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Whole-Farm Revenue Protection as a Factor of Economic Stability in Crop Production

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Abstract: Crop production is largely unprotected and exposed to a great number of production factors. On the other hand, farmers are exposed to fluctuations in the market prices of their products every year, which often has a negative impact on the profits made. There are various risk management measures in plant production, and insurance is certainly one of the most effective instruments. One of the recent insurance models is Whole-Farm Revenue Insurance (WFRP), which is an American insurance model that has been applied since 2015. The essence of WFRP is to ensure that all crops on the farm are secured against production and market risks with only one policy. The aim of the research in this paper is to present WFRP as an entirely new model of revenue insurance on the example of a typical Serbian farm specializing in crop production. The WFRP model works by determining the insured revenue before the start of the production year. If at the end of the production year, for any reason, the realized revenue falls below the level of insured revenue, the farmer is entitled to indemnification. Due to the drought that hit the region where the analyzed farm is located, the yields were reduced, and thus the expected revenue was also reduced, and the farmer was entitled to damages of $5697. On the other hand, it is the farmer's obligation to pay $373 to the insurer as a risk transfer fee. The authors proved that even such complex insurance models can be applied in countries such as Serbia, where awareness of the importance of insurance of agricultural production is still not developed.

Keywords: crop production; insurance; revenue; whole-farm; one policy

1. Introduction

Agricultural production, especially crop production, is exposed to a large number of risks due to its specificities and the fact that it takes place outdoors. Risk is unavoidable in insurance and represents its essence. If there was no risk, it would not make sense to conclude an insurance contract [1]. One of the most comprehensive divisions of risk sources in agriculture are production (yield), price (market), technology, institutional, personal, property, and financial risks [2,3]. Production or yield risk represents an uncertainty about the quantity of agricultural production arising from weather related factors (e.g., hail, frost, floods, and droughts), crop and livestock diseases and pests, and changes in technology, etc. Market or price risk can be defined as an uncertainty about future changes in prices of both inputs and outputs due to shocks, trade policy, new markets, etc. Institutional risk is an uncertainty regarding the regional or national policy and legal environment for agriculture. Furthermore, financial risk can be explained as an uncertainty about financial flows within a business due to variability in interest rates, access to credit, and the value of financial assets. Finally, personal risks represent uncertainty due to personnel hazards such as injury, illness, or death [1]. The consequences of financial crisis in one country could become global (an example of the financial crisis of 2007–2008 in the USA), while at

the same time, the effects of climate change are present throughout the world. Such a phenomenon supports the necessity of changing the current business models by incorporating sustainability, socially responsible economic growth, and corporate social responsibility [4,5]. Although risk in agriculture is imminent and there is no possibility of completely neutralizing it, there are ways in which it can be managed [6]. The existence of the above-mentioned risks has necessitated the establishment of risk management instruments in crop production. The most commonly used risk management instruments are the application of new technologies and agrotechnical measures, diversification of production, vertical integration of production, insurance, and hedging strategies with futures contracts [7].

Crop insurance is nowadays one of the most prevalent risk management instruments in most countries [8]. Generally speaking, all insurance can be offered on the principle of specialization or universality. Insurance against one risk (usually hail) is a typical example of the first principle, while the principle of universality considers protection against a large number of dangers and an appropriate level of coverage, which includes multi-peril crop insurance, all-risk crop insurance, revenue insurance, margin insurance, and net income insurance. [9].

Although studied decades ago, crop insurance still faces many challenges. In addition to traditional insurance models, new models are being developed such as multi-peril crop insurance, revenue insurance, margin insurance, insurance based on regional index, whole-farm yield insurance, area-yield insurance, area-revenue insurance, weather derivatives, bancassurance, etc. [1,10–12].

In the past, most aspects of yield insurance have been discussed. With this insurance, the farmer bears the risk of the price fluctuation of agricultural products because the farmer is entitled to indemnification only if the insured yield is reduced. For that reason, the issue of revenue insuring has come into focus. Revenue insurance is a combination of yield and price insurance and in this case, compensation is paid if the revenue does not reach the insurance level [1]. By revenue ensuring, farmers are making significant savings considering that by purchasing a single policy, they are being insured at the same time from yield reduction and market price reduction [13]. During 1994, this insurance product emerged in two forms in the U.S. market. The first one included individual production lines where the difference between the predetermined amount of revenue and the realized revenue of a particular product was compensated. The second form was related to the whole-farm, and the payment was made if the whole-farm revenue was lower than a predetermined amount [14].

In addition, as an alternative to insuring individual yields, insurance models such as insurance based on regional index, weather derivatives, or bancassurance have emerged. Insurance based on a regional index is an alternative to traditional yield insurance against a larger number of risks, and as a parameter, this type of insurance takes the average realized yield or the average realized production value in a certain region. The insured event occurs only when the realized yield in the region is lower than the expected average yield [15]. Weather derivatives are defined as financial instruments whose payment depends on some weather parameters [16]. They represent financial instruments that do not take, for example, the price of traded goods as a base value, but rather weather variables such as temperature or rainfall [3]. During the construction of weather derivatives, it is necessary to determine the following parameters: weather index, the type of derivatives, meteorological station, accumulation period, fair price, strike level, payoff function, and payoff limit. The strike level represents the value of index from which the payoff is made, while the amount of payoff is determined with the tick size, which indicates the paid amount per unit index or change of unit index. Weather derivatives can be traded in stock exchanges or over the counter (OTC). Option trading is dominant on the market of weather derivatives [17]. On the other hand, bancassurance is a market product and it represents a combination of credit and insurance with which a farmer can stabilize his revenue, but also insure the capital invested in production. In this way, farmers are offered a financial service "all in one" type, which saves their time, costs, and fees.

More recently, agricultural risk management has been increasingly based on ensuring whole-farm revenue [10]. Modern revenue insurance models aim to provide farmers with simultaneous protection against both production and market risks. Although this model avoids certain disadvantages of

traditional insurance models, this does not mean that revenue insurance does not have its shortcomings. As the most common shortcoming, various authors have cited the problem of a moral hazard, which occurs as a consequence of the farmers' lack of interest in investing sufficient quantities of raw materials (mineral fertilizers, pesticides) after they suppress the insurance policy. Additionally, since income insurance provides protection against a large number of risks, there are serious doubts regarding the determination of the probability of the occurrence of damage and the value of the premium rate [18,19]. Furthermore, income insurance requires a higher level of education, since a higher level of knowledge is needed to understand the way the model itself works. In this way, farmers with lower levels of education are in a less favorable position [20]. Whole-farm revenue insurance (hereinafter referred to as WFRP) protects the farmer from the potential reduction of the expected revenue generated through the production of crops, fruits, livestock, etc. during the insured period. On one hand, the expected revenue may be compromised by unforeseen natural impacts, that is, production risks, but also by market fluctuations [21–23].

The U.S. Department of Agriculture, through the Risk Management Agency (RMA), has initiated the implementation of the WFRP, in accordance with the 2014 Farm Bill. WFRP represents the successor to Adjusted Gross Revenue (AGR-Lite), which also represents a whole-farm insurance model [24]. The major benefits of WFRP over AGR-Lite are a higher percentage of coverage, an increase in the maximum amount insured (from $1 to $8.5 million) as well as greater government support in the form of subsidies [24,25].

Generally, the insurance models that insure the whole-farm business are much more efficient and less expensive than the classic insurance models where each plot and each crop is insured with a separate policy [26]. For example, if a farmer grows three crops (A, B, and C), the insurance policy of the total expected farm revenue is far cheaper than insuring all three crops with separate policies [27].

WFRP is an insurance model that enables farmers to insure the whole-farm revenue from production and market risks, since it protects not a natural indicator in the form of yield, but a financial indicator in the form of revenue. This avoids the problems of adverse selection and moral hazard as well as the problems that are common in Serbia, which relate to inadequate damage assessments by insurers. With the WFRP model, the farmer is automatically entitled to indemnity if the achieved revenue is less than the insured (guaranteed) revenue. Additionally, a great advantage is the fact that WFRP requires only one policy, while in traditional insurance models, each crop is secured by a separate policy.

The aim of the research was to analyze and present WFRP as one of the most recent models of agricultural insurance from a theoretical point of view, but also to analyze the possibility of practical application of this model using a typical Serbian farm specialized in crop production. A farm from Serbia was chosen for the analysis, considering that Serbia is a typical representative of a developing country, where even today less than 10% of the total arable land is insured. Furthermore, in Serbia, as in most countries in the world, only classic yield insurance is applied, while the insurance of financial indicators is almost not used by farmers at all.

2. Research Methods and Data

2.1. Data Sources

The functioning of the WFRP model in the USA is based on determining the trigger level of revenue, and if due to reduced yields or market prices of cultivated crops that happen at the end of the year the realized revenue falls below the predetermined trigger level, the farmer is entitled to indemnification. The trigger revenue level is obtained as a product of the insured revenue (which represents a lower value than the planned revenue and average revenue in the last five years) and the selected level of coverage. The level of coverage in the WFRP model ranges from 50 to 85%, depending on the number of crops represented on the farm. Additionally, the expenses at the end of the year must be at least at the level of 70% of approved expenses (i.e., average expenses in the previous five years.)

The bio-economic model of a typical Serbian family farm that specialized in crop production was used to achieve the research goal. A typical Serbian farm is characterized by growing the four most common crops: wheat, corn, sunflower, and soybeans. This family farm cultivates a total of 32 ha of high fertility land and has typical sowing structure for that region, which assumes growing the most important crops (wheat, corn, sunflower, and soybeans) for the northern part of Serbia, the Autonomous Province of Vojvodina. Additionally, to determine the price of crops and inputs, data from the Statistical Office of the Republic of Serbia [28] and the stock market for agricultural products in Novi Sad [29] were used. On the other hand, basic information about the WFRP model was downloaded from the U.S. Department of Agriculture website [30].

The insurance was analyzed for the year 2019 on the basis of data from the period 2013–2017, while 2018 was a lag year. A lag year is the year preceding the insured year, it does not belong to the historical period of the farm (2013–2017), but even in that year, the farm must achieve a certain revenue. This period was chosen for the analysis because it covers not only years characterized by regular production conditions (2013 and 2016), but also years with extreme droughts (2015 and 2017) as well as 2014, which was characterized by extreme floods. Various scientific studies were used for the creation of the theoretical part of the paper. Practical implementation of WFRP is shown in the case of the aforementioned farm.

2.2. Methods

The Whole-Farm History Report represents the starting point for projecting expected and insured revenue. In order to calculate the historical average revenue, it is necessary to calculate the value of the indexed average revenue (R_p) first. This is calculated by multiplying the average realized revenue (I_{pi}) during the past five years and the index factor (i_f):

$$R_p = I_{pi} \cdot i_f \tag{1}$$

The index factor (i_f) is obtained by dividing the revenue from each year of the analyzed period (2013–2017) with revenue from the previous year. This means that revenue from 2017 (I_{2017}) is divided by revenue from 2016 (I_{2016}), revenue from 2016 (I_{2015}) is divided by revenue from 2015 (I_{2015}), and so on. The values thus obtained are first summed together, and then the resulting amount (I′) is divided by 4. Finally, the calculated value (I″) is raised to the fourth power.

$$\begin{gathered} I' = \frac{I_{2017}}{I_{2016}} + \frac{I_{2016}}{I_{2015}} + \frac{I_{2015}}{I_{2014}} + \frac{I_{2014}}{I_{2013}} \\ I'' = \frac{I'}{4} \\ i_f = I''^4 \end{gathered} \tag{2}$$

The same procedure is used when calculating the amount of indexed expense amount (A_p), providing the expenses per year marked with $A_{2017–2013}$. Expenses in the WFRP insurance model have only one role, which is to neutralize the possibility of moral hazard. In particular, this implies that the insured person will be penalized by reducing the insured amount of revenue if the farm does not have at least 70% of the anticipated (approved) expenses during the production (insured) year.

$$\begin{gathered} A_p = A_{pi} \cdot i_f \\ A' = \frac{A_{2017}}{A_{2016}} + \frac{A_{2016}}{A_{2015}} + \frac{A_{2015}}{A_{2014}} + \frac{A_{2014}}{A_{2013}} \\ A'' = \frac{A'}{4} \\ i_f = A''^4 \end{gathered} \tag{3}$$

The forecast of the farm's expected revenue is based on yields and prices in the previous five years. Planned revenue (I) is calculated as the product of the total area planted (h), the expected yield (y), and the product price (c).

$$I = h \cdot y \cdot c \tag{4}$$

The insurance premium represents the fee that the insured (owner of the farm) has to pay to the insurer for the risk transfer. The premium amount is calculated as the product of insured revenue (I_o) and premium rate (p).

$$P_i = I_o \cdot p \tag{5}$$

The amount of the premium rate is directly dependent on the diversification factor, which is determined on the basis of the number of represented products on the farm. In particular, a greater number of produced crops on the farm means a greater diversification factor. On the other hand, the premium rate is also affected by a coefficient called the Weighted Commodity Rate. Each crop has its own weighted commodity rate and its value depends on, for example, the crop sensitivity to weather. In particular, for a higher sensitivity crop, this coefficient is higher and vice versa.

The factor expense reduction (w) is calculated if there is a large difference between the approved and allowable expenses. In particular, if by dividing the allowable expenses with the approved expenses the obtained value (q) is equal to or greater than 0.70, there is no expense reduction. In that case, the expense factor will be equal to 0 and there will be no need for further calculations. However, if the result of dividing the allowable with the approved expenses is less than 0.70, the result needs to be subtracted from 0.70 to determine the reduction factor expenses.

$$\begin{gathered} q = \frac{Allowable\ expenses}{Approved\ expenses} \\ If\ q \geq 0\ \rightarrow w = 0 \\ If\ q < 0\ \rightarrow w = 0,70 - q \end{gathered} \tag{6}$$

In situations where at the end of the production year the farmer has earned revenue that is less than the value of the guaranteed (insured) revenue, the insurer is obliged to compensate the insured for the amount equal to the difference between the insured revenue (I_o) and the realized revenue (I_p):

$$F_r = I_O - I_p \tag{7}$$

3. Results

The first step will be a draft of the Whole-Farm History Report (Table 1). This is a report that documents the allowable revenue and allowable expenses for each tax year and is used in determining the whole-farm historic average of revenue and expenses. The historic period covers five consecutive tax years prior to the tax year immediately before the insurance year (lag year). When determining the whole-farm historic average revenue, as showed in Table 6, we observed two values, the average revenue for the period from 2013 to 2017 and the indexed average revenue. The higher value represents the whole-farm historic average revenue.

Table 1. Whole-Farm History Report.

Tax Year	Allowable Revenue ($)	Allowable Expenses ($)
2013	30,600	21,198
2014	27,587	17,807
2015	26,882	15,028
2016	29,778	19,933
2017	32,600	18,999
Total	147,447	92,965
Average	29,489	18,593
i_f (*Formulas (2) and (3)*)	1.069	0.961
Indexed amount ($Average \cdot i_f$)	31,523	17,868
Whole-Farm Historic Average	31,523	18,593

Source: Authors' calculation.

As can be seen from Table 1, for the farm historic average revenue, a value greater than the simple average revenue or indexed average revenue is taken. In this case, the historic average allowable

revenue equals the value of the indexed average revenue ($31,523). On the other hand, the value of the whole-farm historic average is equal to the mean expenses value ($18,593), considering that this value is greater than the index value.

The Farm Operation Report contains information on all the crops the farmer plans to grow during the production year. It is necessary to enter data on which area each crop will be sown, the expected yield, the expected product price, and the expected revenue. Assessment of the expected prices of commodities produced on the farm is based on: (1) Purchase contract price; (2) price calculated for the commodities that were sold during the current insurance year prior to the submission of the report, and (3) the price with which the insurance agent agrees best reflects the price that the insured expects to gain on the farm or on the market. It is important to note that when determining the expected price, the above sequence (1, 2, 3) must be complied with. The purpose of conducting the Farm Operation Report is to determine the amount of approved revenue, which is lower when comparing the estimated farm revenue in the insured year and the historic average revenue of the whole-farm, as calculated in Table 2.

Table 2. Farm Operation Report.

Commodity Name	Yield ($t \cdot ha^{-1}$)	Expected Value ($\$ \cdot t^{-1}$)	Expected Revenue ($\$ \cdot ha^{-1}$)	Intended Quantity (ha)	Share	Total Expected Revenue ($)
	1	2	3 = 1·2	4	5	6 = 3·4·5
Spring wheat	4.94	163	805	12	1.00	9660
Corn	8.92	141	1257	5	1.00	6285
Soybean	3.62	350	1267	6	1.00	7602
Sunflower	2.88	294	847	9	1.00	7623
Total Expected Revenue						31,170
Whole-Farm Historic Average Revenue (Table 1.)						31,523
Approved Revenue (lesser of Total Expected Revenue and Whole-Farm Historic Average Revenue						31,170
Approved Expenses (Approved Revenue/Average Revenue (Table 1.) · Average Expenses (Table 1.)						18,593

Source: Authors' calculation.

The analyzed farm was engaged in the cultivation of winter wheat, corn, sunflower, and soybean, which means that it is engaged only in crop production, on a total area of 32 ha. The production itself takes place on very good quality land using modern machinery, but without irrigation. During the production (insured) year, the following crops participate in the sowing structure: wheat (12 ha), corn (5 ha), soybean (6 ha), and sunflower (9 ha). Based on Equation (4), the total expected revenue is estimated to be $31,170, which in this case represents the value of the approved revenue, while the value of the approved expenses is $18,593.

It is the obligation of each farmer to file a tax return with the competent National Tax Authority at the end of the production year. The tax return is a fairly complex form that covers all types of revenue and expenses incurred during the production year. Due to its comprehensiveness, the tax return forms the basis for determining the allowed revenue (Table 3) and allowed expenses (Table 4).

Table 3. Allowable Revenue.

Items	Realized Revenue ($)	Allowable Revenue Per Item ($)
Sales of livestock, produce, grains and other products you raised	19,976	19,976
Subsidies	5400	0
Rental income from mechanization	1484	0
Federal gasoline or fuel tax refund	1365	0
Cooperative distributions	822	822
Crop insurance proceeds and federal crop disaster payments	0	0
Total revenue	27,766	
Allowable Revenue for Tax Year		20,798

Source: Authors' calculation.

Table 4. Allowable Expenses Worksheet.

Items	Realized Expenses ($)	Allowable Expense Per Item ($)
Labor	5951	5951
Interest: Mortgage and Other	5302	0
Fertilizers	4804	4804
Seeds material	3880	3880
Gasoline, fuel and oil	3174	3174
Rent or lease: Vehicles, machinery, equipment, and other	2898	0
Pesticides	2755	2755
Repairs and maintenance	2430	2430
Utilities	2114	2114
Taxes	1550	0
Supplies	1420	640
Transport costs	1053	1053
Depreciation	1039	0
Storage and warehousing costs	783	783
Rent for land	0	0
Total expenses	39,153	
Allowable Expenses for Tax Year		27,584

Source: Authors´ calculation.

Allowable farm revenue includes revenue that has been generated as a result of the farm's business on an annual basis, whether it is the crop production (such as the analyzed farm) or the products purchased to continue its growth development on the farm. Based on the completion of the allowable revenue worksheet, the revenue that can be insured by the WFRP model is differentiated from those not covered by this model. Thus, for example, it is not possible to insure revenue from any post-production operation, net profit from hedging or speculation, revenue from renting mechanization assets, revenue from government assistance and support programs, etc.

On the other hand, it is necessary to fill in the Allowable Expenses Worksheet (Table 4). This form determines the expenses incurred by the farm during the production year and if the expenses are not at least 70% of the approved expenses, a correction (decrease) in the value of the insured revenue occurs (Table 2). This prevents the possibility of a moral hazard occurring in the sense that the farmer intentionally reduces his investment (e.g., discontinuation of certain agrotechnical operations, reduction of the applied amount of mineral fertilizer, poor crop protection, etc.), as this would mean that the planned/insured revenue is not realistic, that is, it will inevitably be smaller. Specifically, the amount of insured revenue will be reduced by 1% of each percentage point of approved expenses that falls below 70% of the approved expenses. Generally allowable expenses exclude any expenses related to post-production operations or products for which there is no insured interest.

From Tables 3 and 4, it can be seen that the allowable revenue for the 2019 tax year was $20,798, while the allowable expenses were $27,584.

The insurance provides protection to the farmer against possible revenue loss in the way that the insurance company (as the insurer) undertakes to compensate the farmer (as the insured) in the case of an insured event. On the other hand, the farmer is obliged to pay the insurance premium to the insurer.

The WFRP model gives the farmer the choice of the coverage level of the insured revenue. Coverage levels range from a minimum of 50% to a maximum of 85% of insured revenue, where farms with adequate product diversification are eligible for the highest coverage levels (80 and 85%) [31]. In order to be able to conclude for a particular farm that it has good production diversification, it is necessary to produce at least three different products that must each significantly contribute to the total farm revenue. This reduces the likelihood of an insured event occurring, because there is a possibility that the poor financial result of one product will be offset by the good financial result of the other two. Greater production diversification, in addition to allowing a higher coverage percentage, also allows for a higher amount of subsidies.

The amount of the insurance premium for the WFRP model is calculated on the basis of Equation (5), whereby the insured revenue is obtained by multiplying the approved revenue (from Table 2) with the selected coverage level (Table 5). Administrative costs of $30 should be added to this amount. In

most countries, the Ministry of Agriculture subsidizes a certain percentage of the insurance premium. Specifically, in the U.S., the amount of subsidies depends on the number of products produced on the farm (higher diversification means higher subsidies), while in Serbia, the Ministry of Agriculture, Forestry, and Water Management subsidizes a certain percentage of insurance premiums, depending on the size of the farm's property. In this particular case, it is the farmer's responsibility to pay the insurer $373 in premium, whether or not the insured event occurred during the year. Since the farmer grows four crops, they are entitled to a subsidy of 56% of the premium.

Table 5. The calculation of premium borne by the insured.

Approved Revenue ($)	Coverage Level (%)	Premium Rate (%)	Subsidy Amount (%)	Premium Amount ($)
1	2	3	4	5 = 1 · 2 · 3 - 4
31,170	85	3,2	56	373

Source: Authors´ calculation.

The WFRP policy provides protection against loss of approved revenue due to the unavoidable natural causes that occur during the insurance period such as: (1) unfavorable weather conditions (drought, hail, storm, thunder strike and similar); (2) fire; (3) insects; (4) plant diseases; (5) wild animals; (6) earthquake and volcanic eruption; and (7) the reduction of market prices (provided that the fall of market prices was due to unavoidable natural causes and not due to human factor).

In this model, it can be stated that the insured event occurred in a situation in which the allowable revenue (Table 3) at the end of the production year is lower than the insured revenue obtained as a product of the approved revenue and the selected coverage level (Table 6). The farmer (the insured) is obliged to provide the insurance company with a written notice of loss within 72 h of initial discovery that their allowable revenue for the insurance year could fall below the insured revenue. After that, the claim for the indemnity form is submitted (Table 6), and if the insured has complied with all the provisions of the policy, the insurance company is obliged to pay for the farmer's loss within 30 days.

Table 6. Claim for indemnity form.

Allowable Expenses (Table 5)	Approved Expenses (Table 3)	Expense Percentage	Expense Reduction Factor	Approved Revenue (Table 3)	Coverage Level (%)	Insured Revenue	Allowable (Realized) Revenue (Table 4)	Revenue Loss
1	2	3 = 1/2	4	5	6	7 = 5·6	8	9 = 7–8
27,584	18,593	1.48	0	31,170	85	26,495	20,798	5697

Source: Authors' calculation.

If there is a large difference between the approved expenses (Table 2) and allowable expenses (Table 4), it is necessary to reduce the amount of insured revenue by the expense reduction factor (Equation (6)). In the analyzed case, allowable expenses are higher than the approved expenses, so it is not necessary to make a correction (reduction) of the amount of the insured revenue.

At the end of the 2019 production year, the analyzed farm had a total revenue of $20,798. This revenue was significantly lower than expected and insured revenue, and was a consequence of very adverse weather conditions, especially drought, which led to significantly lower yields of cultivated crops. From Table 6, it can be seen that the difference between the insured and the realized revenue was $5697 (Equation (7)), and the insurer is obliged to reimburse that amount to the farmer.

4. Discussion

Research on revenue insuring in Canada and the United States has been conducted by Turvey and Amanor-Boadu (1989), Hennessiv et al., Babcock and Haies (1997), and Dismukes and Durst (2006), and in the European context by Meuvissen, Huirne, and Skees (2003) and D'ıaz-Caneja and Garrido (2006), but none of these studies were completely satisfactory from an economic point of view [27,32–35]. The U.S. Risk Management Agency (RMA) first offered whole-farm insurance in 1999 when it introduced

AGR (adjusted gross revenue) and later AGR-Lite [23]. Neither AGR nor AGR-Lite were particularly popular with farmers, as together they accounted for less than 0.5% of the total crop insurance in the United States in 2014 [36]. The lack of application was primarily caused by the overall complexity of insurance as well as the observation among farmers that indemnification paid under the policy was lower and much less frequent compared to other crop insurance models [37].

Despite the low representation of AGR and AGR-Lite, interest in whole-farm insurance continues, as evidenced by the 2014 Farm Bill that issued a directive from the U.S. Department of Agriculture (USDA) to conduct a feasibility study on a whole-farm insurance offer with higher levels of coverage [38]. The benefits of applying the WFRP model are reflected in cost-effectiveness (only one policy is paid for the whole-farm), the need for damage assessment (often not realistic and objective) is neutralized, and the problems of negative selection and moral hazard are reduced to a minimum. The system of the model functioning is quite simple, at the end of the year, the farmer is entitled to compensation of damages if for certain objective reasons they do not achieve the planned and insured farm revenue. On the other hand, the biggest disadvantage of the WFRP model is the extensive documentation that needs to be obtained when concluding an insurance policy. Among other things, tax forms are needed for a historical period of up to five years. Furthermore, due to the complexity of the model itself, WFRP is still not suitable for farmers with a lower level of education. As another deficiency, farmers often cite a maximum limit of $8.5 million in insured revenue as well as certain restrictions that apply to some products that cannot be insured with this model. Another disadvantage of WFRP is that it does not imply protection against catastrophic risks.

5. Conclusions

The value of crop production represents a function of the following two factors: the achieved yield of a crop or fruit and the price at which agricultural products are sold on the market. The fluctuations of either of these two factors inevitably reflect the realized revenue, but also the final financial result. In order to prevent and reduce any losses that may occur due to adverse weather conditions that could jeopardize yield (production risk) or lower the sale prices of products (market risk), farmers often opt for insuring their production. They have, at their disposal, a large number of insurance models offered by insurers, and it should be emphasized that the trends in the last few years indicate the increasing use of insurance models based on the insurance of the whole-farm as well as the insurance of financial rather than natural production parameters. The WFRP insurance model analyzed and presented in this paper provides an opportunity to insure the revenue of the whole-farm, not just, for example, the yield of one production line.

In the analyzed case, due to the fact that the value of the realized revenue is less than the insured revenue, the insurer is obliged to pay the farmer compensation in the amount of $5697. On the other hand, the farmer pays a premium to the insurer of $373 as a risk transfer fee. This insurance model involves applying the highest coverage levels as well as government support in terms of subsidizing certain percentages of insurance premiums. It is clear that the WFRP model could be an addition to the existing agricultural risk management instruments, and because of its benefits, it could have a positive impact on the growth of insured farms in Serbia as well as on strengthening trust between farmers and insurance companies. A clear country-wide strategy, which would include establishing a legal framework and financial incentives for this insurance model, could lead to the successful implementation of this financial instrument in the Serbian agricultural insurance market in the near future.

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