impossible

to cover this risk with traditional insurance. Because it will be needed to have information on various meteorological parameters to assess the damage by experts in the insurance event. As a result, the risk of moral hazards will rise, making it harder to estimate the damage objectively. In terms of economics, the probability that the transaction costs associated with insurance companies collecting and processing meteorological data will be higher than profits does not justify traditional insurance coverage of drought (particularly on non-irrigated lands) as a risk. For the reasons stated above, it is not appropriate to cover the drought with a traditional insurance scheme even on irrigated farms. First and foremost, this is explained by information asymmetry and the emergence of moral risks. For example, ensuring drought on irrigated lands discourages producers from irrigating their fields during droughts to reduce costs. They may think: "If the crop is insured and there is a drought, why should I irrigate the field at extra cost? The insurance company will already cover my losses." This is already a moral risk for the insurance company by the producer. An insurance company may only avoid moral risks as a result of asymmetric information by placing a "guard" next to each producer. This can drive up transaction costs to the point where the insurance industry becomes economically irrelevant.

From our perspective, the introduction of weather-based index insurance as an alternative model which is a unique form of agricultural product insurance that has the capacity to alleviate the challenges caused by existing drought insurance techniques might represent a turning point in this sector [4, 3]. We do not intend to go into great depth on the nature and operation of the parametric insurance model in this paper. The nature, advantages, and disadvantages of indexed insurance have been and continue to be addressed in international scientific papers [1, 17].

It should be underlined that the co-authors of this work did a thorough investigation into the nature of index insurance and the necessity for its application in agriculture in Azerbaijan and

made relevant proposals [13]. In 1949, American scientist Harold G. Halcrow suggested the notion of insurance based on air parameters for the first time [7]. In the 1990s, this strategy was initially implemented in the United States and England. Currently, many developing countries (Morocco, India, Mexico, Kazakhstan, etc.) are implementing pilot insurance programs based on weather indexes to protect farmers from drought or excessive rainfall [12, 14].

As previously said, the drought has a homogenous power and is highly long-lasting, affecting a vast region. As a result, there is a high correlation between drought and productivity. This enables you to compensate for the loss of the insured object using an index created using a specific set of weather parameters. This is due to the fact that the predefined index exceeds the specified boundaries (triggers) of air parameters, resulting in product loss. Parameters such as soil moisture, air temperature, or precipitation are used as a digital index during the growing season of the product. The amount of coverage for losses due to drought depends on the degree of change in the insurance index. For example, the value of the index is determined by the fact that the amount of precipitation exceeds the set triggers for every 1 mm^2 less than the norm.

In the previous 20-30 years, the experience of using index insurance in many countries has proven the following advantages over traditional insurance:

- Drought data from hydrometeorological and agrometeorological stations is used as an independent source, ensuring information independence, openness, and objectivity. As a result, policyholders and insurers are unable to affect the index. This, in turn, eliminates the problem of asymmetric information, moral risk, and anti-selection [28].
- Because the indexed insurance model ensures the cause of the covered event rather than the consequence, agricultural producers do not need to report losses or prove reimbursement to the appropriate authorities. This implies that expert evaluations and judgments aren't required to assess the damage caused by the insured event.

- Because of its simplicity and low transaction costs, this model appeals to small farmers, and they become active players in the insurance market. It's no wonder that parametric insurance is more popular in developing countries, where small farms are more dominated [18, 8].

- The experience of countries that have widely applied the index insurance model shows that that it greatly boosts agricultural investment. The majority of Ethiopian farmers choose to save their money rather than invest it. Because there is no typical drought protection system in the country, so, they are hesitant to invest in the sector and use allocated funds as a "safety bag". On the contrary, farmers in Ghana and India are not frightened of drought and are willing to take new risks in order to boost yield. The availability of insurance based on the precipitation index is what drives people to invest [29].

- Improves agricultural producers' access to financing and promotes the growth of the financial industry in general. Commercial banks are usually more interested in lending to insured entities.

However, the parametric insurance model should not be taken as a universal tool that can be applied in the event of a drought. The point is that there are several restrictions to this model's applicability. For example, the application of an indexed insurance model for water-loving products (grapes, orchards, cotton, etc.) is almost inefficient. The experience of India, Kazakhstan, and other countries applying this model shows that index-based insurance is more effective in the insurance of grain products. Because grain products are more resistant to drought. Even in the case of a severe drought, according to statistics, farmers in Azerbaijan get a minimum of 10-12 quintals per hectare, which fully covers 50% of the cost of production. It's no wonder that wheat and barley products accounted for 59 percent of insurance premiums collected in the sector of agricultural production in 2021 [10]. Because these crops are mostly produced on large farms and are heavily reliant on natural disasters, they collect a significant amount of

coverage. Given that just 68.1 percent of the country's cereal demand (excluding rice) is now satisfied, including 57.1 percent for wheat [22], the use of this methodology might help the country become more self-sufficient.

Another issue with this model's implementation is the danger of the base. The problem is that even if the air temperature and precipitation are relatively equal throughout the region, productivity in this region can vary from site to site for a variety of reasons (eg, soil quality differences). According to the terms of the index-based insurance contract, farms operating in the existing area must receive an equal amount of coverage, although productivity may vary from field to field for these reasons. In this case, a situation may arise in which some farms will be guaranteed despite a decrease in productivity, or, conversely, some of the local losses of a farm will remain unsecured. Therefore, farmers who receive an insurance policy are at risk of loss in the event of an accident. Because the general index is based on the average for the entire region. This is known as basic risk, and it is the most significant disadvantage of indexed insurance [6, 20].

If the variety in the productivity of farms operating in a region increases, the base risk level rises; conversely, as the variance reduces, the base risk level falls.

Analysis of statistical data on grain production shows that the country's productivity varies mainly between regions, depending on the climatic zone and geographical area. The average grain output in the Sheki-Zagatala economic region, for example, was 32.7 quintals in 2020. However, in the administrative districts included in the economic region, this productivity was 30.5 quintals for Sheki, 39.5 for Balakan, 36.8 for Zagatala, 36.2 for Gakh, 31.4 for Oguz, and 32 for Gabala [23]. If we compare the productivity of the six administrative districts in the economic region, we find that the productivity of the three administrative districts (Sheki, Oguz, and Gabala) is nearly identical, at around 31 quintals. Despite their great output, the other three areas (Zagatala, Gakh, and Balakan) have nothing in common. When these conditions are equal, the variation

between the productivity of grain producers operating within the regions is negligible. This means that the probability of base risk within the administrative district is significantly reduced and, accordingly, the possibility of applying the model increases.

In the paper, the results of our study can be summarized and discussed in the form of brief theses.

- The current status of agricultural crops and crop products insurance in the country is several times lower than the sector's potential. Crop insurance premiums and claims paid account for the smallest percentage of overall insurance premiums and claims paid obtained in the country.

- The prevalence of small farms in this area is the major cause of this scenario. According to statistical data, large farms are more interested in insuring against natural risks, and their share of the collected insurance premiums is 2/3.

- The majority of collateral risks are found in mountainous and foothill locations, whereas they are uncommon in lowland areas, according to a study of their prevalence during the last 20 years. The use of identical insurance rates for economic areas ignores the diverse geographical and climatic characteristics of the territories that make up these regions. This can accelerate the anti-selection problem in the applied model. It is more practical to differentiate tariff rates based on each administrative region's geographical and climatic circumstances.

- Certain risks (earthquakes, landslides, fires) are more often accepted by farmers as the subject of property insurance.

- There is a need to clearly identify the signs of several risks (storm, hurricane, third party intervention) in the insurance.

- Covering the most significant risks in agriculture, such as frost, crop diseases, and pests, with the primary insurance package and the payment of supplementary insurance premiums, doubles the entire insurance cost and makes it inaccessible to many farmers. Independent collateral for these risks can play an important role in the diversification and development of the insurance market.

- Traditional insurance cannot cover droughts (particularly in non-irrigated areas), hence an index-based insurance model can be utilized as an alternative. Many other countries' experiences also show that the index insurance approach is more successful and plays a key role in limiting drought damage. The necessity for index-based insurance is explained by the fact that droughts' extended duration, which covers a systemic risk of a homogenous nature, and their widespread coverage strongly correspond with agricultural production (particularly grain), necessitating the use of the air index.

CONCLUSIONS

Despite several flaws in the implementation of the traditional insurance system in agricultural risk insurance, we believe that the adoption of legislation in the field of agricultural insurance in 2019 was a significant step in risk management. Its diversification, on the other hand, might be critical to the growth of the agricultural insurance industry. In particular, the application of an air index-based insurance model in the effective management of drought risk can eliminate the problem that traditional insurance cannot solve in this area.

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