IMPACT OF RISK MANAGEMENT ON SUSTAINABLE FARMING BUSINESS

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Abstract
The purpose of this study is to evaluate the instruments utilized in agricultural risk management. The study's goals are to highlight the hazards that Romanian farmers confront and to uncover strategies to mitigate these risks. In this regard, we present an analysis of agricultural risks, the role of agricultural insurance and the impact of risk management on the sustainability of agricultural holdings. The research methodology is based on various reports, official statistics, macroeconomic analysis, case studies, analysis of documents issued by organizations representing the SME sector and the agricultural business environment. After collecting the data, qualitative and quantitative methods were used to express the research results. The study emphasized the constraints that farmers face (depending on the size of the enterprise), the influence of climate change on agricultural output, the main financial risks (e.g., price risk, production risk), and suggested methods for implementing agricultural insurance (eg. production, income insurance). The study also shows that price and production risks such as price volatility and climate change have a significant impact on the sustainability of agricultural holdings. The main conclusion of the study shows that risk management tools encourage farmers to participate in sound risk management. Finally, the results of the research can provide important guidelines in substantiating the needs of risk management in the agricultural sector.

Keywords
Agricultural insurance, Climate changes, Financial constraints, Price risk, Production risk.

JEL Classification
H11, G22, G32, O13, Q14

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Introduction

While the agricultural sector is certainly not unique in terms of its risk exposure, the recent impact on the world economy due to the outbreak of COVID-19 and the isolation procedures put in place to control the spread of the disease provides a reminder of how Many industries are vulnerable to unforeseen risks - government policies have evolved over the last century to address agricultural risks and protect producers from their consequences. At the same time, events such as COVID-19 have broadened the understanding of how shocks outside the agricultural sector can also have an impact on agricultural activities; including unexpected shocks to labor markets and inputs. At the same time, the risk landscape for agriculture is evolving due to climate change, increasing attention to these tools and their usefulness in helping the sector cope with these impacts, as well as their potential to reduce incentives to adapt to changing circumstances.

The theory of changing risk profiles can often require a reassessment of the responsibilities of farm managers and governments to properly manage this long-term risk.

The agricultural production system can be considered as a set of productive activities in the field of plant cultivation and animal husbandry, supported by natural resources, in which the land has a dominant role, as well as material, human and financial resources, with the aim of obtaining agri-food products and for various industrializations, at a certain level of economic efficiency.

In agriculture, unlike the other branches of the economy, the production activity is directly or indirectly influenced by the natural pedoclimatic conditions. If in other sectors of the economy the results obtained depend to a large extent on labor productivity, organization and management of economic activities, in agriculture, at the same level of organization and management of productive activities and level of equipment with means of production, the yields obtained per unit surface may be different depending on the favorable climatic conditions.

Agriculture has a number of specific elements that influence productivity and mode of production such as: cyclical production, caused by seasonal dependence, instability of production and agricultural incomes due to climate change and markets, slower economic growth in agriculture compared to other sectors of the economy , high costs related to the supply of inputs outside the branch, lower prices for delivery of goods, natural risks, the market for agricultural products, difficulties encountered on the ground, compliance with the terms of supply and delivery of goods, waste, etc.

Risk management in agriculture is important for several reasons: even if reducing agricultural risk does not always improve welfare, failure to manage risks has a direct impact on farmers, revenue, market stability and possibly food security. The latter is relevant in developing countries, but also for the most disadvantaged in the EU, where low stocks lead to dramatically higher prices.

Improved and sustainable productivity in the agricultural sector plays a very important role in economic development. Concerns about the sustainability of agricultural systems include the development of new technologies and practices that do not harm environmental goods and services, which are accessible and efficient to farmers and which lead to increased food productivity.

Competition for investment financing sources is high and increasing the sustainability of agricultural holdings becomes eminently mandatory, especially in the context in which the review of specialized studies has not found the existence of an integrated material that includes an interdisciplinary approach to financial management, applied in agricultural companies.

Risk can be defined as the potential deviation between expected and actual results. While this deviation can be positive or negative, a negative outcome is of greater importance from a practical point of view and is usually at the heart of decision makers. In this paper, we consider risk management as a range of techniques and tools that can be applied to avoid or minimize losses and to take advantage of opportunities.

The two main risks that farmers face - production volatility and price volatility - are expected to increase. Indeed, on the one hand, climate change will lead to an increased occurrence of extreme weather through events that will adversely affect production/hectare. On the other hand, long-term imbalances between supply and demand are expected worldwide due to structural factors: increased demand - driven by population and rising incomes - combined with water, arable land and energy shortages. Low stocks may lead to increased price variability.

For decades, several predominant developments in European agriculture have been relevant to the variability of farm income:

- the variability of the yield determined by the weather was coupled with a constant increase of the average yields, determined by the technological innovations;
- relatively stable prices also followed an upward trend;
- due to interventions in the Common Agricultural Policy (CAP) market, farmers have increased their share of non-farm income (eg. agrotourism).

As a result, agricultural risk management tools in Europe have focused mainly on yield variability (excess marketing production, technological innovation and yield assurance) and neglected price stabilization tools, such as futures and forward contracts, options and storage management. Under the CAP reform, it is now expected that a growing number of private instruments will be developed to manage price change.

1. Review of the scientific literature

In agriculture, profit margins are declining and farm income volatility is rising. This is partly due to the fact that farmers need to invest in order to achieve a higher level of productivity and a higher scale of production (Chartier and Cronin, 2017). With a small margin, even a small change in prices will result in relatively strong fluctuations in revenues. Fluctuations in prices and yields combined with a lower margin and a higher volume of production per farm lead to increased income volatility (Akhtar et al., 2019;

Cordier and Santeramo, 2019). This is an incentive to use effective risk management tools. Farmers face a number of risks that are often interconnected (Bolden et al., 2018).

Six types of risk are generally considered in agriculture, according to their sources:

- production risks - related to variations in crop yields and animal production, affected by a number of factors: weather conditions/climate change, pests, diseases, technological changes as well as the management of natural resources and water (Shadbolt et al., 2010);
- price and market risk - associated with the variability of the production price (mostly), also the variability of the entry price and the integration in the food supply chain (regarding quality, safety, new products, etc.) (Chartier and Cronin, 2017);
- regulatory risks - related to the impact of changes in agricultural policies (eg subsidies, food safety regulations and environmental regulations) or trade policies: a change in government action, which is contrary to what farmers expected, may have a negative impact on their income (Iyer et al., 2020);
- technological risks - associated with the adoption of new technologies (Ayadi et al., 2009; Hou, 2020);
- financial risks - resulting from different methods of financing agricultural business, depending on the availability of credit, interest and exchange rates, etc. (Chartier and Cronin, 2017);
- risks of human resources - associated with the lack of qualified personnel (Iyer et al., 2020).

From an economic perspective, since its inception over 50 years ago, the Common Agricultural Policy has focused on both productivity in agriculture and the provision of sufficient food at reasonable prices (Shadbolt et al., 2010). These goals were exceeded in the 1980s, with large quantities of agricultural products putting great pressure on the domestic budget as well as on the effectiveness of the system in the international political arena. Today, farmers in EU Member States guarantee the food security of more than 500 million consumers (Scown and Nicholas, 2020). Abundance, accessibility, safety and food quality are just a few attributes of the EU's approximately 14 million farmers (Brzozowska et al., 2017).

In addition, following the recent food and economic crises, food security has returned to the forefront of the CAP agenda. In the future, Europe will continue its international commitments (World Trade Organization and free trade agreements) on meeting food needs by improving its production capacity and strengthening trade relations, and will continue to be one of the most important major global exporters of processed and high value-added agricultural products (United Nations, 2015; Scown and Nicholas, 2020).

In comparison to other Eu states, the agricultural industry in Romania has a relatively high percentage of Gross Value Added (GVA), although it falls behind in terms of worker productivity. Agriculture, forestry, and fisheries account for 5.3 percent of total GVA, which is much greater than in other EU Member States (EU-27 = 1.8 percent in 2012). However, between 2000 and 2012, agriculture's percentage of total gross value added plummeted from 12-14 percent to 5 percent, while the share of total labor fell

from more than 40 percent to around 30 percent. As a result, labor productivity has lagged behind other sectors of the Romanian economy and is significantly below the EU average. Romanian production is four times lower than the EU27 average (2010-2012) (European Commission, 2017).

Policies are part of the solution to address these risks, but they are also associated with regulatory risks (Onofrei, 2007). In addition to being classified according to their sources, risks can be classified according to the frequency of occurrence of adverse events and the extent of their impact (Brzozowska et al., 2017). Risk management begins with farm and household level decisions: what outputs to produce, how to allocate land, what inputs and techniques to use (Iyer et al., 2020). Diversifying on-farm and off-farm activities normally contributes to reducing risk. The level of the farmer's integration into the food supply chain also affects the degree to which the farmer is affected by price volatility. Vertical integration - when the farm controls goods at two or more levels of activity - usually reduces the risks associated with a change in the quantity and quality of inputs (back integration) or outputs (forward integration) (Njegomir and Rihter, 2018).

In agriculture, the price risk of inputs has been given considerably less attention in the literature and has been considered less substantial than the price risk of production and the risk of yield (Iyer et al., 2020). This does not normally translate into the variability of its magnitude yield (Scown and Nicholas, 2020).

In addition, the time window for input price risk is shorter: fertilizer and input costs are usually borne within a few months of the start of production, while uncertainty around the production price and yield usually remain at least six months (Chartier and Cronin, 2017).

We must differentiate between subjective and objective hazards. Subjective risks relate to the perception of risks, which is a subjective phenomena with varied outcomes for various persons. A novel and complicated event, for example, that is not completely understood might be perceived as an opportunity by an entrepreneur or as a danger by a cautious management. The identification and assessment of objective hazards is based on the use of data and probability distributions to identify and analyze the potential consequences of occurrences. The potential risk of a certain occurrence can be computed as the product of the event's probability and the potential economic implications. When certain events are very unlikely, but can have consequences with a high level of economic, material and human destruction, the risk can be very high. Here we can include earthquakes, hurricanes, floods, epidemics and other natural and social disasters (Njegomir and Rihter, 2018).

However, the magnitude of fluctuations in entry prices can be significant and there is no hedging system against entry prices (although there is the possibility of storing items on the farm). The price risk of tickets is still significant and can be overlooked (Mahul and Stutley, 2010). Variability in fuel prices and fertilizer prices seems to be the main component of the variability of input prices in crop production, partly because fuel and fertilizer account for most of the costs of entering conventional agriculture, and partly

because, as commodities themselves, they are subject to fluctuations price like all other goods. These variability is expected to increase, in line with increased energy price volatility (Scown and Nicholas, 2020). As far as the livestock sector is concerned, entry costs amount mainly to feed expenditure. The following discussion on crop price risk for crops thus covers most of the issues related to input price risk for the livestock sector (Njegomir et al., 2017).

The variability of the production price is determined by a number of factors. Exit price risk arises due to the inherent biological lag of agricultural production. Obviously, growers have to make production decisions months (even years for apple crops) before they have a product to sell, before real crop prices are known. During this period, production prices can change dramatically in response to supply and demand shocks. This can put farmers in a difficult position if commodity prices fall sharply during the production and marketing cycle (Matei and Onofrei, 2021).

Many variables influence price increases, as seen by the 2007/08 increase in food costs. Income and population expansion, economic growth, rising energy prices, and the creation of subsidized biofuels have all led to increased agricultural product consumption. At the same time, natural resource restrictions, insufficient investment in rural infrastructure and agricultural research, farmers' restricted access to agricultural inputs, and weather disruptions have all had an impact on productivity and increased output (Iyer et al., 2020). While speculation has been cited as a driver of rising prices, the issue has been hotly debated, but there is no conclusive evidence that speculation has driven prices up. Consumption of cereals was also consistently higher than production in previous years, which had low stocks. Stocks really play a critical role in their cushioning effect: low stock levels are associated with high price volatility (Matei, 2020).

The transfer of prices from global markets to domestic markets is affected by the level of trade and the extent to which the environment is managed internally. For markets more open to trade, domestic price volatility is close to that of international markets. (For example, in 2007/2008, about 19% of the wheat produced was marketed globally). So a price shock for a crop like wheat tends to spread globally and the magnitude of the price risk for a commodity will tend to be similar for producers around the world (Ayadi et al., 2009).

Insurance is being used more and more to mitigate the risk of production (Bielza Diaz-Caneja et al., 2009). Thus, in order for a risk to be insurable, several conditions are required:

- Sufficient information on risky events must be available to assess their likelihood of occurrence and the expected loss (with associated financial costs) that may result. Calculating the correct premium requires an estimate of the risk distribution. Information must be widely available among market players so that the potential for moral hazard and adverse selection is kept to a minimum (Komarek et al., 2020);
- The appropriate risks for different agents must have some degree of independence (be idiosyncratic). Systemic risks, which are highly correlated, cannot be easily shared

and can generate large losses, so large liabilities for the insurer (Bielza Diaz-Caneja et al., 2009);

To avoid large premiums inaccessible to farmers, systemic risks (which can lead to large-scale losses) are reinsured by the insurance company on the international market, or guaranteed by the state (Hou, 2020). Comprehensive agricultural insurance schemes are usually supported by the public sector. However, in addition to being expensive, the excessive involvement of a government that provides an ad hoc disaster payments stifles the development of insurance products (Chartier and Cronin, 2017).

As mentioned earlier, such government intervention is also likely to reduce the likelihood of farmers actively reducing and mitigating risk (Komarek et al., 2020). With a comfortable public tampon, they may be seduced by the potentially high yield that a successful growing season would bring to the wrong place in the wrong place, even if very unlikely. For example, they can plant crops that consume a lot of water in drought-prone areas, planted on floodplains, practice a monoculture more vulnerable to pests, and so on (Farrin and Miranda, 2015).

Agri-insurance is a component of the financial and credit support of agriculture, which ensures the continuity of the breeding process and compensates the expenses of agricultural producers, their real increase in financial stability and creditworthiness, maintaining the level of profitability, taking into account the risk of an accident (Scown and Nicholas, 2020). Agricultural risks in the production process of agricultural enterprises can be covered by the diversification of business insurance, which has long appeared in the multidisciplinary technology to increase agricultural production (Komarek et al., 2020). However, the arsenal of state regulators of agricultural risks in agribusiness, by reducing and subsidizing them, needs to have an appropriate institutional environment that ensures the vertical integration between the state and agri-insurance entities (Njegomir and Rihter, 2018).

Iyer et al. (2020) shows in a recent study that rewarding farmers with money for the provision of public goods is essential to address the challenges of the future: promoting sustainable agriculture by supporting high-production farming systems.

2. Research methodology

The study is based on various reports, official statistics, macroeconomic analysis, case studies, analysis of documents issued by organizations representing the SME sector and the business environment, from all regions of economic development of the country, reports of national conferences and direct contacts within the various institutions/authorities of the central/local public administration and NGOs on this topic.

The methodology of this study consisted of collecting and interpreting data and making tables and graphs that highlight risk management in agriculture.

The data presented in the study were taken from accredited databases and websites of national bodies, such as INS, ANAF, MADR, etc.

Also, a documentary research was carried out on the risk management in agriculture, the types of insurance used by farmers and the ways to ensure the sustainability of farms. Data analysis and their interpretation using graphs, diagrams and figures was performed in order to express the analyzed phenomena.

The paper includes an analysis focused on the following aspects:
- risk management in agriculture, which consisted of exposing the risks encountered in the agricultural sector and the perception of entrepreneurs regarding the favorable environment for the agricultural business;
- the impact of insurance on agricultural risks;
- the impact of risk management on farm sustainability.

3. Results and discussion

Risk management in agriculture

Climate change is expected to pose a potential threat to Romania and the country's agricultural sector in the medium and long term. Romania will have to expect and prepare economically for a steady increase in average annual temperature, similar to projections for Europe, which could range from 0.5 °C to 1.5 °C by 2029, and between 2.0 °C and 5.0 °C by 2099, depending on the overall scenario. Rainfall patterns are expected to change significantly and produce a differentiated territorial impact in this country. The northern part of the country is likely to achieve medium-term crop productivity gains, but will be subject to higher floods in winter and problems due to lack of water in summer. Southern and southeastern Romania will be severely affected, and heat and drought waves will lead to a general decline in productivity and production in the plant sector.

Specifically, some climate models provide that, in the absence of climate change mitigation actions, individual crops and yields could be affected as follows:
- Corn: in a hot scenario, the EU is facing a possible 9% drop in production compared to an initial value in 2000, and this will mainly affect France, Romania, Italy, Hungary and Spain; in a cold scenario, however, Romania could even register a 15-20% increase in corn production, as in recent years there have been long periods of drought and high temperatures (Scown and Nicholas, 2020).
- Sunflower: in both the hot and the cold scenario, Romania should expect a decrease in sunflower production of up to about 14% by 2030. It is expected that other EU producers (Bulgaria and Hungary) will be similarly affected (Scown and Nicholas, 2020).
- Wheat: Romania could be significantly affected in the cold scenario (-25% by 2030), but this could actually benefit from an increase in production in a hot scenario (7%) (Scown and Nicholas, 2020).

By comparison, a warm scenario would affect Northern and Western Europe (France, Belgium, northern Germany, Lithuania) and favor southern countries, while a cold scenario would most significantly affect Poland and parts of Germany.

Price risk and production risks are usually considered the most important in agriculture and are discussed below. Policies are part of the solution to address these risks, but they are also associated with regulatory risks.

Formerly known as the granary of Europe, Romania still has a significant agri-food trade deficit. The situation is mainly due to the import of processed food. Over 50% of Romania's agri-food imports consist of finished products, of which 60% come from EU member states.

The food industry has declined sharply in the transition years. This was caused by a number of shocks, including:

- reduction in consumer purchasing power as a result of economic reforms;
- privatization;
- the dismantling of large vertically integrated production chains;
- changes in the structure of subsidies;
- the costs of complying with stricter European standards after joining the EU.

Risks associated with frequent low-loss events, such as "normal" price and output fluctuations, are managed on the farm. Events that are rare but lead to severe damage to an entire region (eg. floods, droughts or outbreaks) usually fall into the catastrophic risk layer, for which market solutions have played a less important role, especially due to high public involvement. Between these two layers, financial markets and insurance offer solutions (Iyer et al., 2020).

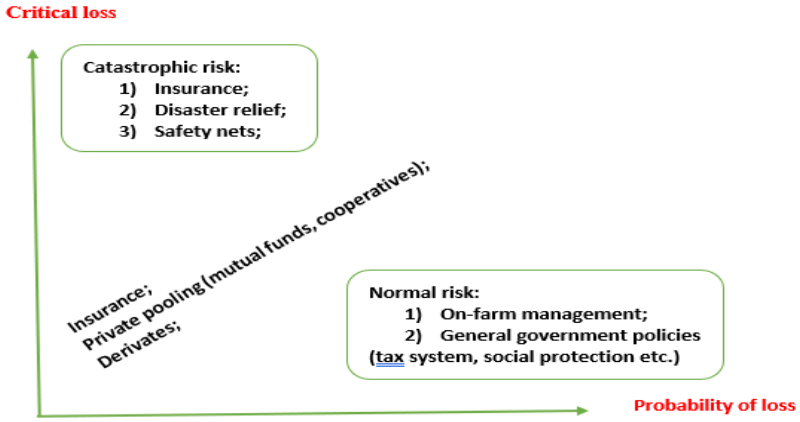

Figure no. 1. A map of agricultural-risk management tools

Source: own processing

In assessing the risks faced by producers, it is important to keep in mind that aggregate data can mislead by underestimating the risk of production at farm level. Indeed, a favorable yield in one location is usually offset by an unfavorable yield in another location, which leads to less variability in yield at the aggregate level than at the farm level. This "spatial aggregation bias" is much smaller because of the variability of prices since the spatial integration of production markets equalize production prices in different locations.

Related to this, there is a classification according to the actions taken to address the different types of risks. Farmers can try to reduce the likelihood of an adverse event (using technology, for example). Alternatively, they can mitigate it: reduce the potential impact of an adverse event by reducing the firm's prior exposure. In the absence of reduction and mitigation, farmers have to deal with the adverse event once it has occurred (supported, for example, by direct payments or insurance income/revenue).

Mitigation strategies include:

- risk pooling (eg. in insurance);
- risk transfer (eg. on the derivatives market);
- diversification of production (different activities or different cultures).

Different categories of risk also require different providers: banks, insurance companies, governments or public-private partnerships, and some risks are best managed on farms by farmers themselves.

Different agents have different goals in risk management. These objectives may be conflicting, depending on their target (food producers or buyers of food or feed). Some agents may focus on stabilizing food prices, others directly on stabilizing farmers' incomes.

Price volatility is a concern both at the macro level for governments (eg. trade bill and inflation) and at the micro level for producers and consumers. A fall in commodity prices during the growing season is negative for farmers, but tends to benefit consumers. In contrast, high prices adversely affect consumers whose food expenditure accounts for a large share of the household's source of income. This is a fairly rare event in developed countries (although it does happen) and their governments are more concerned about the impact of price fluctuations on producers (who also tend to be well organized as a lobby).

Table no. 1. Potential agricultural-risk management tools

Tipes of risk	Farm	Government	Market
Risk mitigation	• Diversification in production • Crop sharing	• Counter-cyclical programmes • Tax sistem income smoothing	• Insurance • Vertical integration • Futures and options • Diversified financial investment • Off-farm work • Spread sales
Risk reduction	• Tehnological choice	• Macroeconomic policies • Disaster prevention (eg. flood) • Prevention of animal diseases	• Training on risk management
Risk coping	• Intra-community charity • Borrowing from neighbours/family	• Social assistance • Agricultural support programs • Disaster relief	• Selling financial assets • Off-farm income • Borrowing from banks

Source: own processing

As food price volatility increases, so does the risk of investing in agriculture: it tends to lower the investment rate and, in turn, the growth rate of agriculture, it also affects the entire food supply chain and possibly food security.

Price risk refers to the variability of production prices and input prices. Macroeconomic factors also influence the volatility of agricultural prices, e.g. variability in inflation rates, exchange rates and interest rates.

Price variability is complex in nature and price volatility can be defined in several ways. This refers to price movements with a certain periodicity: the period can be a day, a month, a season or a year. Volatility can also be considered as being made up of high and low frequency components, which can be useful to distinguish.

A common measure of volatility is the coefficient of variation (the ratio between the standard deviation and its average value) of a historical series of prices with a given frequency. Historically, volatility can also be defined as the standardized annual deviation of the percentage change in daily settlement prices. Some prefer to focus on

the uncertainty component of volatility: given that some variability may be predicted (based on seasonal variation or business cycles, for example), they are concerned not to exaggerate the degree of uncertainty. Therefore, they restrict volatility to unpredictable price movements. There are also measures of default volatility, such as those of the market waiting to see how much a commodity price is likely to move (Mahul and Stutley, 2010).

The relationship between price fluctuations and trade levels is complex. A closed market, although less affected by external shocks - for example a global recession - is very vulnerable to internal shock, for example a drought. An open market is clearly directly affected by the instability of global markets, but it can share its global risk, which has a stabilizing effect on prices.

Prospects for price volatility - The future volatility of prices will depend on a number of factors, including the variability of demand and supply and the receptivity to these variables (elasticity of demand and supply). The supply/demand balance will be essential. Growing demand (for food, feed and fuel) combined with long-term resource shortages (water, arable land and energy) trends indicate a tight balance (Iyer et al., 2020). This is of particular concern at a time when global stocks are low and are likely to indicate an increase in volatility, although it is difficult to distinguish between price trends and volatility.

In the context of climate change, extreme weather events are expected to be more frequent. This and other factors affecting yields will contribute to increased price volatility. In addition, food prices and oil prices are increasingly closely linked, due to the use of crops for energy production and the dependence of agricultural production on energy inputs.

A potential increase in volatility in energy markets (also in a context of tight supply) is likely to spread to food markets.

Public risk management tools - In this section, we first review the traditional market management tools used to stabilize agricultural prices or incomes. Then we discuss the latest idea of rewarding farmers for the delivery of public goods.

The EU's main approach to food price volatility has been to stabilise revenues without affecting prices. The reason for this approach was not to interfere with the natural balance resulting from the law of supply and demand (as demand increases, the price goes up, which motivates an increase in supply, bringing the price back to normal). However, the EU has used price control mechanisms in the past (Iyer et al., 2020).

EU Market Stabilization and Price Policies - Government policies aim to stabilize international price fluctuations through border policies, stockholding policies and the intervention of price schemes. Implemented mainly to provide price support, EU market regulations also affect price stability. The range of intervention measures available under the CAP is significantly smaller than before, but the following measures remain.

Trade intervention measures - Import tariffs are widely used and are linked to Uruguay's 1994 Round of Agriculture Agreement (URAA). The EU is free to adjust its tariffs

within these limits. For example, the tariff on cereals was reduced to zero during the 2007-2008 price increase, so that EU domestic prices have risen less than global market prices.

Export subsidies are also restricted by URAA, with ceilings on total export subsidy expenditure as well as the amount of subsidized exports. These costs have fallen sharply as world prices have risen. EU implemented export refunds for dairy and pork prices after falling prices in mid-2008. Export refunds had a negative impact on developing countries, when cheap goods were sponsored by EU, the cost of local production in these countries was high.

Although a country's import/export restrictions may bring some short-term exemptions for selected farmers/household consumers, economic analysis clearly shows that their overall impact on the domestic economy and the rest of the world is negative. In addition, border protection tends to change the variability of prices to world markets (Bielza Diaz-Caneja et al., 2009).

Trade liberalization increases the chances that developing countries, such as Romania, will have a more competitive agricultural sector - especially in combination with efforts to include smallholder farmers in global food supply chains.

Price support - Direct public intervention can take place in the EU for procurement and withdrawals. Fixed price purchases apply only to certain products (wheat, butter and milk powder) and in pre-determined quantities. A tendering procedure may allow more quantities at a price set by the Commission. Withdrawal procedures may be applied under certain conditions by the producer organizations in the fruit and vegetable sector. Price support has been found to be inefficient in the sense that the price reduction it achieves is largely captured by other full-fledged supply chain agents (input suppliers, processors and distributors, landowners), but little farmers should help (Bielza Diaz-Caneja et al., 2009).

There are also a number of disadvantages to price support mechanisms, such as:

- masks price signals to producers: setting prices higher than natural market prices is likely to lead to surplus production - as in the 1970s and 1980s, when subsidies and dumping were eliminated by exports.
- an increase in prices, and therefore in revenues, in proportion to production means that larger producers benefit more. This also provides an incentive to increase production, which - if done in excess, especially on fragile land - can have a negative effect on the environment (soil quality, biodiversity, etc.).

Finally, the implementation of price support for farmers involves rising consumer prices, which puts poorer consumers at a disadvantage.

There may also be more indirect price support. Private storage aid can be encouraged by specific aid for butter, meat, sugar and olive oil. The products remain the property of the depositors and no restrictions apply at the end of the storage period.

Subsidies to promote domestic consumption are still used for some dairy products: processing aid is in place for some categories of skimmed milk. While these indirect

public support instruments are useful, it may also be beneficial to encourage their private (sector-funded) use.

International market stabilization policies - The focus of this work is on agricultural producers, but in the context of a more open trading system, it is sometimes desirable to act internationally. In the absence of stocks, fluctuations in world prices reflect the position of global demand and supply for individual goods. In order to stabilize international prices, some support a mechanism to ensure that stocks are built up during periods of low prices and launched during periods of high prices (Mahul and Stutley, 2010).

Previous attempts to establish international commodity agreements back in the 1940s have not been very successful in stabilizing prices, or being implemented at all. Following the 2007-2008 food price crisis, a number of proposals for stockpiling have been put forward, including an internationally coordinated strategic food reserve system.

Direct payments (especially as SFP-Single Farm Payment) are now a substantial part of agricultural income, with variations between countries, agricultural systems and farms. These payments are considered effective in increasing farm welfare, but are not as effective in reducing income variability as risk market subsidy tools. Some of the above arguments for price support also apply here: direct payments in the current form are biased towards large producers and tend to favor intensive agriculture, especially in Western Europe (Bielza Diaz-Caneja et al., 2009).

Ad hoc payments or disaster funds exist in most countries - Disaster funds are public funds managed by national or provincial governments - sometimes receive contributions from the private sector, collected in the form of taxes on production, premiums, etc.) They are insured every year by the government and mobilized under the declaration of catastrophes. The main advantage of these funds over ad hoc aid is that they avoid major distortions of the government budget. However, these public aids have a majority warning: their perverse effect on farmers' risk appetite. Indeed, if farmers are aware of an existing safety net, they are less motivated to reduce either the risk of loss or the exposure of the farm in advance. In some countries, there are no payments from public funds if insurance is available (for example, Austria, Greece, Portugal, Spain and Sweden - in France only if the insurance has reached a significant level of diffusion) (Bielza Diaz-Caneja et al., 2009).

An alternative to stabilizing farmers' incomes is increasingly being discussed. It is based on the fact that farmers also deliver goods to the public. These benefits are not passed on as prices, which are delivered as a side effect to the benefit of the company as a whole, other than the producer/consumer exchange. Public goods are defined in the economy as goods that are:

- non-rival: the consumption of the good by one individual does not reduce the availability of the good for consumption by others;
- non-exclusive: no one can be effectively excluded from using the property.

In many ways, agriculture is like other economic sectors: a large number of producers participate in a number of markets for food, feed, fuel and fiber. At the same time, agriculture is distinguished by the fact that it is a sector in which the supply of public goods is particularly widespread.

For example, a corn grower wants to reduce his uncertainty about sales revenue and concludes a contract at the time of planting. It is not concerned with the risk of yield (irrigation, etc.) and covers an amount equal to the actual production, which it compensates at the time of harvest. This hedging on production price volatility is popular with experienced farmers and can be an important element in implementing a risk management strategy.

The approximate price per tonne at the time of sowing is 200 EUR per tonne. The farmer expects a harvest base of -10 EUR, offering an estimated cash price of 200 EUR plus -10 EUR, meaning 190 EUR per tonne.

Table no. 2. Effect of cover on the profitability by concluding the contract for the sale of corn production at the time of planting

Price per tonne (EUR)	Price increase scenario	Price decrease scenario
Cash price realised at harvest	205	175
Cash price expected at harvest	190	190
Futures price at harvest	215	185
Futures price at planting	200	200
Futures return to the producer	-15	15
Net price realised with hedging	190	190

Source: own processing

In Table no. 2. two scenarios are illustrated:

- a reduction in price by 15 EUR between planting and harvesting;
- an increase in price by 15 EUR.

In both cases, the harvest base is -10 EUR, as expected. As a cover, the yield per tonne is EUR 190 in both cases. It can be calculated as the approximate price at the time of planting plus the basis of the harvest or the cash price.

The impact of insurance on agricultural risks

Given that crops and animal production are sensitive to weather conditions and other hazards, there is a clear demand for insurance in the agricultural sector.

Agricultural risk insurance consists in the fact that the farmer pays a premium for the purchase of insurance, thus acquiring a contract which, in case of adverse events, entitles him to an indemnity - of an amount related to a certain calculation of losses. These can be specific events, in the case of a single insurance risk (eg. hail and/or fire) or a number of weather events (eg. including frost) for a combined risk insurance.

Agricultural production insurance covers crop losses for a particular crop due to any weather event. Multi-risk insurance covers situations where production falls below a threshold level. Animal insurance mainly covers non-epidemic diseases and accidents. Production insurance for the whole farm refers to all crops produced by the farm: the farmer is entitled to compensation only if the overall production falls below a certain threshold (not just one field).

The level of interconnection is also important: it is relevant, for example, for insurance or policy purposes, whether only a few farms are affected (idiosyncratic risk) or if there are a large number of farms (systemic risk). Risks that at the same time affect a large population over time, such as droughts or floods or price shocks, are more difficult to manage within the sector.

Income insurance combines yield and price insurance and is based on the total value of the farmer's production. The source of income and insurance also take into account production costs. It is only applied in the US so far.

The more comprehensive the insurance scheme, the more it tends to be supported by the state. (All examples of the world's high-risk insurance policies are government-funded.) Thus, the budgetary implications can be significant.

Whole Area Indexed Insurance - Indexed insurance is based on a common index for an area, such as the types described above for individual farms where losses are assessed on the ground. The index can be direct, as the statistical yield for the year in a predefined area or the average yield/income in that area. Indirect index coverage is based on a weather indicator (eg rainfall, dry days, humidity, accumulated frost, etc.) or satellite imagery. Index-based weather insurance products, also called meteorological derivatives, fall into this category, even if they can also be considered as a team over-the-counter option traded.

Indexed insurance refers to a completely different approach to ensuring crop yields altogether: instead of requiring an independent risk for outflows, it actually works best for the individual farmer if the risk is correlated. Area Index insurance has been experienced for several years in Brazil, Canada, the USA or India. India and Canada have also developed meteorological and Canadian insurance products based on satellite imagery. Index contracts offer more advantages than traditional forms of crop insurance with multiple risks at farm level.

The absence of both moral hazard and information asymmetry as well as low administrative costs (no inspections of individual farms are required) translates for the farmer to higher levels of coverage. No limit should be placed on the farmer's liability, as it has no effect on a result of payments. Because they are standardized and transparent. Index insurance contracts can be traded on futures markets. They can also be used as reinsurance to transfer the risk of spreading related agricultural production losses.

Meteorological index-based insurance products are also called weather derivatives because they can be brokered as an insurance contract or as an option traded on a stock exchange. As compensation is not paid for actual losses to be verified by experts in the field, these products may also be sold outside the sector insurance by banks and other financial institutions. They differ, however, from traditional commodity price derivatives in that the medium is not a traded asset.

The price of meteorological derivatives is usually based on actuarial calculations, as traditional Black-Scholes algorithms do not seem to be suitable for these products. This makes the market less transparent and increases transaction costs. Overall, insurance products with weather indexes offer good potential, even if the market has not yet developed.

Prospects for indexed insurance - As the systems for measuring events that cause widespread problems become more sophisticated, indexing major events can be easier and more accepted by capital markets. The basic advantage of merging indexed insurance in the banking sector is that a bank can use correlated risk management contracts. This will put the bank in a position to help the farmer manage the core risk: if the individual bears an independent loss when the indexed insurance does not pay, he can borrow money from the bank to alleviate this shock. This can be an effective way to avoid the major concern associated with indexed insurance (the real possibility of a person suffering a loss without being eligible for payment).

Insurance schemes in the EU - The level of risk experienced by EU farmers varies widely, depending on the country and the type of farm and the size of the farm. The development of the agricultural insurance sector in each country is linked to the level of risk but also to the policy that supports the insurance system.

Single risk insurance (mainly hail) is well developed in Europe. Usually, private companies provide only hail and fire, and as the Government increases its involvement in insurance, more comprehensive coverage is provided. Yield insurance provides coverage against all major climatic hazards, but plant diseases and pests are usually not covered. This requires finding the cause of the loss, as opposed to the US Multiple Danger Crop, for which damages are calculated simply as the difference between guaranteed and actual returns. The European insurance system is associated with higher loss adjustment costs but no moral hazard.

In Romania, the Groupama insurance company offers farmers a Standard Insurance for agricultural crops. Standard insurance covers the following risks: hail, fire, storm/hurricane, torrential rain, late spring frosts and early fall frosts. In addition, under

certain conditions, the risk of winter frosts and the collapse/landslide of cultivated land can be covered, in the case of agricultural crops such as wheat, rapeseed, corn, sunflower, potatoes, soy, beets, etc.

Stabilization mutual funds - Mutual funds (stabilization) provide a way for a group of producers to share the risk. A loss suffered by a member will be fully or partially offset by the money collected available in the fund according to predefined rules (often with an additional collection from participants). Founded on a private initiative, they are mainly established either for a specific sector or for a specific region.

The impact of risk management on farm sustainability

The link between farm sustainability and risk management is very close, practically, without efficient management, a farm cannot be economically efficient, so it cannot be sustainable.

It is important to reward farmers for the delivery of public goods: biodiversity, water quality and availability, air quality, soil functionality, climate stability etc. Switching to more sustainable agriculture by providing public goods (such as agrotourism) can also help stabilize farmers' incomes.

The biggest problem today for producers, farmers and/or farm owners is finding the best risk management solutions to make the desired structural investments and ensure the sustainability of the farm.

The latest trend in sustainability has emerged as a result of the expansion of agricultural companies across national borders, many of them with thousands of employees and a turnover that exceeds the gross domestic product of small states.

Price risk and production risks are usually considered the most important in agriculture, with the sustainability of the farm being directly influenced by them.

It is considered that a favorable yield in one location is usually offset by an unfavorable yield in another location, which leads to a lower variability of the yield at the aggregate level than at the farm level. This spatial aggregation distortion is much smaller due to price variability, as spatial integration of production markets equals production prices in different locations. Thus, farmers can try to reduce the likelihood of an adverse event (using technology, for example).

Price volatility is a major micro concern for farmers. A fall in commodity prices during the growing season is negative for farmers, but tends to benefit consumers. In recent years, there has been a trend among farmers - they have made considerable investments in production storage facilities so that they are no longer constrained to sell their production at a reduced price during the harvest period. By using storage space, farmers manage to increase sales revenue, respectively increase profit.

The sustainability of the farm can be achieved by using certain tools such as stabilization funds or insurance.

The difference between a mutual fund and a mutual insurance scheme (also a non-profit cooperation based on self-help) is the legal nature of the institution.

The advantage of these risk-sharing cooperatives is that farmers often know each other, which reduces the moral hazard and negative selection. The disadvantages are limited resources, especially in the early years and interconnection: a farmer may at the same time incur a loss and must contribute to the fund to cover other farmers' losses. Reinsurance or cooperation with other regions can help address this issue.

Conclusions

The variability of farm income depends on the variability of prices, yields, costs and support, but also on the covariability between all these factors and the diversification of production. In a variety of situations in different countries, we expect EU farmers to experience more price and yield variability in the future due to the changing global context as well as the gradual dismantling of traditional CAP market management tools.

It is an open question whether the EU or the Member States should address the increased volatility for farmers. Some argue that farmers, like other business people, need to adapt to supply and demand and constantly make choices between higher, higher-risk yields and lower but more stable yields. Others argue that the agricultural sector is a special one that needs public support, given its role in addressing a basic human need (for which no substitute is available): ensuring an adequate supply of food in a sustainable way, which means protecting the environment, animals, and tackling climate change.

Market risk management support tools have the advantage of encouraging farmers to participate in financial risk management, thus reducing their income variability. These are represented by direct payments, production insurance, public policies to stabilize prices for certain productions, etc.

Given the declining public support, market-based risk management tools will play an increasingly important role. Futures and other derivatives will be increasingly used by Romanian farmers to cover price risk.

At the same time, insurance is expected to be used more and more frequently to reduce the risk of return. Increasing insurance portfolios is expected to increase the effects of risk pooling and reduced reinsurance costs. Index-based insurance tools will also help insure against many dangers.

The public sector can support the use of agricultural insurance by reinsuring or subsidizing the minimum crop yield premium: enough to make it affordable, but not too much to avoid irresponsible behavior (eg, improper planting of crops).

The COVID-19 pandemic suddenly appeared as a phenomenon called the black swan, which demonstrates the strong impact of highly unlikely events. The agricultural sector poses an inherent risk and therefore farmers need to find strategies to deal with financial losses. The business philosophy of profit maximization has changed in recent years with the theory of competitive advantage and farm sustainability.

Sustainability must be understood as a synergy between the following factors: economic, social and natural environment. Although these factors are associated with uncertainty, it is found that sustainability risk management is a complex construction, with an important impact on managerial thinking today.

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