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DO DIRECT PAYMENTS AND AGRICULTURAL INSURANCE IMPACT VITICULTURE INCOME?

In the EU 7 million farmers benefit from direct payments. Direct payments represent a significant share of farmers' income and help stabilize the farm income. Besides direct payments, the farmer can contract agricultural insurance to guarantee compensation for occurred damage on their farm. The insurance premium is a cost for farmers but provides safety in the situation of a risk occurrence. Premium can be subsidized in the frame of Common Agricultural Policy to help farmers insure their business and prevent climate risks and damages. The paper aims to determine the importance of direct payments and insurance in stabilizing farmers' income using gross margin in viticulture. Both scenarios, 1st with direct payments and 2nd without direct payments with sub scenarios – 1st without risk occurrence, 2nd most probable, 3rd probable, and 4th catastrophic were calculated and discussed. Results show that in all shown scenarios/sub scenarios, farm income in viticulture is positive while only catastrophic scenario shows a negative gross margin. The decision tree shows that farmers need to insure their business in both scenarios. Limitations of the research arise from the limited access to data. To the best of our knowledge, there are no studies investigating the importance of direct payments and agricultural insurance in stabilizing the farmers' income in Croatian agriculture.

Keywords: *direct payments, agricultural insurance, income, viticulture*

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1. INTRODUCTION

Agriculture is exposed to different types of risks, and farmers are faced with various risks, such as price risks, production, or income risks (European Commission, 2017b). Moreover, farmers are faced with institutional, traditional, human, and financial risks. Today, globally significant are climate change risks and consequences that cause production, financial or human losses. Research shows that climate change increases farmers' risk exposure (Cordier and Santeramo, 2019). Climate change consequences are seen in the variability of food prices, food security, land use (Lobell and Field, 2007; adopted Roco et al., 2017), increasing uncertainty (Pathak and Wassmannn, 2009; adopted Roco et al., 2017), and impact agricultural production and farmers' production/financial results. Global climate change risks in economic losses between 1980 and 1999 were about $ 1.63 trillion, increasing to nearly $ 3 trillion between 2000 and 2019 (UNDRR, 2020). Only in Croatia in 2017 losses were more than 2 billion HRK (~ $ 319 million), and in 2018 recorded losses were 170 million HRK (~ $ 26 million), in 2019 192 million HRK (~ $ 29 million).

Price risk is linked with the variability of input and output prices, consequently impacting income. Income as an amount of money available to farmers can vary due to unexpected events. Matthews (2018) stated that heterogeneity in income among EU member states is recorded. In the EU-28 highest farm income per Annual work unit (AWU) have Denmark, The Netherlands, and Luxembourg, while the lowest farm income per AWU has Poland, Croatia, Romania, and Slovenia (DG Agriculture and Rural Development, 2018). The share of direct payments in Farm Net Value Added (FNVA) in the EU is on average 31%, and the highest is in Finland and Slovakia, while only 12% of direct payments in FNVA is in the Netherlands (Bardají and Garrido, 2016). Bardají and Garrido (2016) concluded that farmers in the Netherlands are more focused on profitable sectors (horticulture, milk, pig, poultry) that are less dependent on direct payments. According to Očić et al. (2018), Croatia's highest direct payments dependency is on cattle, sheep, goat, and dairy farms. On the other side vegetable and floral types of farms are less dependent on direct payments. According to Jones and Webb (2010) wine producers are vulnerable to income variability and market fluctuations. Furthermore, small Italian and French farms are exposed to income volatility (Enjolras et al., 2012).

Various strategies were defined for production and income risk at the global and national levels. On-farm, off-farm strategies, market-based strategies, and policy interventions are available due to the higher exposure of farmers to an increased probability of extreme weather events (Cordier and Santeramo, 2019). The best strategy to cope with income risk is to diversify income sources through production diversification, non-farm income sources, marketing techniques, and using

other strategies (OECD, 2000). For example, more than 7 million farmers in the EU benefit from direct payments, representing an essential share of farmers' income (European Commission, 2017a). Terluin and Verhoog (2018) researched that higher average direct payment leads to farm income increment. Farmers receive income support according to farm size, and precisely it means farmers get direct support depending on how many hectares they cultivate. Besides direct payment, farmers within rural development measures can apply for subsidized insurance to help them insure their business and prevent risks. Insurance represents a tool to cover losses due to natural disasters, from the risk that has a low occurrence probability as well as high losses. Insurance is defined as a tool for transferring risk from a farmer to an insurance company in exchange for paying a premium (Njavro and Čop, 2021). The primary purposes of buying insurance are risk reduction, risk transfer, and loss reimbursement (Marković, 2013). It is known that when the insured event occurs, insurance will be paid out to farmers.

Study on Agricultural Risk Management (identified three important barriers to more effective on-farm risk agricultural management. One of the barriers is the current direct payments scheme. The authors mentioned how such a claim might sound strange having in mind that one of the most important effects of direct payments is its contribution to farm income stabilization. But, direct payments work as a disincentive for a more effective on-farm risk management. Direct payments were not conceived as a risk management tool and in fact, they are not efficient as they are decoupled from production and depend on the number of hectares. Due to the pressure to reform direct payments in the coming years, the risk management tools will gain more relevance (Bardaji and Garrido, 2016).

To the best of our knowledge, there are no studies investigating the importance of direct payments and agricultural insurance in stabilizing the farmers' income in Croatian agriculture. The paper fills the mentioned gap in the literature. The paper aims to provide a structured and updated review of income support measures and an overview of risk management measures in Common Agricultural Policy (CAP). The paper reviews the average direct payments at the EU level and in Croatia. Additionally, the aim is to determine the importance of selected instruments (direct payments and agricultural insurance) in stabilizing the farmers' income using gross margin budgets in viticulture. Selected production is viticulture – producing grapes for wine production because viticulture is defined as one of the most sensitive agricultural sectors (Neethling et al., 2016). Viticulture is more exposed to climate risk (Carraro and Sgobbi, 2008), because of increasing climate change consequences, therefore insurance as a strategy helps to cope with climate risks. In Croatia, the highest share of family farms is in vineyard areas (Bedek and Njavro, 2015), and the reason for discussing the viticulture and wine sector is the high competitiveness of the industry in Croatia (Bedek and Njavro, 2016).

2. METHODOLOGY

Gross margin budgets are used to research the importance of selected instruments (direct payments and insurance) in stabilizing the farmers' income in crop production. The gross margin budget was calculated by subtracting the total variable cost from revenue.

$$Gross\ margin = \sum Revenue - \sum Variable\ costs$$

Firstly, revenue was calculated by multiplying the selling price with the yield. Direct payments are added to the total revenue. The variable costs in viticulture are pruning, fertilizers, plant protection agents, the cost of harvesting, and other works and costs. Insurance premiums represent fixed costs. Revenue and variable costs are provided from the Agricultural Extension Service of the Ministry of Agriculture, direct payments from Farm Accountancy Data Network (FADN) data, and insurance cost (basic and additional risks – frost and storm) extracted from insurance offers. Insurance cost is presented according to the final insurance premium after EU subsidization. Additionally, the gross margin budget for insurance premium without EU subsidies is shown in Appendix 1. The gross margin is calculated on 1 hectare. The probability of risk occurrence in gross margin budgets was the expert's assessment.

For our research, the equation is

$$Gross\ margin = \sum Revenue - \sum Variable\ costs - Insurance\ cost$$

The gross margin baseline scenario (without direct payments and with subsidized insurance costs) was compared with two additional scenarios.

Subscenarios in 1st scenario with direct payments are:

1st without risk occurrence (12,000 kg/ha yield) and with direct payments and insurance costs;

2nd most probable – 60% probability of 20% yield drop and with direct payments;

3rd probable – 30% probability of 40% yield drop and with direct payments;

4th catastrophic – 10% probability of 70% yield drop and with direct payments.

Subscenarios in 2nd scenario without direct payments are:

1st without risk occurrence (12,000 kg/ha yield) and without direct payments and with subsidized insurance costs;

2nd most probable – 60% probability of 20% yield drop and without direct payments;

3rd probable – 30% probability of 40% yield drop and without direct payments;

4th catastrophic – 10% probability of 70% yield drop and without direct payments.

Simulation is a process of designing a model of a system and conducting experiments with the model for the purpose either of understanding the behaviour of the system or evaluating various strategies for the operation of the system (Shannon, 1975, in Classens et al. 2010). In the paper, discrete-event simulation was used. In discrete-event simulation description of events in the system (an event signifies the transition from one state to another at a specific point of time) has probabilistic components and changes in a certain moment of time (Classens et al. 2010)

The decision tree represents the graphical presentation of the problems' events and decisions and their chronological sequence. The main advantages of a decision tree are a clear presentation of the problem, consideration of all directions and possible actions, and clarifies the nature of risks and uncertainties within the considered problem (Njavro and Čop, 2021). The decision tree was used to present calculated gross margin budgets and expected decision-making choice. We used @ Risk 7.6 for simulations and PrecisionTree 7.6 software for creating a decision tree.

@Risk is an add-in to Microsoft Excel that lets risk analysis using Monte Carlo simulation. @RISK shows all possible outcomes for any situation – and tells you how likely they are to occur. One can judge which risks to take on and which ones to avoid – critical insight in today's uncertain world (Palisade, 2022).

PrecisionTree is also a Microsoft Excel add-in that helps address complex sequential decision models by visually mapping out, organizing, and analyzing decisions using decision trees (Palisade, 2022)

To provide a short overview of the study background (direct payments and agricultural insurance) and the state of agriculture in Croatia and the EU were used different secondary sources, the Croatian Bureau of Statistics, EUROSTAT, and additional recent literature on direct payments and agricultural insurance.

3. RESULTS AND DISCUSSION

3.1. Agriculture in EU and Croatia

In the EU in 2019, total agricultural output was 418 billion Euros. The biggest producers in the EU in 2019, according to total agricultural output, were France (77 billion EUR), Germany (58.2 billion EUR), and Italy (57.8 billion EUR) (Eurostat, 2020). The total agricultural output was 2.4 billion EUR in Croatia, while the crop production share is higher than livestock production (Croatian Bureau of Statistics database, 2021). In general, the agricultural sector in Croatia is currently in the process of structural transformation, which relates to the modernization of agriculture, stimulating the growth of labor productivity, rural-urban migration, reducing the share of agriculture in total employment, and in GDP (World Bank, 2019). According to the Croatian Bureau of Statistics, the total utilized agricultural area in Croatia decreased from 2015 to 2019 by slightly more than 2%. The largest share of the total utilized agricultural area in 2019 is areas under arable land, around 53%, and permanent grassland (39.42%), while vineyards, orchards, and olive groves – permanent crops, make 4.79% (Table 1). The average size of agricultural holdings in Croatia is 11.6 ha, slightly lower than the average size of farms (15.2 ha) at the EU level. According to Eurostat data, at the EU level, the largest percentage of farms size ranges from 0 to 4.9 ha (65%), and the smallest farms (< 5 ha) utilize only 6% of agricultural areas. Furthermore, only 3.3% of farms utilize more than 50% of agricultural areas.

Table 1:

TOTAL UTILIZED AGRICULTURAL AREA (UAA)
IN CROATIA 2015-2019, IN HA

	2015	**2016**	**2017**	**2018**	**2019**
UAA	1,537,629	1,546,019	1,496,663	1,485,645	1,504,445
Vegetable garden	2,150	1,885	1,848	1,848	1,848
Permanent crops	75,470	71,728	71,937	72,340	73,659
Permanent grassland	618,070	600,000	607,555	607,555	606,129
Arable land and gardens	841,939	872,406	815,323	803,902	822,809

Source: Croatian Bureau of Statistics database, www.dzs.hr

In the European Union, it is evident that "old" member states have a higher income than new member states. For example, the highest income per full-time worker is in the Netherlands (> 17 thousand euros/AWU per year), and the lowest income levels per full-time worker are in Romania, Slovenia, and Croatia (< 6,000 euros/AWU per year).

Data from 2018 present that the average FNVA in EU-28 is more than 36 thousand EUR, while in Croatia is around 33% of EU-28 FNVA. The FNVA/ Annual work unit (AWU) is more than 23 thousand EUR and in Croatia is more than 7 thousand EUR. Family Farm Income (FFI) is expressed per family work unit and is calculated only for the subset of farms with family labour, and Croatia is around 33% of EU-28 (FADN database).

Table 2:

AGRICULTURAL INCOME INDICATORS
IN THE EU AND CROATIA, 2018

EUR	**All farms EU-28 2018**	**All farms Croatia 2018**	**All farms Share Croatia in EU**	**Specialist wine EU-28 2018**	**Specialist wine Croatia 2018**	**Specialist wine Share Croatia in EU**
FNVA*	36.537	12.013	33%	63.596	25.299	40%
FNI*	22.940	9.639	42%	43.095	17.663	41%
FNVA/ AWU*	23.057	7.586	33%	35.909	11.710	33%
FFI/ FWU*	19.415	6.488	33%	39.980	9.313	23%
Number of farms	4.033.544	72.366	2%	224.003	2.128	1%

Source: FADN database

*FNVA – Farm net value added; FNI – Farm net income; FNVA/AWU – Farm net value added/ Annual work unit; FFI/FWU – Family farm income/Family work units

3.2. Common Agricultural Policy overview

Common Agricultural Policy (CAP) was launched in 1962 and through years and reforms, CAP evolved and changed. From 1962 to 1992 classical CAP was marked with high market price guarantees, the CAP reforms started with the Mac Sharry reform from 1992 that replaced price support with direct payments, as well as introduced new supply control measures. To additional build, Mac Sharry reform, Agenda 2000 (from 1999) reform continues to turn the European path from price support to direct payments and income stabilization. Considering the Mid-term review reform from 2003, CAP is reducing market and price support and tends to develop new rural development programs. The Mid-term reform introduced new mechanisms, such as decoupled aid transferred to single farm payment, implementing cross-compliance, and establishing a single common market organization (single CMO). The Health Check reform 2009, aimed to reinforce the complete decoupling of aid by gradually eliminating the remaining coupled payments to production and reorienting first pillar funds towards rural development. Reform from 2013 converted single farm payments to a system of payments with seven different components; as well as single CMO become safety nets, and the first pillar which funds through the European Agricultural Guarantee Fund consolidated the second pillar, which covers rural development measures (European Parliament, 2020).

Table 3:

CAP REFORMS

Name of the Reform	**Year**	**Before Reform**	**After Reform**
Mac Sharry	1992	Price protection (market support)	Direct income support (producer support)
Agenda 2000	1999	Price support	Direct payments and income stabilization (creation of second pillar of CAP – rural development)
Mid-term review	2003	Market and price support	New rural development programs
Health Check	2009	Coupled payments	Production payments and reorient first pillar funds towards rural development.
The 2013 reform	2013	Decoupled aid	Greening Support for small farms Incentives for young farmers

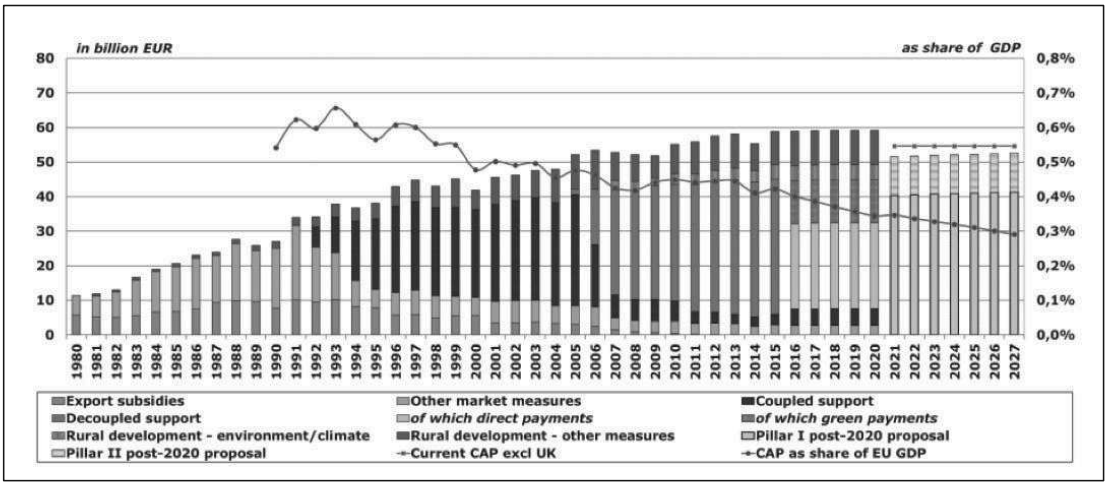
Source: Author's synthesis according to European Parliament, 2020

Currently, the CAP is in the process of reform for the next programming period (2021-2027). The general goals of the new CAP are to foster an innovative, resilient, and diversified agricultural sector ensuring food security; secure environmental care and climate action to contribute to the environmental and climate-related objectives of the Union; strengthen the socio-economic fabric of rural areas (Council of the European Union, 2020). The new CAP has nine specific objectives: 1) support farm income and resilience to enhance food security, 2) enhance market orientation and increase competitiveness, including greater focus on research, technology and digitalization, 3) improve the farmers' position in the value chain, 4) contribute to climate change mitigation and adaptation, as well as sustainable energy, 5) foster sustainable development and efficient management of natural resources such as water, soil and air, 6) contribute to the protection of biodiversity, enhance ecosystem services and preserve habitats and landscapes, 7) attract and sustain young farmers and facilitate business development in rural areas, 8) promote employment, growth, gender equality, social inclusion and local development in rural areas, including bio-economy and sustainable forestry and 9) improve the response of EU agriculture to societal demands on food and health, including safe and, nutritious and sustainable food produced in a sustainable way, food waste, as well as animal welfare (Council of the European Union, 2020).

In the total EU budget (162.11 billion euros), 58 billion euros refers to CAP (around 36% of the overall EU budget is directed toward agriculture), of which approx. 41.74 billion euros were directed for direct payments, 2.7 billion euros for market measures, and 14.37 billion euros for rural development. In a comparison of Croatia to the EU, the quota of direct payments in the Republic of Croatia is 48%, the market measures 2%, and support for rural development is 50%. In the new CAP period 2021-2027, for the next Multi-annual Financial Framework (MFF) total CAP budget is 365,006 million euros, and 78% is for the 1st Pillar, with the highest percentage for direct payments and 22% of the total budget for 2nd Pillar (Picture 1).

Picture 1:

CAP BUDGET, 1980-2027



Source: European Commision, 2021b

To help achieve the mentioned CAP goals, farmers can implement income support (direct payments) and market measures (1st Pillar) financed by the European agricultural guarantee fund (EAGF) and rural development measures (2nd Pillar) financed by the European agricultural fund for rural development (EAFRD). Therefore, the highest share regarding value support is for income support, then in the second place are rural development measures and market measures.

According to European Commission (2021a), the primary goals of income support are to function as a safety net and make farming more profitable, guarantee food security in Europe, and assist in the production of safe, healthy, and affordable food, reward farmers for delivering public goods not usually paid by markets, such as taking care of the countryside and the environment. Member states are obligated to provide basic, greening, and payment for young farmers, while other payments are optional or voluntary. Voluntary payments are payments for areas of natural constraints, coupled support, small farmers' schemes, and redistributive payments. Direct payment consists of seven components forward mentioned and represented in Table 4.

Table 4:

COMPONENTS OF DIRECT PAYMENT

Obligatory payment	Voluntary payment
Basic payment	Areas of natural constraints
Greening	Coupled support
Young farmers	Small farmers scheme
	Redistributive payment

Source: Author's synthesis according to European Commission, 2021a

The basic payment as income support is divided into the basic payment scheme and a single area payment scheme. The basic payment scheme can be paid out to active farmers according to their activation of the payment and the number of hectares. This payment activation is done annually by declaring eligible hectares. Under the new basic payment scheme, direct payments account for around 70% of Member States' national funding allocation after deduction of the amounts allocated to young farmers or other voluntary payments.

Greening payment or payment for sustainable farming methods represents additional payment per hectare for using climate and environment-friendly farming practices. Three greening measures are crop diversification, maintaining existing permanent grassland, and an ecological focus area. Payment for young farmers (under 40 years) is mainly for the generational renewal of farms in the EU, and 2% of the national budget needs to be allocated for young farmers. The redistributive payment as voluntary payment is for the first hectares, whereby they can take up to 30% of the national allocation and redistribute it to farmers on their first 30 hectares. Coupled support is linked to some specific products, and this support must account for no more than 8% of the national funding. For areas with natural constraints or less favored areas, a payment must account for no more than 5% of national funding allocation in the Member States. Payment for small farmers is linked with enhancing the competitiveness of small farms and is called the "Small farmers scheme" (Council of the European Union, 2013).

The FADN sample is more than 4 million farms, and Table 5 represents the value of paid subsidies from 2013 to 2019. In the last observed year, the average total subsidies (excluding investments) per farm in the EU were 14 thousand EUR. Total direct payments are 10,534 EUR. As a new member state from 2013, in Croatia, the average total subsidies from 2013 to 2019 increased, and in 2019 were more than 7 thousand per farm. The average direct payment is more than 5 thousand in

Croatia, while for specialist wine total direct payment is 1.239 EUR per farm. The average wine farm in the FADN sample has 4.2 ha of vineyards. Direct payments per hectare are 295 EUR or 2,229.85 HRK.

Table 5:

AVERAGE SUBSIDIES PER FARM IN THE EU AND CROATIA, 2013-2019.

EUR	2013	2014	2015	2016	2017	2018	2019
European Union							
Total subsidies – excluding on investments (€)*	11,146	11,285	11,218	11,796	12,090	13,856	14,113
Total direct payments (€)**	8,810	8,963	8,867	9,253	9,397	10,527	10,534
Total support for rural development (€)	1,998	2,017	1,963	2,113	2,252	2,699	2,863
Farms represented (nb)	4,961,852	4,801,332	4,639,797	4,643,177	4,586,135	4,035,682	4,032,874
Croatia – total							
Total subsidies – excluding on investments (€)*	4,313	4,967	5,185	6,387	7,411	7,075	7,584
Total direct payments (€)**	4,313	4,431	4,503	5,183	5,136	5,130	5,219
Total support for rural development (€)	0	328	639	1,131	1,478	1,504	1,835
Farms represented (nb)	80,942	81,427	72,483	72,218	72,259	72,439	72,456

EUR	2013	2014	2015	2016	2017	2018	2019
Croatia – Specialist wine							
Total subsidies – excluding on investments (€)*	1,382	1,147	1,838	1,930	11,933	4,644	5,423
Total direct payments (€)**	1,382	914	1,158	1,165	1,261	1,298	1,239
Total support for rural development (€)	0	197	608	701	1.268	1,705	2,494
Farms represented (nb)	4,249	3,675	2,323	2,006	2,035	2,128	2,150

Source: Author's synthesis according to FADN database

* Represent total payments without investment payments, including direct payments of rural development measures and other payments paid in the observed period. **Represent direct payments, including basic payments, greening, redistributive payment, payments from the national reserve for demined area, coupled support, payments for state aid measures, payments for agri-environmental and climate measures, organic farming, and payments for areas with natural constraints or other special constraints.

3.3. Agricultural Insurance overview

Insurance protects farmers against loss in exchange for paying a defined premium (Hatch et al., 2012), and the insurance elements are risk, premium, and indemnity. If the risk does not exist, it does not make sense to contract insurance (Marković, 2013). Premium presents the amount of money that farmers need to pay to the insurance company, and indemnity is the value that the insurance company will pay out to farmers when insured risk appears. Although member states subsidized agricultural insurance for many decades, risk management tools were introduced in Common Agricultural Policy (CAP), and the new risk-sharing strategies as subsided insurance schemes and mutual funds were introduced in the second Pillar of the Rural Development Program (CAP) for the first time in 2008 (European Commission, 2017b). Later the income stabilization tool was introduced. European Commission (2017a) implemented public aid as an ex-post strategy for catastrophic or systemic risks that cause, e.g., drought or floods, and negatively

impact business. Because it is a large-scale risk, it is not profitable for private companies to provide instruments to cover losses, so the EU provided public aid. Some of the ex-ante policies that can be used in the frame of CAP are income stabilization tool, subsidized insurance (crop and livestock) and mutual funds for production risk, CAP market measures, basic payment scheme, and for ex-post, ad hoc disaster aid (European Commission, 2017b).

On the EU level Measure fiche, Risk Management (Measure – M17) consists of 3 articles from 36-39 (EU No 1305/2013). Crop and livestock insurance (Article 37) can be used to cover yield losses caused by climate risks. Almost all west European states can be insured for all types of risks. Insurance is divided as single-peril that covers one risk, and multi-peril that covers several types of risks, available in all Member states (except Belgium and Denmark). Subsidized insurance under CAP uses different EU member states such as Croatia, Italy, France, The Netherland, Estonia, Latvia, Lithuania, Hungary, Malta, and Romania. Other member states such as Austria, Bulgaria, Czech Republic, Poland, Spain, Slovenia, and Portugal subsidized insurance through national schemes. Subsidized insurance shall only be granted for insurance contracts that cover losses caused by an adverse climatic event, animal, plant disease, pest infestation, or environmental incident. The farmer becomes eligible when risk destroys more than 30 % of the average annual production of the farmer in the preceding three-year period or a three-year average based on the preceding five-year period, excluding the highest and lowest entry. Support shall be limited to 70% of the premium value. Only 5% of farmers are insured in Croatia, and only 40% of utilized agricultural areas (Croatian Chamber of Commerce, 2017). Farmers in Croatia can insure from hail as single-peril insurance, with additional risks, such as frost, storm, low temperature, floods, loss of fruit and vegetable quality.

Mutual funds (Article 38) are the results of the joint action of farmers that invest money for future risks in business. Mutual funds are more used in livestock production and less in crop production (Italy, France, Denmark, and Belgium). The significant losses that can be covered with mutual funds are losses caused by climate events, animal or plant disease, pest infestation, and environmental incidents (Council of the EU, 2013). Support under risk management measures covers financial contributions to mutual funds to pay financial compensations to farmers for economic losses caused by adverse climatic events or by the outbreak of an animal or plant disease or pest infestation, or an environmental incident. For example, in France, the mutual fund covers losses from sanitary and environmental incidents for livestock and plant. Italian mutual fund covers farmers' losses when revenue is lower than 70% of the historical one.

Income stabilization tool (IST) (Article 39) provides compensation to farmers for a severe drop in their income (European Commission, 2017b) when their

income drops more than 30% of the average annual income of the individual farmer in the preceding three-year period or a three-year average based on the preceding five-year period excluding the highest and lowest entry, or more than 20% income drop for sector-specific IST. Income represents the farmer's sum of revenues from the market, including any form of public support, deducting input costs. Payments shall compensate for less than 70 % of the income lost in the year the producer becomes eligible to receive this assistance. The benefit of the income stabilization tool is that it covers price and production risks from the whole farm (Finger and El Benni, 2014). According to Article 40, Reg. 1305/2013 IST functions as mutual funds, with a public contribution. In Rural Development Programme, for 2014-2020, only Italy, Hungary, and Spain – Castilla y Leon planned to implement the Income Stabilisation Tool. Only Italy implemented IST, while Hungary and Castilla y Leon did not.

In Croatia, till 2013 farmers insured their agricultural production through crop insurance and livestock insurance with state support. After Croatia became an EU member state, in 2013 Croatia applied Common Agricultural Policy (CAP) on their national level and received access to the CAP budget. Currently, Articles 38-39 (Mutual funds and IST) of Regulation No 1305/2013 of the European Parliament and the Council are not implemented in Croatia. Article 37, Crop, and livestock insurance in Croatia is only implemented.

3.4. Impact of direct payments and insurance on viticulture income

How direct payments and crop insurance reduce income volatility in Italy and France was researched by Enjolras et al. (2012). Results suggest that Italian farms are smaller than French farms and more exposed to income volatility. To manage income volatility, Italian farmers apply different strategies/tools to stabilize crop income, such as EU payments and crop insurance. On the other side, French farms with higher income volatility apply for direct payments as a substitute for insurance. Enjolras et al. (2012) stated that from income volatility besides crop insurance and direct payment, the main role is also played by farm specialization and climate. Finger and Lehmann (2012) researched which farm characteristics impact farmers' decision-making to choose agricultural insurance. Research emphasizes that introducing general and direct ecological payments and the higher the share of direct payments, decreases the implementation of hail insurance among Swiss farmers. Finger and Lehmann (2012) concluded that farms with a higher share of direct payments in farm revenue are less prone to contract insurance. Research shows that in Switzerland, off-farm income and direct payments are more

important than before, and in the situation of price increment of the product, direct payment is becoming increasingly important, and on the other side, fewer and fewer farmers are ready to accept insurance. El Benni et al. (2012) researched that gross farm revenues are significantly more variable in the mountain than in the valley regions. More specialized farms have unstable revenues. Swiss FADN data shows that switching from market to direct payment led to significant decrement volatility of gross revenues and, consequently, household income. On the other hand, German farmers will be ready to contract whole farm income insurance and revenue insurance even if the direct payments were discontinued entirely (Möllmann et al., 2019).

The gross margin budget shows a baseline scenario without direct payments and with insurance costs. In our first scenario, we used total direct payments for wine specialists to show the share of direct payments in total revenue and subsidized insurance premium cost to present the gross margin budget. In the second, third, and fourth scenarios, we did not include revenue from compensation because of the complex assessment of compensation due to yield losses, damage, and further investment that is farm specific.

Results from the baseline scenario show that revenue would be 72 thousand HRK, total variable costs more than 28 thousand HRK, and gross margin will be almost 43 thousand HRK. So it can be concluded that vine production on 1 hectare is profitable. Including direct payments, a total revenue increase of more than 74 thousand HRK, and with subtracting costs (including insurance cost), the gross margin would be higher than in the baseline scenario. In the scenarios with yield drop, it can be concluded that gross margin decreased from an initial 44 thousand HRK to around -4,236 HRK (Table 6). If extreme events caused greater damage, for example, in the situation of hail occurrence and estimated yield decrement of 40% (Čop et al., 2020), the calculation would still be favorable, higher than 17 thousand HRK, but with a catastrophic risk gross margin is negative (-4,236 HRK). In the scenario without direct payments, the gross margin will be positive, except in the fourth scenario (Table 7).

Table 6:

GROSS MARGIN BUDGET SCENARIO WITH DIRECT PAYMENT – GRAPES FOR WINE PRODUCTION, IN HRK PER 1 HA

Subscenarios	**Baseline scenario**	**1st without risk occurrence**	**2nd most probable (20% drop in yield)**	**3rd probable (40% drop in yield)**	**4th catastrophic (70% drop in yield)**
Probability of yield occurrence		p(x)=0	p(x)=60%	p(x)=30%	p(x)=10%
Yield, kg/ha	12.000,00	12.000,00	9.600,00	7.200,00	3.600,00
Price, 1 kg	6,00	6,00	6,00	6,00	6,00
Direct payments, HRK/ha		2.229,85	2.229,85	2.229,85	2.229,85
Total revenue	72.000,00	74.229,85	59.829,85	45.429,85	23.829,85
Total variable cost	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**
Insurance premium subsidized with EU	1.270,00	1.270,00			
Gross margin	**42.664,46**	**44.894,31**	**31.764,31**	**17.364,31**	**-4.235,69**

Source: Authors

Table 7:

GROSS MARGIN BUDGET SCENARIO WITHOUT DIRECT PAYMENT – GRAPES FOR WINE PRODUCTION, IN HRK PER 1 HA

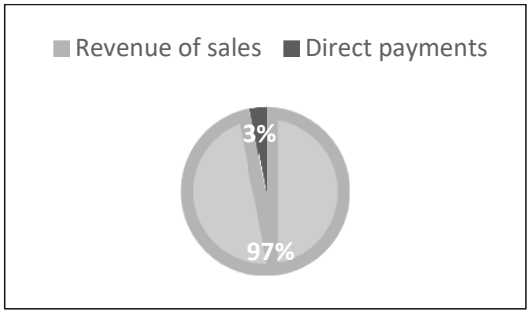
Subscenarios	**Baseline scenario**	**1st without risk occurrence**	**2nd most probable (20% drop in yield)**	**3rd probable (40% drop in yield)**	**4th catastrophic (70% drop in yield)**
Probability of yield occurrence		p(x)=0	p(x)=60%	p(x)=30%	p(x)=10%
Yield, kg/ha	12.000,00	12.000,00	9.600,00	7.200,00	3.600,00
Price, 1 kg	6,00	6,00	6,00	6,00	6,00
Direct payments, HRK/ha					
Total revenue	72.000,00	72.000,00	57.600,00	43.200,00	21.600,00
Total variable cost	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**
Insurance premium subsidized with EU	1.270,00	1.270,00			
Gross margin	**42.664,46**	**42.664,46**	**29.534,46**	**15.134,46**	**-6.465,54**

Source: Authors

To sum up, total direct payments make up 3% of total revenue. In a situation with risk occurrence (yield decrement), direct payments make up 4% to 9% in a catastrophic scenario (10% probability of 70% yield drop). Graph 1 shows the share of sales revenue and total direct payments in total viticulture revenue. If we calculate the share of total subsidies – excluding investments in total revenue, it can be concluded that total subsidies – excluding on investments represent 12% of total revenue (Graph 2). For comparison, in the EU, the proportion of direct payments in agricultural income is 30%, and the higher share of direct payments is seen in the sector such as grazing livestock, mixed production, field crops, and milk sector, and the lowest one is in the horticultural sector and wine, lower than 10% (Bardají and Garrido, 2016).

Graph 1:

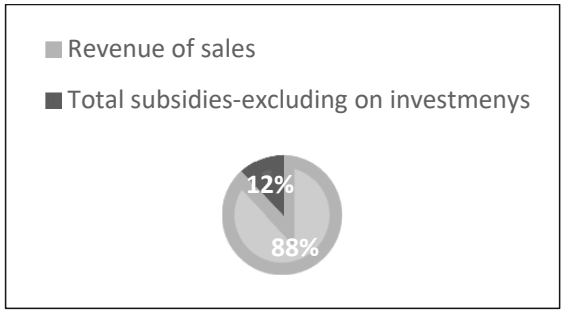
SHARE OF TOTAL DIRECT PAYMENTS (€) IN TOTAL REVENUE



Source: Authors

Graph 2:

SHARE OF TOTAL SUBSIDIES – EXCLUDING ON INVESTMENTS (€) IN TOTAL REVENUE

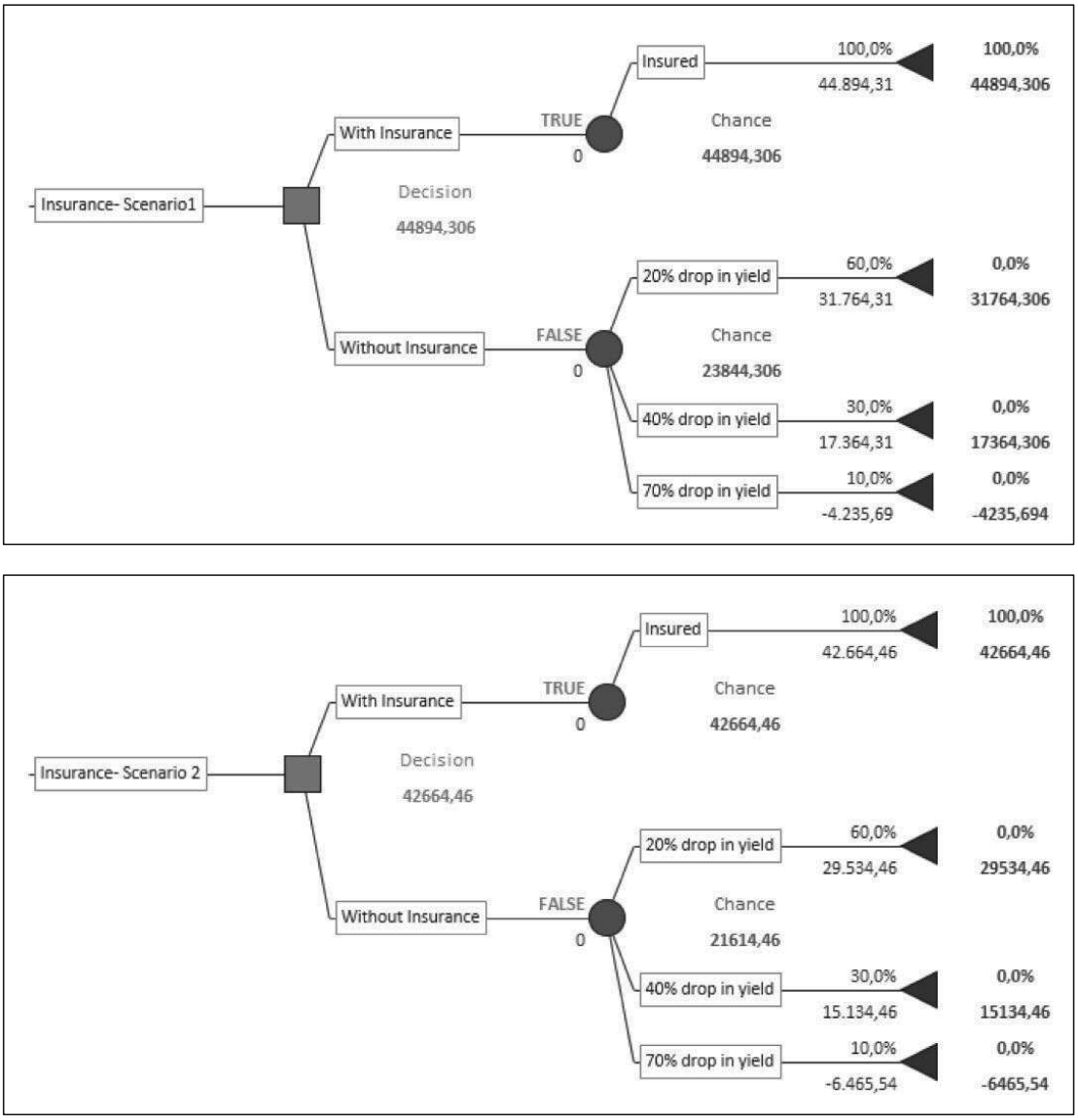


Source: Authors

The decision tree was used to compare different scenarios. Results show that farmers need to choose agricultural insurance in a scenario with direct payments and without direct payments. In both scenarios, with choosing agricultural insurance, farmers can expect a gross margin higher than 42 thousand HRK (scenario without direct payments) and more than 44 thousand HRK (scenario with direct payments). In events of risk occurrence in both scenarios, farmers can expect a gross margin lower than in the events with direct payments.

Figure 1:

DECISION TREE FOR TWO SCENARIOS –



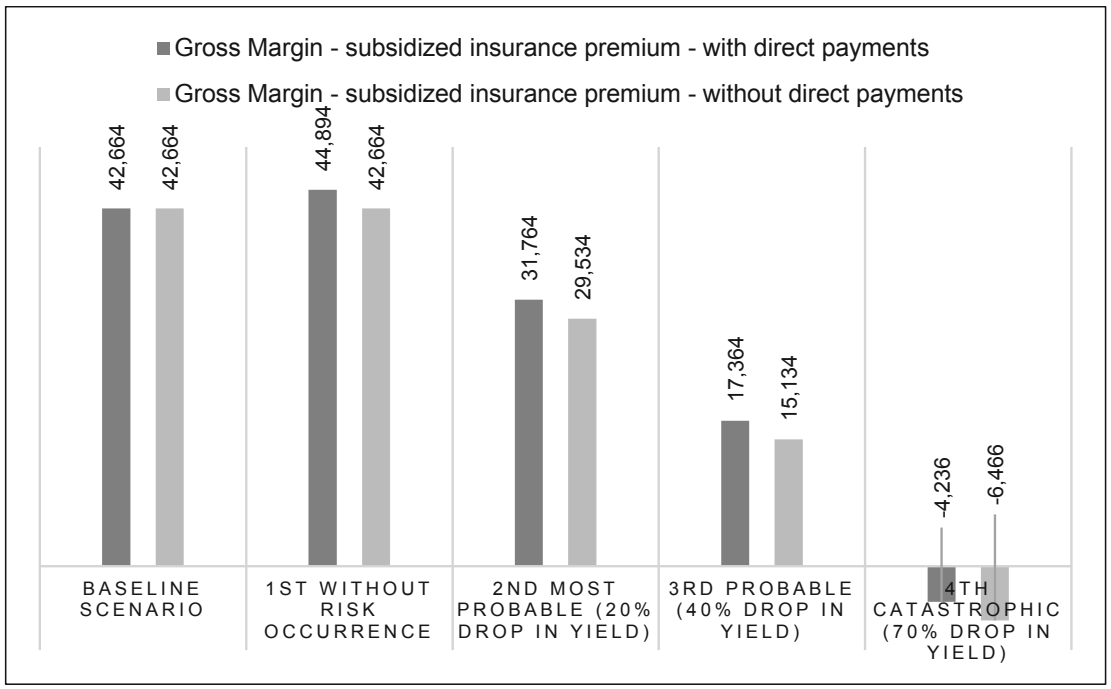
Source: Authors by @Risk software

Further discussing it, if yield decrease by more than 70% and variable cost stay the same, viticulture would not be profitable even with direct payment. So, in extreme events and reduction of production by 70% or more, it can be expected that viticulture would not be profitable, especially if the EU does not subsidize the cost of insurance.

Graph 3 compares gross margin budget results with subsidized insurance premiums with and without direct payments. If grape growers contract agricultural non-subsidized insurance, the insurance premium would be slightly lower than three thousand HRK (2,889.44 HRK). In all scenarios, the same gross margin is expected compared to those in which subsidized insurance is around 1,200 HRK (Appendix 1). Only in a catastrophic scenario with and without direct payments and with subsidized and non-subsidized premium gross margin becomes negative. For example, depending on the level of risk (layering system), there is a need for different risk management. Farmers and producer organizations, cooperatives, and other collective action forms cope with normal risks. In the situation of higher risk (more than 30% of yield, revenue, or income loss), risk needs to be managed by crop insurance, mutual funds, or saving accounts. When a catastrophic risk occurs, the problem should be managed through public intervention and financing (Bardají and Garrido, 2016).

Graph 3:

COMPARATIVE VIEW OF GROSS MARGIN BUDGETS
WITH AND WITHOUT DIRECT PAYMENTS



Source: Authors

In the end, it can be concluded that direct payments have a positive impact on farm income. Precisely from the gross margin budget, it can be seen that viticulture production shows a positive gross margin. Only in the situation with disaster risks (destroyed more than 70% of yields) gross margin will be negative. Besides direct payments, farmers need to consider the importance and advantages of agricultural insurance, such as income stability and yield protection. By contracting agricultural insurance farmers can secure their production and get compensation in the occurrence of extreme events. The low acceptance rate of insurance emphasizes the need for strengthening the awareness of insurance, especially with more favorable terms of contracting insurance due to Measure 17 in the CAP. Furthermore, Bardají and Garrido (2016) stated that substituting direct payments with new risk management measures in CAP (insurances or mutual funds) needs to be considered and that farmers can benefit from it.

4. CONCLUSION

The paper's goal was to provide a structured and updated review of selected measures, direct payments, and agricultural insurance. In addition, the paper aims to determine the importance of direct payments and agricultural insurance in stabilizing income using gross margin budgets in viticulture production. Limitations of the research arise from the limited access to data. Our dataset included the direct payments value of specialist wine producers because there is no available data for viticulture producers in the FADN database and we calculate the direct payment on 1 ha. Limited access to data is also for average insurance premium, which is farm-specific and depends on risks that farmers want to insure.

Results show that direct payments positively impact gross margin in viticulture production, and with insurance cost, the gross margin remains positive. The share of direct payments in viticulture revenues is from 3% to 9%. Different calculations with two types of insurance cost were represented – subsidized insurance premium and non-subsidized insurance premium, and both calculations result in a positive gross margin in viticulture. A negative gross margin was recorded only in the situation of catastrophic risks occurrence with and without direct payment.

The decision tree in both scenarios shows that farmers need to choose insurance to protect their businesses because they expect a higher gross margin. It is important to emphasize that the subsidized agricultural insurance premium within the EU presents the advantage of choosing insurance, such as lower costs for farmers.

Further research is required to provide evidence of the effectiveness of other risk management measures (mutual funds and income stabilization tool) within

CAP and their impact on farm income. Simulation methods should be used in examining how mutual fund and income stabilization tool help farmers to cope with different risks and how they impact farm income.

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APPENDIX

Appendix 1:

GROSS MARGIN BUDGET – GRAPES FOR WINE PRODUCTION (COST OF INSURANCE PREMIUM WITHOUT EU SUBSIDIES), WITH AND WITHOUT DIRECT PAYMENTS, IN HRK PER 1 HA

Subscenarios	**Baseline**	**1st without risk occurrence**	**2nd most probable (20% drop in yield)**	**3rd probable (40% drop in yield)**	**4th catastrophic (70% drop in yield)**
Probability of yield occurrence		p(x)=0	p(x)=60%	p(x)=30%	p(x)=10%
Yield, kg/ha	12.000,00	12.000,00	9.600,00	7.200,00	3.600,00
Price, 1 kg	6,00	6,00	6,00	6,00	6,00
Direct payments, HRK/ha		2.229,85	2.229,85	2.229,85	2.229,85
Total revenue	**72.000,00**	**74.229,85**	**59.829,85**	**45.429,85**	**23.829,85**
Total variable cost	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**
Insurance premium non-subsidized with EU	2.889,44	2.889,44			
Gross margin	**41.045,02**	**43.274,87**	**31.764,31**	**17.364,31**	**-4.235,69**

Source: Authors

Subscenarios	**Baseline**	**1st without risk occurrence**	**2nd most probable (20% drop in yield)**	**3rd probable (40% drop in yield)**	**4th catastrophic (70% drop in yield)**
Probability of yield occurrence		p(x)=0	p(x)=60%	p(x)=30%	p(x)=10%
Yield, kg/ha	12.000,00	12.000,00	9.600,00	7.200,00	3.600,00
Price, 1 kg	6,00	6,00	6,00	6,00	6,00
Direct payments, HRK/ha					
Total revenue	**72.000,00**	**72.000,00**	**57.600,00**	**43.200,00**	**21.600,00**
Total variable cost	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**	**28.065,54**
Insurance premium non-subsidized with EU	2.889,44	2.889,44			
Gross margin	**41.045,02**	**41.045,02**	**29.534,46**	**15.134,46**	**-6.465,54**

Source: Authors

UTJEČU LI IZRAVNA PLAĆANJA I POLJOPRIVREDNO OSIGURANJE NA DOHODAK U VINOGRADARSTVU?

Sažetak

U EU sedam milijuna poljoprivrednika koristi izravna plaćanja. Izravna plaćanja predstavljaju značajan udio u dohotku poljoprivrednika i pomažu u stabilizaciji poljoprivrednog dohotka. Osim izravnih plaćanja, poljoprivrednik može ugovoriti poljoprivredno osiguranje kako bi ostvario naknadu štete na poljoprivrednom gospodarstvu. Premija osiguranja je trošak za poljoprivrednike, ali stvara sigurnost u situaciji nastanka rizika. Premija osiguranja se može subvencionirati u okviru Zajedničke poljoprivredne politike s ciljem pomoći poljoprivrednicima u osiguraju poslovanja, ali i smanjenju šteta uzrokovanih klimatskim promjenama. Cilj rada je utvrditi važnost izravnih plaćanja i mjere osiguranja u stabilizaciji dohotka vinogradara korištenjem metode pokrića varijabilnog troška. Prikazani su izračuni i rasprava za oba scenarija, 1. s izravnim plaćanjima i 2. bez izravnih plaćanja s podscenarijima – 1. bez pojave rizika, 2. najvjerojatni, 3. vjerojatan i 4. katastrofalan. Rezultati pokazuju da je u svim prikazanim scenarijima/podscenarijima dohodak u vinogradarstvu pozitivan, dok samo katastrofalni scenarij pokazuje negativno pokriće varijabilnog troška. Stablo odlučivanja u oba scenarija pokazuje kako bi poljoprivrednici trebali izabrati osiguranje. Ograničenje istraživanja ogleda se u ograničenom pristupu podacima. Prema saznanjima autora, nisu dostupna istraživanja koja ocjenjuju važnost izravnih plaćanja i poljoprivrednog osiguranja u stabilizaciji dohotka vinogradara u hrvatskoj poljoprivredi.

Ključne riječi: izravna plaćanja, poljoprivredno osiguranje, dohodak, vinogradarstvo