p-ISSN 0044-1600
e-ISSN 2392-3458

Problems of Agricultural Economics

www.zer.waw.pl

3(352) 2017, 133-144

DOI: 10.5604/00441600.1245858

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INDEX-BASED MARGIN INSURANCE IN AGRICULTURE – ON THE EXAMPLE OF WHEAT PRODUCTION IN AUSTRIA

Abstract

This paper presents a concept of a system allowing farmers to insure against price risk of inputs and products. The insurance existing in agriculture so far (against hail and drought) did not cover incomes. The basic insurance category, which also takes into account the prices of products and inputs[1], is the gross margin obtained from respective products. The concept of gross margin insurance was discussed on the example of wheat. The article does not discuss the legal issues related to the implementation of the proposed system, which provides for state support.

Keywords: agricultural insurance, gross margin, revenues, inputs.

JEL codes: Q12, Q18, G22, G32.

* Paper prepared under the project "Adjustments in Austrian cattle and milk production" (Contract No. KR13AC6K11112). Support was granted under the project BMLFUW 101114 – FACCE Knowledge Centre MACSUR 2: Modelle zur europäischen Landwirtschaft unter Berücksichtigung von Klimawandel und Nahrungsmittelsicher.

[1] The term "gross margin" means a difference between the value of revenues on given production activity and direct costs (total or per 1 ha), which corresponds to the term of margin used by the author.

Motivation and problem statement

In recent years, the portfolio of insurance products for agriculture has expanded significantly in many EU Member States. Insurance against damages due to natural hazards like hail, frost, snow, floods are now available for a large number of crops. Recently, index-based insurances were introduced to cover losses due to draught for crops and grassland. Their acceptance on the market shows that farmers actually need such products and are willing to pay for them.

Representatives of farmers, however, are not yet satisfied with the current product portfolio. Their argument is that a single product that covers both production and market risks is needed. Such a product would reduce transaction cost compared to the current situation, where additional contracts are necessary to hedge price risks. A revenue insurance would be an improvement compared to the current situation but farmers are mainly concerned about profits and incomes and less about yields or revenues. Therefore, an ideal insurance product would cover not only production risk and product price risks, but also price risks of inputs, such as fuel and fertilizer.

Moreover, many farms in the EU are relatively small and farmers are typically both managing and operating their business. They would benefit from a simple insurance product since many of them are extremely time-constrained, but nevertheless need to make well-informed choices whether to take up the insurance or go along with their current practice.

These considerations and the fact that index-based products are already well established on the market, made it plausible to develop a product that is simple to communicate and that can be implemented at low costs. In order to evaluate the feasibility of such a solution, a prototype product was developed for the most important crops and production regions in Austria. Its purpose is to identify the elements that are necessary for developing a marketable product that deals with production and market risks and that offers advantages over existing approaches.

The state of agricultural production risk management in Austria

The market of Austrian disaster risk management is characterized by the fact that private and public companies are active, but not well coordinated (Url and Sinabell, 2008). With respect to agriculture, the situation is different: a single company offers a wide range of insurance products to mitigate agricultural production risks. The Austrian Hail Insurance Company (*Österreichische Hagelversiche-rung*) is a mutual insurer, founded by the Austrian insurance industry in 1947. As a mutual insurer it is not profit-oriented and thus costs can be kept low. The national government has subsidized the hail-insurance premium for all crops since 1995 and the frost-insurance premium for vine-cultures and insurable crops since 1997. The subsidy is shared equally between the federal and Lnd governments and amounts to 50% of the total premium.

An overview of the products portfolio offered by this company shows that insurance products are available for almost all relevant production activities. Figure 1 shows an overview of the market volume. Statistics on the market for agricultural production risk (Table 1) show that in 2000-2014 the market has grown significantly and that public support has grown in a likewise manner. The annual total volume of production of agriculture in Austria was EUR 6.7 billion in recent years. The sum of insured risks was EUR 3.7 billion and the figures shows a high market penetration (over 55%).

Fig. 1. Market penetration of production related risk insurance in Austrian agriculture in 2014.
Source: Österreichische Hagelversicherung VVaG, 2016.

Table 1

Basic data on the market for production related risks in Austrian agriculturein 2000-2014

Items	2000	2005	2014
Clients[a]	71,897	67.866	n.a.
Area, (thousand ha)	913	1.079	1.209
Premium volume (EUR million)	45.9	53.1	96.3
Farmer's losses, (EUR million)	64.3	23.3	n.a.
Premium subsidy, (EUR million)	22	24	40
Sum insured, EUR (billion)	n.a.	n.a.	3.7

[a] Note: the decreasing number of clients is due to structural changes.

Source: Österreichische Hagelversicherung, VVaG; BMF various years.

Drought is a severe production risk in Austria. Recently, new index insurances were introduced that rely on big data meteorological applications as trigger. Drought index insurance for winter wheat and sugar beet were introduced in 2017. The portfolio was expanded to frost and flood insurance products in the same year (AWI, 2016).

Weaknesses of agricultural risk management in Austria – state of affairs and remedies

For production-related risks there is a broad portfolio of insurance products available and the rate of innovations (e.g. index-based insurances) is very satisfying from the farmers' perspective. However, price volatility has increased dramatically since 2005 and farmers are more and more concerned about price risks as well.

Until recently there were no products available that a typical Austrian farmer would use to reduce price-related risks. Only few farmers are employing brokers for the hedging of futures contracts or are buying options or similar financial products. Several years ago, grain trade companies started to introduce price hedging products as a service for their suppliers. One of the motivations was to strengthen the ties to suppliers and another – to make price negotiations easier. Several big trade companies in Austria are co-operatives and therefore are interested in negotiating high prices for their members. Such products are available only for a few crops (wheat, rapeseed, maize). Many producers of piglets, pigs or milk were also interested in the new products. The decline in agricultural prices in 2014 has further raised the awareness among farmers for price hedging instruments.

Farms in Austria are small, by European standards, and a typical farmer has little time for managing the business since most of the time is consumed by working in the field or stable. Therefore, there is an entry barrier for farmers, who wish to get involved in price hedging, because the learning curve is felt to be very steep. Farmers wish to have price hedging instruments at their disposal that are standardized, easy to understand and affordable. Eventually, farmers are mostly concerned about income stability (Larcher, Schönhart and Schmid, 2015). Therefore, alleviating production-related risks like frost, hail or drought is improving the situation for those exposed to them. But many more were confronted with very volatile income streams during the last years, for instance milk or pig producers.

In a study on risk management in Austrian agriculture, Sinabell, Url, Kniepert and Strauss (2010) analysed a general income insurance / margin insurance for Austrian farms. The idea was to switch the EU farm payments from hectare-based premiums to support premiums for such a product. Livestock producers and fruit producers would considerably benefited from such a policy at

the cost of farms with large areas of land. This proposal was not implemented. However, the discussion to insure income losses in Austrian agriculture has been going on in a small group of persons in administration, insurance business and research.

The Farm Bill of 2014 introduced an insurance in the US which resembles such an approach (Orden and Zulauf, 2015). The Dairy Margin Protection Program (US DMPP)[2] was established on the market in 2015 and is available for milk producers in the US to cover part of losses in income, which are a result of low milk prices or high feeding costs. A minimum coverage is guaranteed by a government funded premium support. The prototype of an insurance product presented in the next chapter has some common features with the US DMPP. The two commonalities are (1) that indexes are used to identify losses and (2) that the insurance covers a certain share of the margin. Scharner and Pöchtrager (2016), recently, presented a version of this scheme adapted to the Austrian situation. Because the general concept is not limited to milk production, we demonstrate a similar insurance product for wheat.

Necessary conditions for an income insurance scheme in agriculture to work

Income insurance schemes are widely used in the Austrian economy but only very few of them are offered by the private market. Such products cover the payment of daily allowances in the case of illness or annuity payments for reduction in earning capacity.

The coverage of income losses is offered by the unemployment insurance which is offered by the state to all employees. Self-employed persons have the option to buy such an insurance as well. The premium is 6% of gross income Contrary to employees and the self-employed population, an income insurance does not yet exist for farmers in Austria. However, the experience from the other schemes can be used to identify necessary conditions that must be met in order to get the system working:

1. *Cost of administration*: in order to keep premiums low, administrative processes have to be highly automated, information has to be transparent and available swiftly at low costs to all involved parties.
2. *Moral hazard*: the farmers' behaviour should not have impact on the outcome. Easily observable variables should trigger indemnities automatically.
3. *Adverse selection*: the characteristics of potential buyers of a gross margin insurance have to be well known. Contracts need to be designed in a manner that self-selection supports a smooth operation of the insurance system.
4. *Concentration risks*: Livestock production (milk and pig production) is more important than crop production in Austria. If only milk producers bought an

[2] https://www.fsa.sda.gov/programs-and-services/Dairy-MPP/index (access date: 13.03.2017).

income insurance and crop producers did not, risks for the insurer would be highly concentrated. Reinsurance premiums would be relatively high in such a case. A diversification of not related income risks would help to reduce the exposure of the insurance company.

5. *Trends in agricultural prices and input costs*: an income insurance should not have impact on structural change and adaptation to unexpected market conditions, but it should help farmers to adjust to new situations without worrying too much about income losses. This can be achieved by adjusting premiums periodically. An alternative is to block access to loss coverage for a certain period for those clients who received indemnities.

A product that is placed on the market and successful over long periods has to have finely-tuned features that address all the elements listed above. For the prototype of a farm income insurance in Austria these features have not yet been fully developed. The concept presented in the next section addresses the first two elements: cost of administration and moral hazard. It is based on existing data sources that are maintained for other purposes and therefore most of the data are available at low costs. It uses wheat production in Austria as an example, but the method is developed for all major crops, for milk, piglet and pig production. The concept can, therefore, be expanded to reduce concentration risks as well.

The concept of an index-based income insurance

The core of the new product is calculation of standard gross margins. Almost every Austrian farmer is familiar with this method and farm advisory services offer sophisticated online tools that implement this concept (AWI, 2016). In addition, many farmers are organized in working groups, promoted by the Chamber of Agriculture, where they meet in order to compare the gross margin results and cost break downs of their farm, and to learn from the peers performing above average (benchmarks).

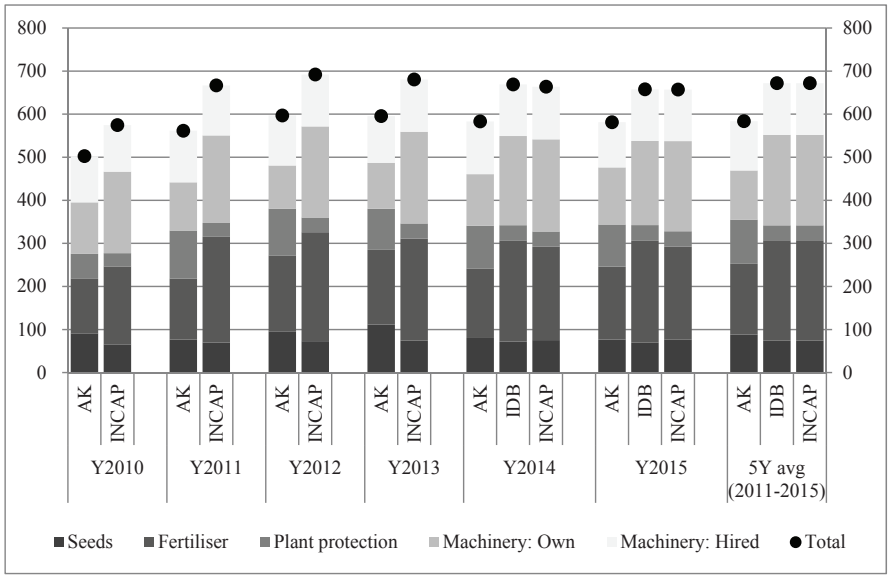
In order to calculate the premiums the volatility of input prices (fuel, fertilizer), output prices, yields and the cost structure need to be known. Volatility of output prices and input prices can be observed on the market and detailed statistics are readily available. To deal with the production risk is the core business of any crop insurance and therefore it is well known to incumbent insurance companies.

The cost structure and the relative weight of each cost item is not yet understood well. For this purpose, INCAP (Index-Based Costs of Agricultural Production) was developed. The data set is designed to make such analyses possible by covering all relevant production activities of the Austrian agricultural sector (Heinschink, Sinabell and Lembacher, 2016; Heinschink, Sinabell and Tribl, 2016). Data derived from INCAP can be used as a tool for examining risks in Austrian agriculture, such as fluctuations of activity-specific gross margins.

It can also be used to evaluate farm-specific incomes or incomes at sector level (Sinabell, Heinschink and Tribl, 2016).

The data used for INCAP are not based on farm cost accounting data but are derived from many sources. INCAP is originally an engineering data set. The quality of results and their validity is scrutinized using data from farmers in accounting working groups from a major production region (Heinschink, Sinabell and Lembacher, 2016).

Figure 2 shows an example of results derived from INCAP concerning the gross margin for quality wheat over a period of six years. Prices of outputs and inputs are from annual statistics and yields are the average of Austria in this example. Like in other index based products, easily accessible observations are used to trigger the incidence of a coverage. The combination of several market observations is used to derive gross margins.



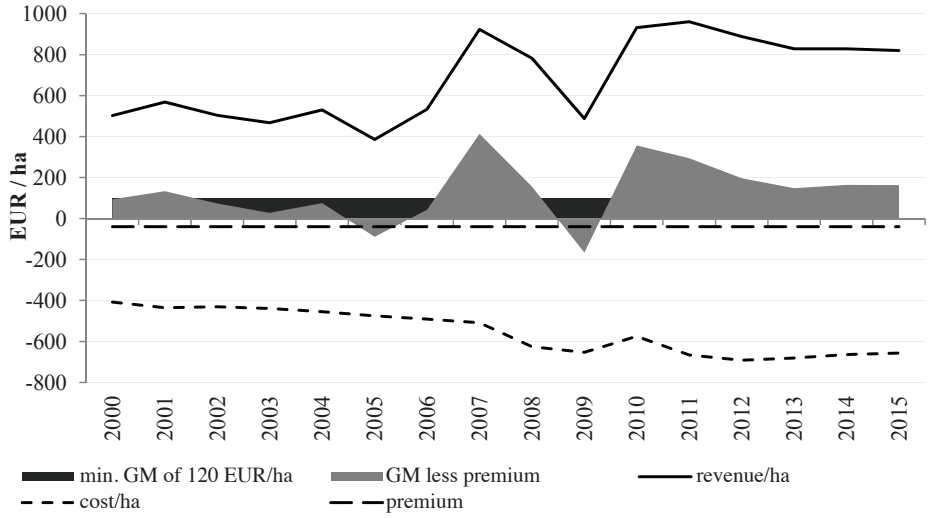
Notes: AK – farm data from peer groups, IDB – gross margin calculation of Bundesanstalt für Agrarwirtschaft (www.awi.bmlfuw.gv.at/idb), INCAP – own calculations of authors, set of data based on indices and costs of agricultural production.

Fig. 2. Level and structure of gross margin in production activity "High quality wheat" in 2010-2015.

A prototype of a margin insurance scheme for wheat producers in Austria

The concept developed in the previous chapters is now applied to an example for a gross margin insurance for wheat producers in Austria. The main elements at the concept are show in Figure 3. The data are representative for the whole country. Austria is a small country but production conditions are very heterogeneous. Similar calculations as the one shown in Figure 3 can be made for any district and for various production systems (standard tillage, minimum tillage, organic production, etc.).

In Figure 3 all types of wheat are aggregated and numbers represent weighted averages. The upper line is the average price of wheat in Austria over a period of 13 years. The lowest dashed line indicates the standard production costs (seed, fertilizer, machinery, energy, plant protection). The dark grey area is the margin (revenue minus costs) before deducting any "margin insurance" premiums. The light grey area represents the insurance benefits that accrue when the margins fall below the lower bound of 120 EUR/ha. Prices of outputs and inputs are not observed on farms but taken from public sources that are available to anyone.



Note: the assumption is made that administrative costs and re-insurance is covered by a farm programme. If government in addition fully supports the premium the total costs per hectare are EUR 49 per hectare.

Fig. 3. An *ex post* calculation of an index-based margin insurance scheme (EUR/ha) with minimum margin of EUR 120 per hectare.

Source: own figure.

The fair premium is 49 EUR/ha per year in this example (Fig. 3). In order to keep things simple, the assumption was made that a public fund is sponsoring the insurance by covering administrative costs and re-insurance premiums (together approximately 20%). The premium accrued over the period, therefore, equals the indemnities that are used to compensate any shortfall of margins below EUR 120 per hectare. This lower bound is chosen arbitrarily and is designed as a choice variable for the farmer buying such an insurance. If government fully supports the premium of EUR 49 per hectare the question is whether this amount is deducted from the area payment or not. The average direct payment in Austria per hectare of utilized agricultural land was EUR 258 in 2015.

Figure 3 clearly shows that trends in agricultural prices and input costs are a severe problem for calculating adequate premiums in advance. This may be the reason that such insurance products as the one presented here do not yet exist in Austria.

Apart from trends it is important to have in mind that a margin calculation includes more than one variable. The level of covariance between the time series of different prices is sometimes very high. The stability of the margins under consideration need, therefore, to be explored in detail in order to better understand the underlying data generating processes.

Table 2

Three types of farmers and their economic performance

No.	Specification	UoM	A[a]	B	C
			Ø 2000-2015		
	Selling price	EUR/tonne	134	140	127
	Yield	tonne/ha	5,145	5,659	4,630
1	Revenue	EUR/ha	689	792	588
2	Revenue/ha + indemnity	EUR/ha	738	841	637
3	Seed, fertilisers, plant protection products	EUR/ha	273	273	273
4	Machinery	EUR/ha	280	280	280
5	Premium (indemnity)	EUR/ha	49	49	49
1-3-4	GM (no indemnity)	EUR/ha	136	239	35
2-3-4	GM (with indemnity)	EUR/ha	185	288	84
	Δ to farmer A	EUR/ha		103	-101

Notes: farmer A is the representative farm which represents the index. Farmer B gets higher prices (e.g. better quality) and higher yields (e.g. better management). Farmer C is performing worse than farmer A, revenues per ha are, therefore, much lower. All farmers pay the same premium and get the same indemnities.

Source: own calculations.

An important aspect of the margin insurance presented here is that moral hazard can be avoided effectively. Regardless of the efforts made by individual farmers, the benefit of being insured is always the same. A premium has to be paid and indemnities are paid out only if the representative index farm falls short of the defined minimum gross margin. Table 2 shows an example of two farms (B and C) which deviate from the index farm (A) is show in. Farmer C, which is assumed to be very careless and therefore gets lower prices and harvests less wheat, gets the difference to the insured minimum only in years when farmer A gets benefits as well. The example shows the fair premium of 49 EUR/ha which is by definition equivalent to the losses over the period of interest.

Discussion and outlook

This paper presents core elements of an insurance product that allows farmers to insure against price risk of both input and output prices. Several additional steps need to be made before a product can be developed that is placed on the market. After concluding the data validation phase it is necessary to define the details of the sub-indexes that enter the formula and the details of premium calculations and the specification of the product that shall be placed on the market. To evaluate the acceptance on the market for such a product is probably the most important step before its launch. The European Innovation Partnership would offer a chance to support its development because it supports cooperation between science, industry and farmers in order to develop new products and services.

It is important that margin insurance presented here is that it can be seen as a partial substitute of production risk insurances. Only very risk averse farmers are likely to buy a combination of a margin insurance and a drought insurance.

An important aspect not discussed in this paper is the legal one. It is not yet examined if the national or the EU legislation limits the scope of detail or any variant of implementation of such a product. It also has to be checked whether public support for such an insurance may be granted or not. It may be advisable to do this in order to save re-insurance premiums at least during the phase of gaining experience and building up the necessary reserves. In such a case it will be necessary to check conformity with WTO commitments. Given the fact that a very similar scheme is operated in the USA there is a certain likelihood that conformity is given.

The results shown in this paper are based on the assumption that technology (apart from yield increases due to genetic improvements) does not change. Such an assumption may be justified for some short periods but is certainly inadequate for longer ones. In order to account for technological changes, it will be necessary to show technology assumptions transparently and explicitly and to explore their change over time.

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UBEZPIECZENIE NADWYŻKI BEZPOŚREDNIEJ W ROLNICTWIE OPARTE NA WSKAŹNIKACH NA PRZYKŁADZIE PRODUKCJI PSZENICY W AUSTRII

Abstrakt

W artykule przedstawiono koncepcję systemu umożliwiającego rolnikom ubezpieczenie się od ryzyka cenowego nakładów i produktów. Dotychczasowe systemy ubezpieczeń w rolnictwie (od gradu i suszy) nie obejmowały dochodów. Za podstawową kategorię podlegającą ubezpieczeniu, która jednocześnie uwzględnia ceny produktów i nakładów, przyjęto nadwyżkę bezpośrednią uzyskiwaną z poszczególnych produktów. Koncepcję ubezpieczenia nadwyżki bezpośredniej omówiono na przykładzie pszenicy. W artykule pominięto zagadnienia prawne związane z wdrożeniem proponowanego systemu, w którym przewidziano wsparcie ze strony państwa.

Słowa kluczowe: ubezpieczenia w rolnictwie, nadwyżka bezpośrednia, przychody, nakłady.

Accepted for print: 16.10.2017.

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