Food and Agriculture Organization of the United Nations

Decoupling direct payments in North Macedonia

Impacts on farmer income

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Abstract

North Macedonia's ambition to join the European Union requires reforms of the agriculture sector and subsidy system. One major reform is the alignment to the rules of the Common Agricultural Policy (CAP) of the European Union on direct payments, including the "decoupling" of direct payments from production quantities. The decoupling of direct payments is likely to have significant impacts on production decisions, prices and therefore on farmer income. This paper identifies four possible scenarios for North Macedonia to align the direct payment scheme to regulations of the European Union and subsequently analyses the impact of each scenario on farmer income, using an *ex ante* analysis method in the form of a static microsimulation approach and the farm accountancy data network (FADN) data at individual farm level. The results show that, on average, farmer income increases should direct payments be decoupled in North Macedonia. We further test for heterogeneity and find different effects along farm types and economic farm size – and find that some farmers would exhibit income loses as a result of the reform (i.e. specialist cattle, mixed crops and livestock farmers).

Keywords: Microsimulation, subsidies, direct payments, European Union, accession.

JEL codes: C53, H2, Q12.

Acknowledgements

1 Introduction

North Macedonia's longstanding ambition to join the European Union involves the implementation of numerous large-scale political, economic and institutional reforms.[1] In the context of the agriculture sector, North Macedonia is required to align its agricultural policy to all rules and regulations of the European Union Common Agricultural Policy (CAP). The CAP aims to provide a decent standard of living for European farmers, promote food security and safety. It is based on three instruments: 1) income support (direct payments); 2) market measures; and 3) rural development. The major component of the CAP – representing around 72 percent of the European farm budget, or EUR 41.43 billion – is income support, i.e. direct payments to farmers (European Commission, 2022c).

Traditionally, direct payments supported farm income through coupled, production related payments, e.g. payments per production quantity of a specific crop or per-head livestock holding. Due to the high level of market distortion associated with these subsidies, the 2003 CAP reform implemented the "decoupling" of direct payments from production quantity or livestock holding. Direct payments are now issued contingent on agricultural land holdings and compliance with farming practices, i.e. they do not have a direct effect on production decisions or output. The aim of decoupling direct payments is to raise overall income and well-being without distorting the price mechanism. Recently, climate change and environmental issues, such as biodiversity and management of natural resources, have become a core part of the CAP, and will continue to do so for the new CAP 2023–2027. CAP Strategic Plans will further be evaluated considering the European Union's Green Deal Targets for 2030 and will seek the implementation of new environmental requirements, the improvement of existing requirements, to increase sustainability, and achieve a fairer distribution, i.e. a larger share of income support will be dedicated to smaller farms (European Commission, 2022b).

In North Macedonia, however, agricultural subsidies in the form of direct payments are fully coupled to production and output (Volk *et al.*, 2017), and therefore, the country's direct payment scheme must undergo drastic reforms to align with the CAP. Given the large scope of this policy reform, significant impacts are to be expected on production decisions, prices, wages, land value, entry and exit decision and, finally, farm income. This paper aims to support North Macedonia's ambitions to join the European Union by analysing one aspect of the necessary agriculture sector reforms, i.e. the decoupling direct payments and its impact on farmer income.

To that end, this paper engages in a two-tiered approach: As a first step, we identify multiple scenarios that North Macedonia could implement to align to the CAP. The CAP itself is a complex system, which, nevertheless, provides Member States with some range to decide on how to implement the different support schemes. The objective is to explore this regulatory range to find the best possible scenario for North Macedonia's farmers, i.e. a scenario that increases farm income, while minimizing potential negative impacts. In a second step we use

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[1] North Macedonia became a candidate country for accession of the European Union in 2005 (European Commission, 2022a). Accession discussions were blocked over a name dispute with Greece until 2019, with North Macedonia ultimately changing its name from Republic of Macedonia. The European Union officially approved accession talks in March 2020 (Council of the European Union, 2020). In November 2020, Bulgaria blocked the start of accession negotiations (Mojsovska, 2021).

microsimulations for each identified scenario and estimate the impact of decoupling direct payments on farmer income.

The paper proceeds as follows: We start by delineating the context of direct payment system in North Macedonia and the European Union, outlining the necessary reforms that North Macedonia must implement to align its direct payment system with the CAP. This is followed by an exploration of the different scenarios that North Macedonia could implement for the CAP alignment. Subsequently, we describe the methodology and data used to answer the research question how each individual scenario changes farmer income, followed by an analysis of results and conclusion.

2 Direct payments: North Macedonia versus Common Agricultural Policy of the European Union

2.1 Direct payments in North Macedonia

The agriculture sector plays an important role in North Macedonia's economy: the agricultural gross value added amounted to EUR 948 million in 2017 contributing 11 percent to the overall economy.[2] In the same year, the government subsidized the agriculture sector with EUR 136 million in the form budgetary support. Most of this support – EUR 99 million or 73 percent – was distributed in the form of direct payments to producers.

Direct payments can usually be separated into coupled and decoupled direct payments and while on average 90 percent of payments are decoupled in the European Union; in North Macedonia decoupled payments do not exist (Volk *et al.*, 2019), i.e. 100 percent of direct payments in North Macedonia are coupled to output (40 percent) or to area/animal production (60 percent). Decoupled direct payments are considered less market distortive, as they are not linked to production quantities but to area, and, hence, do not drive production decisions, while providing income support.

An in-depth analysis describing the status quo of North Macedonia's direct payment scheme was conducted by Carfi, Pierangeli and Solazzo (2018). The report summarizes the current direct payment scheme as highly complex, affecting both the control and accessibility of the payments. The complexity of the direct payment scheme lies in the numbers of applied measures and sub measures. Currently, over 100 measures are available to which North Macedonian farmers can apply. The measures include basic and additional schemes, with each scheme including one or more sub measures and different top-up mechanisms with differing eligibility requirements (Carfi, Pierangeli and Solazzo, 2018). For an overview of the measures for the period 2014–2018 (see Table A1 in the annex). This complexity further translates into a huge administrative burden leading to delayed payments. Currently, 25 percent of area based payments and 46 percent of livestock payments fail to comply with deadlines of regulations of the European Union (Carfi, Pierangeli and Solazzo, 2018).[3]

North Macedonia's reliance on coupled direct payments and the convolution of the current system contribute to making any large-scale reform particularly challenging and complex. Therefore, it is essential to consult and communicate in a transparent fashion any suggested changes to the direct payment system to ensure that farmers do not feel left behind. Nevertheless, reforming North Macedonia's direct payment scheme should be considered an opportunity to improve the current agricultural subsidy scheme, particularly given its complexity and administrative burden. Reforms could be used to simplify processes, reduce bureaucracy, and allow farmers to receive payments in a timelier manner.

2.2 Direct payments under CAP and beyond 2020

First introduced in 1962, the CAP's objective is to ensure food security and provide a fair standard of living for European farmers. Over time, the CAP underwent several major and many minor reforms. The most important reform from the perspective of this paper occurred in 2003 when the CAP started to provide income support instead of market or producer support.

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[2] All numerical values in this section are derived from Agricultural Policy Plus [2019], if not stated otherwise.

[3] The deadline set by the European Union is regulated in Article 75.1 of Regulation (EU) No. 1306/2013.

Income support cut the link between subsidies and production; i.e. direct payments became decoupled from production decision (European Commission, 2019a).

The next reform is currently being discussed in the proposal "CAP 2023–2027", which aims to make the CAP more responsive to future challenges, such as climate change and environmental issues, e.g. biodiversity and management of natural resources (European Commission, 2022c). Constant changes of the CAP make reform efforts by applicant countries difficult, as the time from negotiation start to final accession of the European Union stretches over several years or decades, as is the case with North Macedonia. Furthermore, this implies that North Macedonia is aiming at a moving reform target and flexibility in the reform process is required to achieve a successful outcome.

Direct payments to farmers of the European Union are organized under the CAP and amounted to EUR 293 billion during the period 2014–2020. This corresponds to 72 percent of the CAP budget and 27 percent of the total European Union budget. Each year, some EUR 41 billion are reserved for direct payments (European Commission, 2018). The next phase seeks to cut the CAP budget by about 5 percent due to lower contribution after the exit of the United Kingdom of Great Britain and Northern Ireland (European Commission, 2019b). Nevertheless, direct payments will remain a major component in the EU budget and therefore an assessment of the reform progress in applicant member countries is likely to be thorough.

The objectives of the direct payments is to provide income support for farmers, promote competitiveness, sustainability and environmentally-friendly farming practices (European Commission, 2018). These payments also reward farmers for aspects of their work that are not considered by the market, like preserving biodiversity, soil quality and the environment in general, through implementing efficient agricultural practices, such as crop diversification, the maintenance of permanent grassland and the preservation of ecological areas on farms.

The rules underlying direct payments are defined at European level, however, they are implemented directly by Member States, with national authorities being responsible for the control and administration of direct payments. Furthermore, the rules usually come with a certain degree of flexibility, which allows the Member States to adjust direct payments to the local needs.

Farmers can apply for direct payments in the form of a basic income support (BSP) based on the number of hectares farmed. This basic income support is complemented by a series of other schemes each with a specific objective. The additional payment schemes and objectives are:

- Green payment scheme (GPS): for agricultural practices benefitting the environment.
- Young farmer payment (YFS): payment to support young farmers.
- Redistributive payment (RP): provide improved support to small and middle-size farms.
- Payments for areas with natural constraints (NCS): support for farmers in areas which are particularly difficult to be farmed, such as mountains.
- Small farmers scheme (SFS): simplified payment scheme for small farmers (replacing the other schemes).
- Voluntary coupled support (VCS): the only measure that allows coupled support (i.e. contingent on production quantity or livestock holdings) to products, which are economically important and are undergoing difficulties. The European average of the direct payment per eligible hectare is EUR 266 in 2015.

Some of the schemes are mandatory and others are optional. Within certain limits, countries can choose a combination of different payment schemes and different percentages in allocation to support farmers, considering (and adapting it to) their national context. Table 1 shows the schemes and indicates which one is mandatory and how much of the national envelope must or can be allocated to a scheme.

To be eligible for direct payments, farmers must comply with defined minimum requirements, i.e. to be an active farmer, have agricultural land that is used for agricultural activities and hold payment entitlements[4]. These minimum requirements are set by the Member States in the form of a threshold for minimum direct payments or minimum area farmed. For most Member States this minimum requirement is between 0.3 ha to 5 ha.

Table 1.   Direct payments under the European Union's Common Agricultural Policy

Components	Type of component	Type of measure	Share of the envelope
Basic Payment Scheme (BPS)	Compulsory	Decoupled	up to 68%
Greening Payment Scheme (GPS)	Compulsory	Decoupled	30%
Young Farmers' Scheme (YFS)	Compulsory	Decoupled	up to 2%
Redistributive Payment*	Voluntary	Decoupled	up to 30%
Payments for areas with natural constraints (NCS)	Voluntary	Decoupled	up to 5%
Small Farmers' Scheme (SFS)	Voluntary	Decoupled	up to 10%
Voluntary Coupled Support (VCS)	Voluntary	Coupled	up to 13% + 2% for protein crops

Note: The redistributive payment scheme is scheduled to have a mandatory allocation of 10 percent in the CAP 2023–2027 reform.

Source: Authors' elaboration based on European Commission, Directorate-General for Agriculture and Rural Development. 2018. *CAP explained: Direct payments for farmers 2015-2020*. Brussels. Cited 19 May 2022. https://data.europa.eu/doi/10.2762/572019

Under these schemes, farmers are usually free to cultivate any crop, if they satisfy certain mandatory requirements. Since payments are not linked to the quantities produced, farmers are encouraged to align their businesses and production to the demands of the market. In fact, all direct aid is paid to farmers subject to the condition that they keep standards relating to the environment, food safety, plant and animal health, and keep their land in good productive condition, i.e. cross compliance.

The post-2020 CAP contains some new schemes, and the general approach becomes more results oriented. Countries are granted greater flexibility, while obtaining more responsibilities, as they must set targets to be achieved and evaluated. In comparison with the previous CAP, the most relevant changes include: (i) increasing the resources for young farmers from a

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[4] Direct payments are only granted above a certain threshold defined by Member States. In general, direct payments are not granted where the amount of direct payments to be granted is between EUR 100 to EUR 500. To be eligible for direct payments, applicants must be active farmers. A farmer is defined as a natural or legal person, or a group of natural or legal persons, whose holding is situated within the territory of the European Union and who engages in an agricultural activity. Only land suitable for agricultural production is considered an agricultural area. Forests are in principle not eligible. The Basis of the BPS system is payment entitlements allocated to farmers. In general, each eligible hectare gives the right to one entitlement (European Commission, 2019c, 2022d).

maximum of 2 percent to a minimum of 2 percent of the national ceiling; (ii) the redistributive payment is mandatory; (iii) greening payment is cancelled and replaced with a mandatory eco-scheme; (iv) basic payment scheme is replaced with a basic income support for sustainability (BISS) whose functioning remains substantially unchanged; and (v) the ceiling of the coupled income support will be reduced from 13 percent + 2 percent to 10 percent + 2 percent (Carfi, Pierangeli and Solazzo 2018).

The main change of the possible CAP beyond 2020 reform is that many decisions will be moved from European to Member State level. This means that North Macedonia has more freedom to choose on how to implement the payment schemes in detail and adjust the payments to the national context.

3 Scenarios for CAP alignment

In the following, we delineate the scenario selection and budget allocation to the different payment schemes. To inform North Macedonia's budget allocation, we use a forward-looking perspective and anticipate changes to the CAP post-2020. We further examine the direct payment schemes of selected Member States of the European Union located in North Macedonia's broad vicinity, to identify common patterns in CAP allocation across payment schemes.

In a first step, we examine the direct payment schemes of selected Member States of the European Union located in North Macedonia's broad vicinity, i.e. Bulgaria, Croatia, Greece, Hungary, Romania, Slovakia and Slovenia (Table 2). Neighbouring Member States allocate a minimum of 40 percent to the BPS. This minimum amount has been implemented particularly by more recent Member States, i.e. Croatia, Bulgaria and Romania, who allocate around 40 percent of their funds to the BPS. Other Member States allocate a larger share to the BPS, ranging at around 50 to 55 percent.

Yet, it is noteworthy that no country in this selection allocates the allowed maximum share, i.e. 68 percent, to the BPS. Furthermore, three countries allocate funds to the Redistributive Payment Scheme for small and middle-sized farms. These are Croatia, Bulgaria and Romania with 9.7, 6.9 and 4.9 percent respectively. Post 2020, however, the RPS is scheduled to become mandatory, which we consider in our scenario building.

Table 2.   Direct payment schemes of nearest Member States, 2017 (%)

	Bulgaria	Croatia	Greece	Hungary	Romania	Slovakia	Slovenia	Mean
Basic payment scheme (BPS)	46.7	42.4	49.8	51.4	43.3	55.7	52.7	48.9
Redistributive payment scheme (RPS)	6.9	9.7	-	-	4.9	-	-	7.2
Green payment scheme (GPS)	29.8	29.7	25.7	29.8	25.4	29.9	29.9	28.6
Young farmers scheme (YFS)	0.1	1.9	1.1	1	0.7	0.1	1.9	1.0
Small farmer scheme (SFS)	0.3	1.4	4.6	1.4	12.1	-	0.4	3.4
Voluntary coupled support (VCS)	14.7	14.9	8.3	15.2	12.7	13	12.8	13.1
Payments for areas with natural constrains (NCS)	-	-	-	-	-	-	1.6	1.6
Cotton	0.3	-	8.9	-	-	-	-	9.2

Source: Authors' elaboration based on data from European Commission. 2020. Financing the Common Agricultural Policy - (EU 27) - European Union 27. In: *European Commission.* Brussels. Cited 31 March 2020. https://agridata.ec.europa.eu/extensions/DashboardIndicators/Financing.html

The share allocated to Greening is a fixed share of 30 percent, which has been implemented by all countries. Up to 2 percent could be allocated to the young farmers scheme (which will transition to a mandatory minimum share post-2020). Croatia and Slovenia allocated a share close to the maximum with 1.9 percent each. The remaining countries allocated between 0.7 and 1.1 percent. The only exemptions are Bulgaria and Slovakia with 0.1 percent, hence, allocating a minimum amount.

Member States are allowed to allocate 10 percent to the small farmers scheme. Romania has allocated the largest share of direct payment to the SFS, i.e. some 12.1 percent. The other countries allocate a significantly smaller share of 0.3 to 4.6 percent of their direct payments.

All countries in this selection allocate some share to voluntary coupled support, which can constitute up to 13 percent (plus additional 2 percent for protein crops) of direct payments. Most countries allocate between 12–15 percent, hence, close to the allowed maximums share. The only exemption is Greece with 8.3 percent. Overall, the majority of selected Member States base their direct payments on four pillars, i.e. BPS, greening, young farmers scheme and voluntary coupled support.

North Macedonia is likely to initiate the CAP-alignment process by adopting a simple scenario that is based on a combination of compulsory payment schemes, i.e. BPS, greening and YFS, to limit the bureaucratic burden and ease the transition. Furthermore, given that North Macedonia's current direct payments are fully based on coupled support, we assume the VCS scheme to be applied in all scenarios. The emerging scenario, i.e. a combination of BPS, Greening, YFS and VCS, has also been used by neighbouring Member States and will be the first scenario in our estimation. Subsequently, we define scenarios that incorporate a larger number of voluntary payment schemes.

Considering that all Member States must allocate 30 percent to the green payment scheme, we assume this to be also the case for North Macedonia. The young farmers' scheme was usually supported with a smaller amount in most Member States; however, this scheme is to be enlarged under CAP beyond 2020 and the proposal states that it should receive at least 2 percent of the total amount. We are assuming that North Macedonia is going to fulfil this requirement and allocate 2 percent to the young farmers' scheme. The remaining part of the budget will be allocated to the basic payment scheme.

Based on anticipated changes to CAP and patterns in the direct payment schemes implemented by neighbouring Member States, as well as aspects that are specific to North Macedonia's context, we define 4 scenarios for our analysis (Figure 1).

Figure 1.   Scenarios and budget allocation

Scenario 1	GPS (30%)	YFS (2%)	VCS (13%)	BPS (55%)			
Scenario 2	GPS (30%)	YFS (2%)	VCS (13%)	BPS (50%)			RPS (5%)
Scenario 3	GPS (30%)	YFS (2%)	VCS (13%)	BPS (47%)		RPS (5%)	SFS (3%)
Scenario 4	GPS (30%)	YFS (2%)	VCS (10%)	BPS (47%)	RPS (5%)	SFS (3%)	NCS (3%)

Note: GPS – green payment scheme; YFS – young farmers scheme; VCS – voluntary coupled support; BPS – basic payment scheme; RPS – redistributive payment scheme; SFS – small farmer scheme; NCS – payments for areas with natural constrains.

Source: Authors' elaboration.

Base scenario: The base scenario is the benchmark against which policy scenarios are compared and shows the current situation of North Macedonia's agricultural support, i.e. a direct payment system that consists of coupled payments for areas and animals, as explained in Section 2.

Scenario 1: Scenario 1 depicts the situation in which North Macedonia adopts the CAP-system and transitions to a system based on a simple combination of compulsory schemes, i.e. basic payment scheme, greening and young farmers' scheme. Furthermore, we assume North Macedonia to allocate the maximum share to the voluntary coupled support scheme, i.e. 13 percent, given that the current system is fully coupled. Allocating the compulsory share to greening (30 percent), YFS (2 percent), the maximum share to VCS (13 percent), yields a share of 55 percent to the BPS.

Scenario 2: In the second scenario, we add the RPS, which is set to become a compulsory scheme. The redistributive payment scheme can receive up to 30 percent of the budget. Nevertheless, the ten Member States who incorporated the redistributive scheme did not use the full allowance but allocated between 5 and 15 percent. Hence, we are going to allocate 10 percent to the redistributive scheme, providing support to small and middle-sized farms.

Scenario 3: Scenario 3 includes the small farmer scheme on top of the redistributive payment scheme. Farmers can choose to receive the SFS instead of any other payment. The payment is restricted to range between EUR 500 and EUR 1 250, which is roughly the range between MKD 30 000 and MKD 75 000. Considering that many Member States have allocated a relatively small share to the SFS (but Romania), we allocate 3 percent to the SFS.

Scenario 4: Scenario 4 includes payments for areas with natural constraints (NCS). Up to 5 percent of the budget can be allocated to this scheme, however, only two Member States – Denmark and Slovenia – have implemented the NCS.[5] Given that North Macedonia is a

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[5] Denmark allocated 0.33 percent of its direct payments to the NCS (European Commission, 2020).

mountainous country with 80 percent of the country covered in mountains and hills, there is sufficient reason to assume that the NCS can be a beneficial scheme for North Macedonia. We follow Slovenia and Denmark and allocate 3 percent of the budget to the NCS in our analysis. Usually, funds through the NCS are allocated based on slope of farmland. Data on natural constraints is currently not available in North Macedonia's farm accountancy data network (FADN). Data on national constraints will only be collected upon accession of the European Union. We hence use altitude of farms as proxy variable to identify eligible farms.

4   Methodology and data

To estimate the effect of decoupling direct payments under CAP regulations on farmer income in North Macedonia, we use a microsimulation model. Microsimulation is an *ex ante* tool that is used to evaluate the effect of policies on income and income distribution (Figari, Paulus and Sutherland, 2014). Microsimulation uses micro data, i.e. individual level data, which is in this case data at the farm level. The micro perspective allows to estimate the effect for the overall population, as well as for the distribution of sub-groups. This is particularly relevant in our context, as farmers often differ in several dimensions, such as size and type of production.

We consider a Cobb-Douglas production function (CDPF) in our model to estimate the income of a farmer. The traditional CDPF consists of capital and labour inputs and a technology term. We extend the traditional CDPF by also including subsidies as a form of input. The CDPF has the following form:

$$Y = AK^{\alpha}L^{\beta}S^{\gamma} \tag{1}$$

where Y denotes total output; K, L and S are total capital, labour and subsidy inputs, respectively; A denotes Total Factor Productivity (TFP); and α, β and γ represent the elasticity of capital, labour and subsidies, respectively.[6]

Through log transformation equation (1) can be transformed into an econometric model to be estimated.

$$lnY_i = \beta_0 + \beta_1 lnK_i + \beta_2 lnL_i + \beta_3 lnS_i + \varepsilon_i \tag{2}$$

As Y_i we use the farm net income for farmer i. For capital inputs (K_i) we use land, livestock and costs of total inputs. The labour input (L_i) is measured in annual work units and subsidies are expressed in Macedonian Denars. Furthermore, a time dummy is included in the regression to control for time trends.

After estimating the model, the resulting coefficients are used to predict the outcome under different scenarios, i.e. we re-estimate the net farm income using different subsidies values (according to CAP direct payments) for each farmer.

The data used in the analysis is the FADN, collected by North Macedonia's Ministry of Agriculture, Forestry and Water Economy (MAFWE). The FADN is used across the European Union to evaluate the income of agricultural holdings and the impacts of the Common Agricultural Policy. According to Council Regulation (European Commission) No. 1217/2009 each member country is responsible to collect the data and North Macedonia, as part of their efforts to join the European Union, started collecting data using the FADN methodology in 2010 (Gidalova, Caviroska and Musalevski, 2016).

FADN collects data for commercial holdings and is representative of the commercial farm holding population of North Macedonia, i.e. farm operations that are sufficiently large to provide an income source. FADN data is representative of commercial farms, and the sample is derived from the population of commercial farms. The data comprises 561, 548 and 651

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[6] Total Factor Productivity "is the part of output not explained by the number of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production" (Comin, 2009)

farmers in 2014, 2015 and 2016, respectively. Hence, the sample consists of 1 758 observations. While the data is available for several years it is not panel data, with farmers entering and exiting the sample due to their representativeness in the overall population. Furthermore, the data are encoded for privacy reasons, such that it is not possible to match individual farmers across years.

Figure 2 shows the distribution of the sample along farm types and year. Most farmers are classified as specialist grazing livestock followed by mixed crops–livestock and specialist field crops producers. Each of these farm types can be disaggregated even further into smaller sub-groups (see Table A2 in the annex for the full list). Figure 3 shows the farms by economic size, i.e. yearly value of agricultural income. Most farms produce a total standard output between EUR 2 000 and EUR 8 000. These two dimensions – farm type and farm size – will be used as sub-groups to identify differences in the effect of decoupling direct payments on different farmers in the analysis. Yet, it is to note that for some sub-groups the number of observations in the sample are rather small, such as specialist horticulture, specialist granivore and mixed livestock.

Figure 2.   Prevalence of different farm types (2014, 2015, 2016)
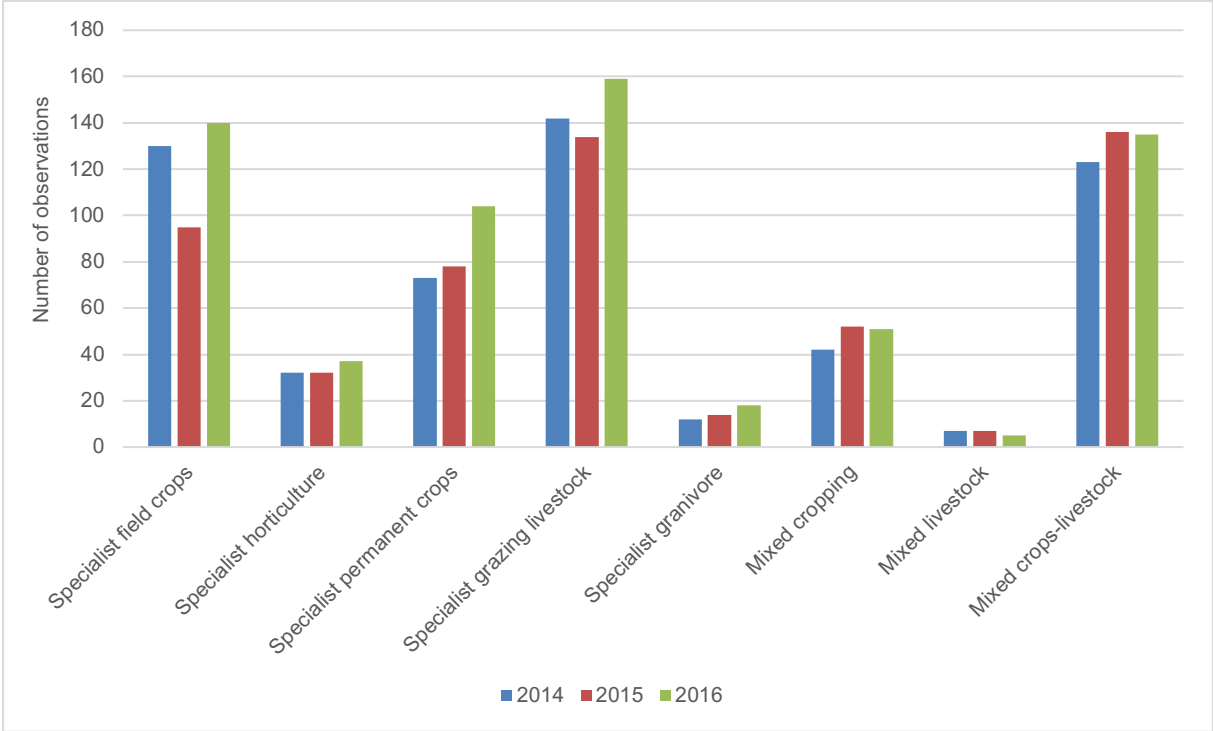
Source: Authors' elaboration based on European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

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Figure 3.   Farms by economic size (2014, 2015, 2016)
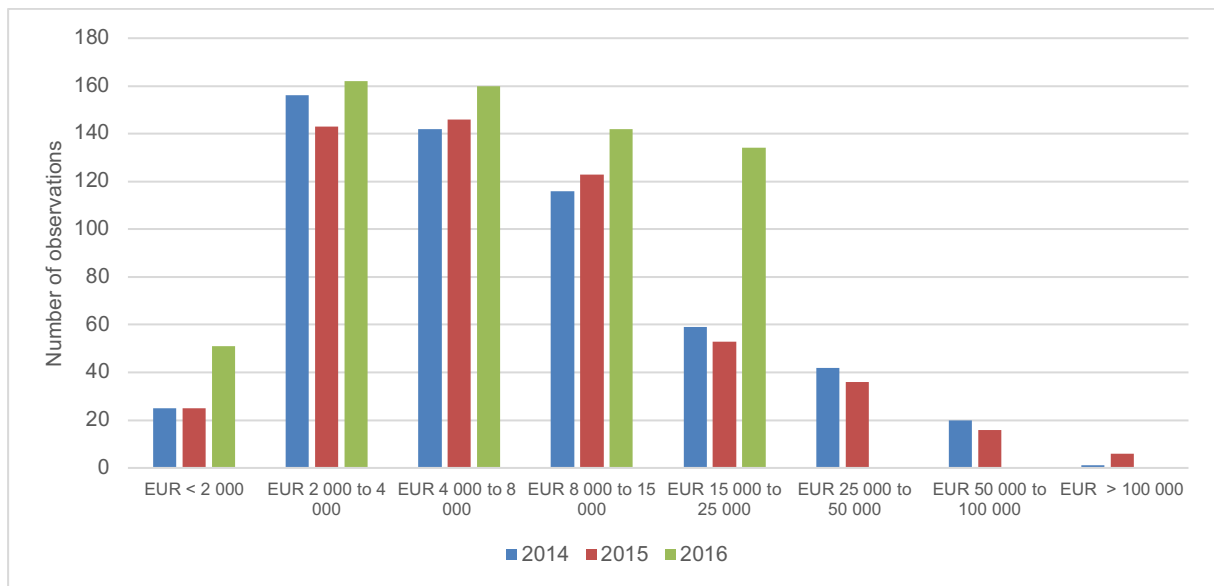
Source: Authors' elaboration based on European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

FADN data provides information about farmer income, production, costs and subsidies. The main variables used in the microsimulation model are shown in Table 3. Furthermore, the average net farm income is around MKD 400 000 or EUR 6 500. The average farm cultivates between 4 ha and 5 ha of land, owns six to seven livestock units of animals, invests around MKD 35 000 in the form of inputs, provides between two and three annual work units, and receives around MKD 75 000 in subsidies. Around 18 percent of net farm income is derived from subsidies. Comparing the variables over time shows that on average all of them are smaller in 2016 compared to 2014.

Table 3.   Descriptive statistics by year

		2014	2015	2016
Net farm income (MKD)	Mean	412 670	435 886	384 793
	Standard deviation	636 139	550 767	621 506
	Minimum	-1 047 811	-319 136	-1 310 702
	Maximum	6 456 740	4 625 990	7 311 325
Land (ha)	Mean	5	5	4
	Standard deviation	11	12	9
	Minimum	0	0	0
	Maximum	144	144	130
Livestock unit (LU)	Mean	7	7	6
	Standard deviation	16	17	15
	Minimum	0	0	0
	Maximum	139	181	159
Inputs (MKD)	Mean	363 374	354 265	348 707
	Standard deviation	638 903	627 591	501 142
	Minimum	9 277	4337	5737
	Maximum	5 165 074	5 804 573	4 796 238
Labour (annual work unit)	Mean	3	3	2
	Standard deviation	8	7	6
	Minimum	0	0	0
	Maximum	97	104	110
Subsidies (MKD)	Mean	77 411	75 852	72 156
	Standard deviation	186 642	177 321	180 575
	Minimum	0	0	0
	Maximum	2 847 500	2 531 700	2 867 300

Source: Authors' elaboration based on European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

Table 4 provides an overview over total land, subsidies and average payment per year. The sample covers around 2 800 ha and the total subsidies spent in each year are around MKD 43 million. In our sample, on average farmers received payments per hectare of around MKD 14 500.

The values for total subsidies shown in Table 4 represent the budget in our analysis. This is the amount that is distributed each year to the farmers for each eligible hectare farmed. Whether a hectare is eligible for payments depends on the scenario and practices the farmer is using and will be explained in more detail below.

Table 4.   Total land, subsidies and average payment per hectare by year

	2014	2015	2016
Total land (ha)	2 955	2 850	2 689
Total subsidies (MKD)	43 427 664	41 566 824	46 829 472
Mean payment per ha	14 698	14 582	17 413
Farmers	568	548	651

Source: Authors' elaboration based on European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

4.1   Eligibility and requirements

This section details how the information from the FADN data was used to decide which farmer is eligible for which payment scheme.

Eligibility: To be eligible for direct payments, farmers must comply with the "minimum requirements" of being an active farmer, having agricultural land at their disposal, holding payment entitlements, and fulfilling a threshold set by the Member States in terms of minimum direct payments or area farmed. The first requirement of being an active farmer is met by all farmers in our dataset considering that the FADN dataset only includes commercial farms. However, there are farms that do not have agricultural land at their disposal. These farmers are going to receive zero direct payments in our model unless they receive payments per livestock unit through the VCS channel. Furthermore, farmers do not have entitlements yet, as entitlements will be distributed once the reform is being implemented. Finally, the threshold for eligibility set by Member States varies between EUR 100 and EUR 500 minimum in direct payments, or 0.3 ha to 5 ha of farmed land. Considering that North Macedonian farmers are rather small we opted here for a low threshold of 0.3 ha land farmed.

Cross-compliance: Farmers must respect cross-compliance regulations to receive direct payments. Cross-compliance regulations are concerned with food safety, animal health, plant health, the climate, the environment, the protection of water resources, animal welfare and the condition in which farmland is maintained. Non-compliance results in punishment through the reduction of direct payments paid to the farmer (European Commission, 2017). For the purpose analysis, given the inability to predict which farmer breaches cross-compliance regulations, we exclude this aspect.

Basic payment scheme: The assumption is that every farmer in the sample is eligible to receive the basic payment scheme if they comply with the minimum requirements.

Greening payment scheme: To receive funds through the GPS, farmers are required to use crop diversification, maintain grassland, and generate and care for ecological focus areas. The idea is that all three requirements are achieved simultaneously, however, the European Union allows for an exchange of equivalence, i.e. farmers with a lot of permanent grassland can reduce their requirement to produce in a diversified manner and still receive the greening payment. The equivalence exchange allows us to identify farmers receiving the greening

payment by picking the once who perform well in diversified production or maintaining grassland.[7]

The following rules have been applied to determine eligibility for GPS:

- if a farmer receives revenues from two or more non-permanent crops conditional on the size of the farm to comply with the diversification rule.[8]

- if a farmer is categorized as "mixed cropping" or "various field crops combined" in the FADN farm typology.[9]

- If a farmer's share of grassland in total land is more than 75 percent.

- If a farmer is categorized as specialist grazing livestock.

Each eligible farmer will apply for the green payment scheme and receive the payment. For farmers with more than 15 ha of arable land the payment received must be higher than the income loses generated by the creation of the ecological focus areas. The income loss is calculated as 5 percent of crop related revenues minus 5 percent of crop related costs.

Voluntary coupled support: The support through the VCS is allocated to priority crops and livestock as defined by MAFWE, contingent on production quantities and livestock units. These are wheat and rice (crop production), tomato, pepper and cabbage (vegetable production), apple and peach (fruit production); grapes and wine grape varieties (viticulture) and cow's milk and lamb (animal production). Contingent on the level of aggregation of the FADN data used in the analysis, the VCS is allocated using an approximation of these priority crops, i.e. cereals, vegetables, orchards, wine grapes, dairying cows, sheep and goat.[10]

We assume that North Macedonia would seek to replicates to a certain degree its existing incentives scheme across sectors. Hence, we use the subsidy shares that we currently observe in North Macedonia (year 2020) and allocate accordingly (see Table 5). Livestock receives 60 percent und crops receive 40 percent under the VCS. Out of the livestock allocation, 45 percent are allocated to dairy cows and 55 percent to sheep and goat. For crops, we allocate 42 percent, 13 percent, 15 percent and 30 percent to cereals, vegetables, orchards and vineyards, respectively. This sub-distribution across crops and livestock remains the same across all scenarios. Due to data constraints, we allocate VCS for livestock (dairying, sheep and goats) based on livestock units and not on animal heads. For cereals, vegetables, fruits and wine, we allocate the direct payments per hectare planted.

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[7] Ecological focus areas do not produce an income for the farmers and therefore it is ignored when it comes to the decision who receives the payment but will be included again when it comes to the question how much the payment will be.

[8] We use revenues over land farmed, as revenues are more detailed than land farmed.

[9] This includes the categories: field crops and horticulture combined, field crops and vineyards combined, field crops and permanent crops combined, mixed cropping (mainly field crops), other mixed cropping.

[10] This approximation of the VCS is driven by data constraints. It should be noted that this leads to an underestimation of the income support that eligible farmers receive, particularly farmers in aggregate groups such as fruit, vegetables and cereals.

Table 5.   Subsidy allocation within the voluntary coupled support scheme

Shares	Share FADN (2016)	Share allocated	FADN variable
Livestock	60%	45%	dairy cows (livestock unit, proxy for cow's milk)
		55%	sheep and goat (livestock unit, as proxy for lamb)
Crops	40%	42%	cereals (hectare, as proxy for wheat and rice)
Vegetables		13%	vegetables (hectare, as proxy for tomato, pepper and cabbage)
Fruits		15%	orchards (hectare, proxy for peach and apple)
Grapes/wine grape varieties		30%	vineyards (hectare, as proxy for grape and wine grape varieties)

Notes: FADN – farm accountancy data network. Voluntary coupled support scheme (VCS) is being allocated based on fixed areas and fixed number of animals. VCS was derived using MAFWE priority crops and FADN subsidy shares (2016).

Source: Authors' elaboration.

Young farmers scheme: There is no information concerning the age of a farmer in the dataset. For this reason, we exclude the young farmer scheme in the distribution of the budget, while deducting the 2 percent compulsory allocation from the total subsidies. Therefore, we underestimate the income for the young farmers in our sample.

Redistributive payment scheme: Member States can allocate up to 30 percent of the budget to the redistributive payment scheme. All farmers receive payments for the first eligible hectares. The number of eligible hectares is limited to a threshold set by the Member States and cannot exceed 30 ha or the average farm size in Member States, if the latter is more than 30 hectares. Only 10 Member States introduced this scheme, with a lot of variation in terms of payment per hectare, tranches and set threshold. In most countries with redistributive payment scheme the threshold is set to at least 30 ha (European Commission, 2017). In our sample, however 97 percent of the farmers do not reach this threshold and the redistributive purpose of the payment would not be met. Instead, we set the threshold to 5 ha (approximately the mean of 4.8 ha) or as set in Portugal. This means that the first 5 ha of every holding will receive the redistributive payment in our analysis.

Natural constraints scheme: The only indication in our data about natural constraints is provided in the form of a rough altitude variable, which indicates whether a farm is between 0–300, 300–600, and above 600 metres above sea level. Due to the absence of further data, we define areas above 600 metres as natural constrained areas and allocate 3 percent of the budget to the NCS.

Small farmers scheme: To identify farmers who participate in SFS, we estimate the direct payment for a farmer with a reduced budget. The budget in the first round will be reduced by the amount that is allocated to the small farmer scheme, in our case 30 percent of the total budget. After estimating the direct payment for each farmer with the reduced budget, we order them according to the amount they would receive and compare it with the amount the farmers would receive in the small farmer scheme. Any farmer with a direct payment that is lower than the payment in the small farmer scheme will automatically apply for the small farmer scheme. The number of farmers that apply for the small farmer scheme divided by 30 percent of the budget generates the lump sum payment the farmer receives under the small farmer scheme.

Those farmers are then removed from the sample, and we estimate again the direct payment for the remaining farmers who apply for the normal payment schemes. The small farmer payment in 2014, 2015 and 2016 is MKD 47 549, MKD 45 846 and MKD 42 062, respectively. The fact that the payment each year is slightly different in our analysis does not correspond exactly to the CAP regulation in which this payment should stays constant. However, because the data are not panel data, we have no alternative then treating each year individually as if the reform was implemented in each year.

Applying all the assumptions and rules discussed above results in the following distribution of the budget to each scenario in each year. Table 6 shows the total amount in MKD and percentage allocated to each payment scheme in each scenario and Table 7 shows the total amount per eligible hectare.

Table 6.   Total payments by scheme

		Total	BPS	GPS	YFS	VCS	RPS	SFS	NCS
2014									
Scenario 1	MKD	43 427 664	23 885 216	13 028 299	868 553	5 645 596			
	%	100.00%	55	30	2	13			
Scenario 2	MKD	43 427 664	21 713 832	13 028 299	868 553	5 645 596	2 171 383		
	%	100	50	30	2	13	5		
Scenario 3	MKD	43 427 663	20 411 002	13 028 299	86 8553	5 645 596	2 171 383	1 302 829	
	%	100	47	30	2	13	5	3	
Scenario 4	MKD	43 427 663	20 411 002	13 028 299	868 553	4 342 766	2 171 383	1 302 829	1 302 829
	%	100	47	30	2	10	5	3	3
2015									
Scenario 1	MKD	41 566 825	22 861 754	12 470 047	831 336	5 403 687			
	%	100	55	30	2	13			
Scenario 2	MKD	41 566 824	20 783 412	12 470 047	831 336	5 403 687	2 078 341		
	%	100	50	30	2	13	5		
Scenario 3	MKD	41 566 825	19 536 408	12 470 047	831 336	5 403 687	2 078 341	1 247 004	
	%	100	47	30	2	13	5	3	
Scenario 4	MKD	41 566 825	19 536 408	12 470 047	831 336	4 156 682	2 078 341	1 247 004	1 247 004
	%	100	47	30	2	10	5	3	3
2016									
Scenario 1	MKD	46 829 473	25 756 210	14 048 842	936 589	6 087 831			
	%	100	55	30	2	13			
Scenario 2	MKD	46 829 472	23 414 736	14 048 842	936 589	6 087 831	2 341 473		
	%	100	50	30	2	13	5		
Scenario 3	MKD	46 829 473	22 009 852	14 048 842	936 589	6 087 831	2 341 473	1 404 884	
	%	100	47	30	2	13	5	3	
Scenario 4	MKD	46 829 472	22 009 852	14 048 842	936 589	4 682 947	2 341 473	1 404 884	1 404 884
	%	100	47	30	2	10	5	3	3

Note: BPS – basic payment scheme; GPS – green payment scheme; YFS – young farmers scheme; VCS – voluntary coupled support; RPS – redistributive payment scheme; SFS – small farmer scheme; NCS – payments for areas with natural constrains.

Source: Authors' elaboration.

Table 7.   Payment per eligible hectare or livestock unit by scheme (in MKD)

| | BPS | GPS | YFS | VCS | | | | | | RPS | SFS* | NCS |
				Cereals	Vegetables	Fruit	Vine	Dairy	Sheep and goat			
2014												
Scenario 1	8 084	6 544	868 553	798	2 390	7 627	6 285	384	777	0	0	0
Scenario 2	7 349	6 544	868 553	798	2 390	7 627	6 285	384	777	1 484	0	0
Scenario 3	6 908	6 544	868 553	798	2 390	7 627	6 285	384	777	1 484	13 860	0
Scenario 4	6 908	6 544	868 553	614	1 839	5 867	4 835	296	597	1 484	13 860	2 028
2015												
Scenario 1	8 020	6 802	831 337	803	2 360	3 903	6042	369	711	0	0	0
Scenario 2	7 291	6 802	831 337	803	2 360	3 903	6042	369	711	1 485	0	0
Scenario 3	6 854	6 802	831 337	803	2 360	3 903	6042	369	711	1 485	13 126	0
Scenario 4	6 854	6 802	831 337	617	1 815	3 002	4648	283	547	1 485	13 126	1 828
2016												
Scenario 1	9 577	7 844	936 589	879	2 364	3 641	8353	419	819	0	0	0
Scenario 2	8 706	7 844	936 589	879	2 364	3 641	8353	419	819	1 477	0	0
Scenario 3	8 184	7 844	936 589	879	2 364	3 641	8353	419	819	1 477	13 130	0
Scenario 4	8 184	7 844	936 589	676	1 819	2 800	6425	322	630	1 477	13 130	2 785

Notes: * SFS is paid as a lump sum payment independent of number of eligible hectares. BPS – basic payment scheme; GPS – green payment scheme; YFS – young farmers scheme; VCS – voluntary coupled support; RPS – redistributive payment scheme; SFS – small farmer scheme; NCS – payments for areas with natural constrains.

Source: Authors' elaboration.

5   Results

This section presents the results of the analysis, where each scenario is estimated and compared to the base scenario. We start by presenting the results for the full sample and will then provide details on sub-groups. The farmers are grouped according to the FADN farm type. Finally, we also analyse the effect on farmers according to economic size to see whether the effect differs between small and big farmers. Table A2 and Table A3 in the annex show the categories of farmers and economic size classification considered in the analysis.

Table 8 and Figure 4 show the results for the mean income of the full sample for each scenario. Mean income in the sample and therefore in the base scenario is MKD 3 031 million. In each scenario the average income is higher compared to the base scenario. The difference in income between the base scenario and scenario 1 to 4 ranges from about MKD 15 945 to around MKD 16 663 (see Figure 4). The highest value is reached in scenario 3 with the introduction of the SFS, which seems to be a particularly important scheme, given that the mean farm size is 4 to 5 hectares in our sample.

This is followed by scenario 4, i.e. the adoption of all available payment schemes. Yet it is to note, that scenario 4 is the first scenario, in which we reduced coupled payments through a lower VCS allocation, i.e. a reduction from 13 percent to 10 percent. This reduction in VCS is likely to contribute to averaging out the theoretically anticipated positive effect of the NCS, given that North Macedonia is a quite mountainous region.

Table 8.   Mean income, full sample (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Mean income	3 031 018	3 046 863	3 047 097	3 047 918	3 047 681
Standard deviation	605 248	611 467	611 411	611 081	610 975
No. of observations	1 758	1 758	1 758	1 758	1 758
Difference to base	0	15 845	16 079	16 900	16 663

Note: MKD refers to Macedonian Denar.

Source: Authors' elaboration.

Figure 4.   Difference to base scenario in average income, full sample (in MKD)
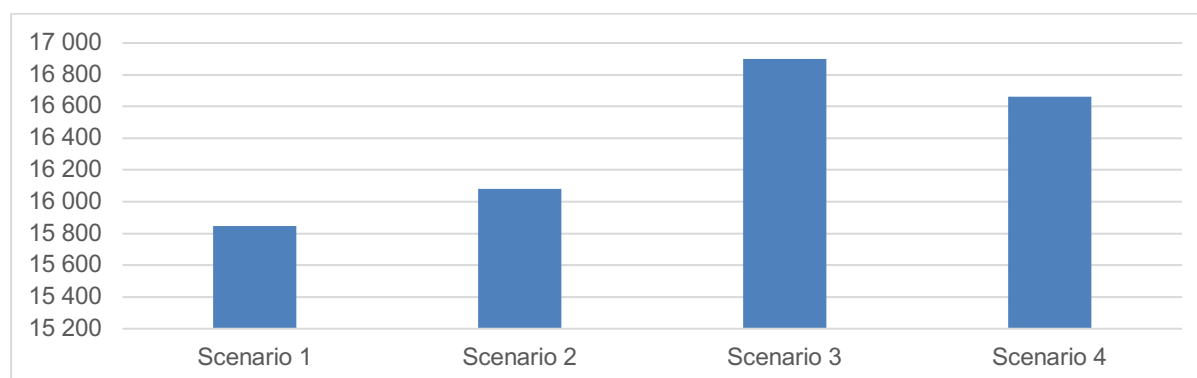
Source: Authors' elaboration.

The results for the full sample shown in Table 8 and Figure 4, indicating that on average the decoupling of North Macedonian's direct payments has a positive effect on income. Furthermore, the average impact on income is within the same range. However, it should be stressed that this result only holds on average, it does not hold for the whole income distribution and different farmer groups.

The results for farmers by general farm time are shown in Figure 5 and Table 9. In most cases the average income is higher with decoupled payments compared to the base scenario. We observe the largest increase for specialized horticulture. The exception are farmers categorized as mixed crops–livestock. Furthermore, the smallest income impact can be observed for specialist grazing livestock. This finding is along the expectation, given that that mixed crops–livestock and specialist grazing livestock farmers represent 99 percent of the farmers in the sample without land.[11] Hence, the subsidies allocated to this group stems mostly from the livestock payments allocated under the VCS. Mixed crops–livestock farmers lose between MKD 16 676 and MKD 17 226. Considering the variation between the scenarios it is visible that the best results are achieved in scenario 4.

Figure 5.   Difference in average income compared to base scenario by general farm types (in MKD)
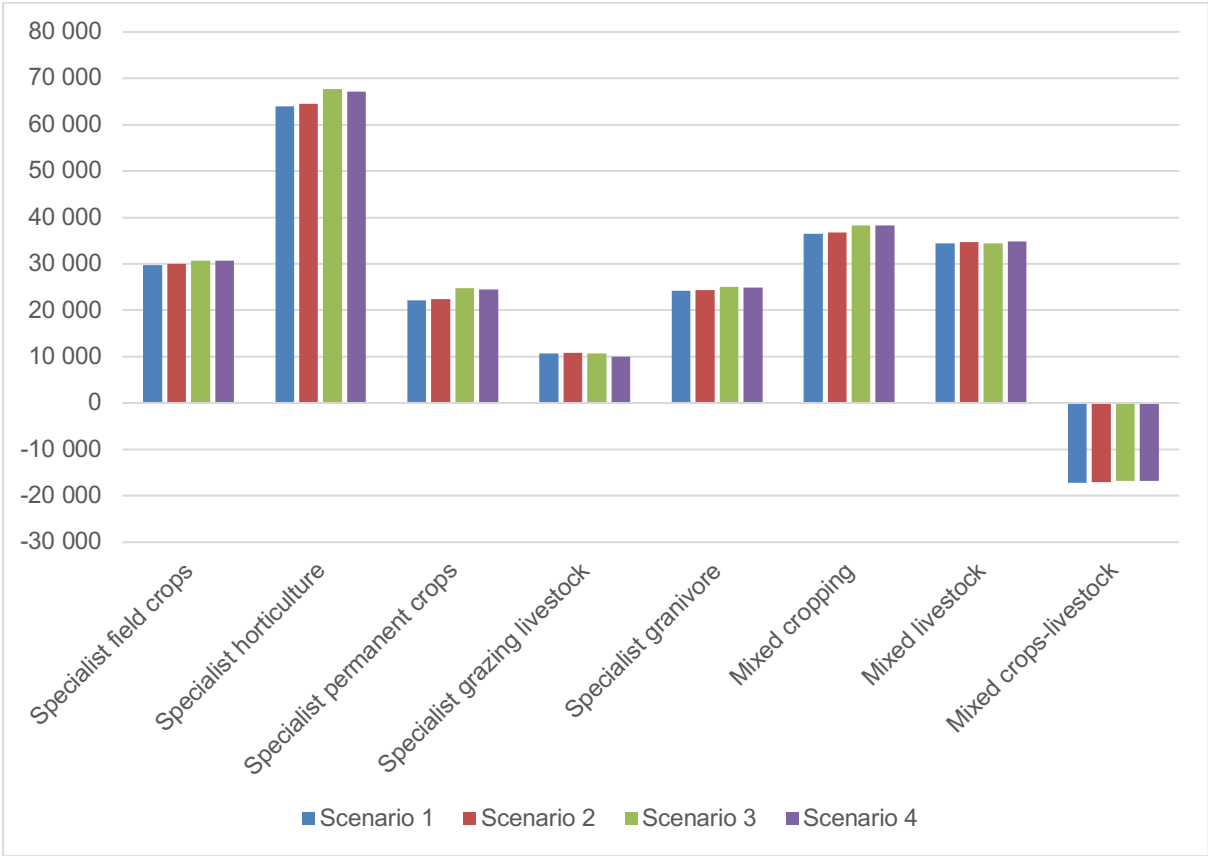
Source: Authors' elaboration.

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[11] There are overall 269 farmers without land in the sample of which 265 are either categorized as specialist grazing livestock or mixed crops–livestock.

Table 9. Mean income by general farm type (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Specialist field crops	3 009 778	3 039 542	3 039 833	3 040 423	3 040 483
Difference to base scenario	0	29 764	30 055	30 645	30 705
Specialist horticulture	3 023 855	3 087 844	3 088 301	3 091 593	3 090 928
Difference to base scenario	0	63 989	64 446	67 737	67 073
Specialist permanent crops	2 890 115	2 912 224	2 912 546	2 914 820	2 914 587
Difference to base scenario	0	22 110	22 432	24 705	24 472
Specialist grazing livestock	3 324 273	3 335 021	3 335 154	3 334 999	3 334 331
Difference to base scenario	0	10 748	10 881	10 726	100 58
Specialist granivore	2 719 956	2 744 126	2 744 367	2 745 037	2 744 880
Difference to base scenario	0	24 171	24 411	25 081	24 925
Mixed cropping	3 048 199	3 084 640	3 084 985	3 086 543	3 086 435
Difference to base scenario	0	36 440	36 786	38 344	38 235
Mixed livestock	2 970 891	3 005 370	3 005 527	3 005 263	3 005 676
Difference to base scenario	0	34 479	34 636	34 373	34 785
Mixed crops–livestock	2 851 270	2 834 044	2 834 183	2 834 519	2 834 503
Difference to base scenario	0	-17 226	-17 086	-16 751	-16 767

Source: Authors' elaboration.

We continue by analysing different farmer groups, starting with farmers categorised as specialist grazing livestock. The 435 farmers in this category can be further divided into specialist dairying (137), specialist cattle-rearing and fattening (13), cattle-dairying, rearing and fattening (43), and sheep, goats and other grazing livestock (242).

Figure 6 and Table 10 show the results for the specialist grazing livestock farmers. The negative effect of decoupling in this category is borne by farmers specialised in rearing and fattening of cattle. Farmers categorized as sheep, goats and other grazing livestock specialist in dairying and farmers who combine dairying, fattening and rearing of cattle, on the other hand are not negatively affected by the decoupling of the direct payments.

Figure 6.   Difference in average income compared to base scenario, specialist grazing livestock (in MKD)
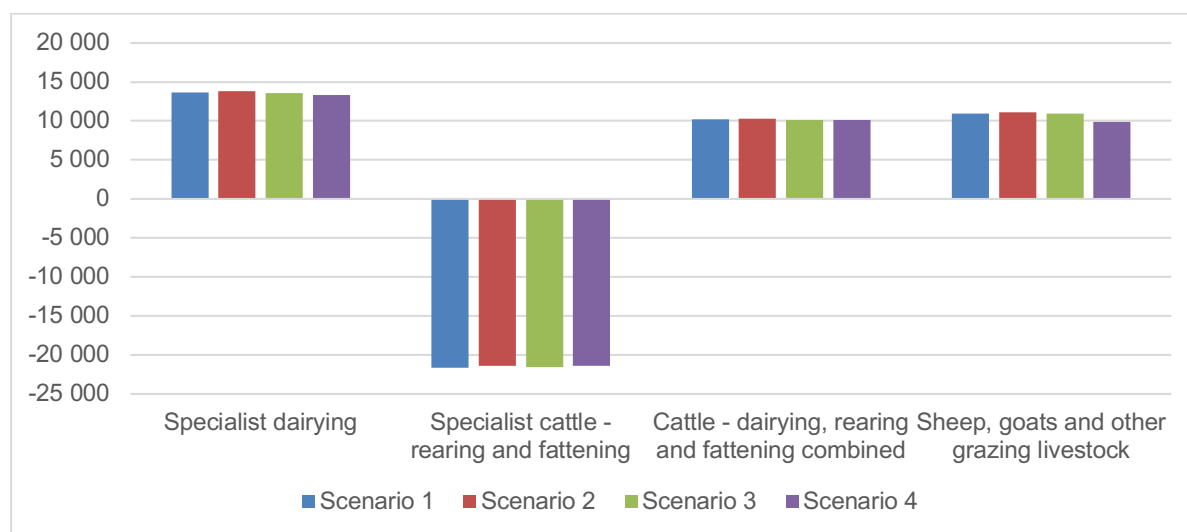
Source: Authors' elaboration.

Table 10.   Mean income for specialist farming livestock (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Specialist dairying	3 422 823	3 436 441	3 436 598	3 436 368	3 436 113
Difference to base scenario	0	13 618	13 775	13 545	13 290
Specialist cattle-rearing and fattening	2 804 575	2 782 924	2 783 147	2 782 995	2 783 166
Difference to base scenario	0	-21 651	-21 428	-21 579	-21 409
Cattle-dairying, rearing and fattening combined	3 236 500	3 246 677	3 246 814	3 246 652	3 246 615
Difference to base scenario	0	10 177	10 314	10 152	10 115
Sheep, goats and other grazing livestock	3 311 995	3 322 961	3 323 075	3 322 963	3 321 904
Difference to base scenario	0	10 966	11 079	10 968	9 909

Source: Authors' elaboration.

Disaggregating the group of sheep, goats and other grazing livestock into their individual components reveals that the specialist sheep and specialist goats' farmers are all gaining in income from the reform. This is in line with the expectation, given that sheep and goat receive an allocation under the VCS.

Figure 7.   Difference in average income compared to base scenario, sheep, goat and other grazing livestock (in MKD)
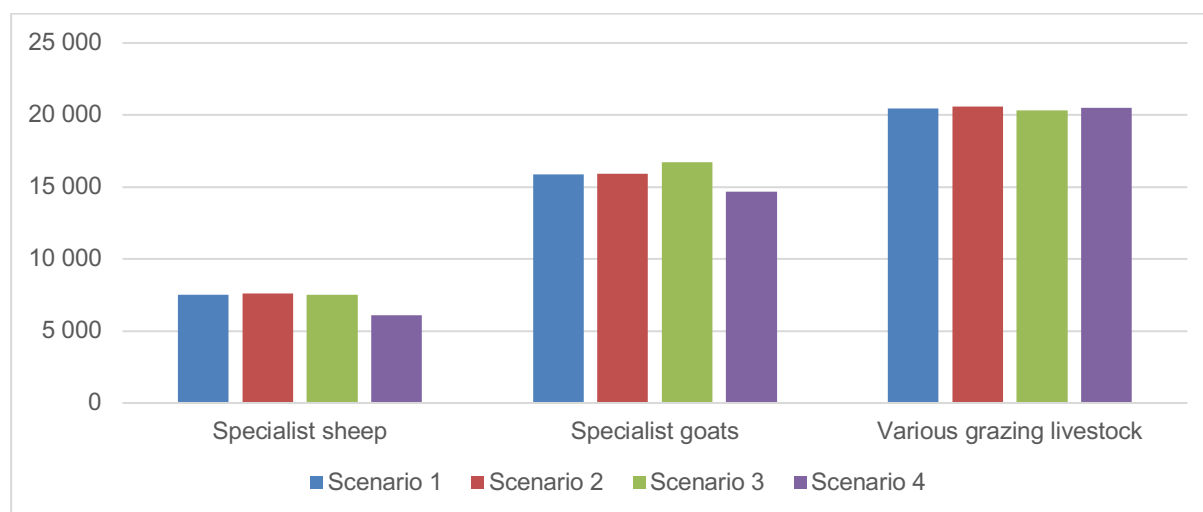
Source: Authors' elaboration.

Table 11.   Mean income for sheep, goat and grazing livestock farmer (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Specialist sheep	3 413 407	3 420 902	3 421 010	3 420 905	3 419 483
Difference to base scenario	0	7 494	7 602	7 498	6 076
Specialist goats	2 967 059	2 982 943	2 982 980	2 983 755	2 981 714
Difference to base scenario	0	15 884	15 921	16 696	14 655
Various grazing livestock	3 065 533	3 085 986	3 086 128	3 085 860	3 086 023
Difference to base scenario	0	20 453	20 595	20 327	20 490

Source: Authors' elaboration.

Moving next to the sub-groups of mixed crops–livestock, we can see in Figure 8 and Table 12 that the negative effect in this group is mostly driven by the sub-category of various mixed crops and livestock and to a very small amount by the category permanent crops and grazing livestock combined. Various mixed crops and livestock farmers, on the other hand, lose over MKD 30 000 through the reform in all scenarios. The value of MKD 30 000 corresponds with the direct payment these farmers would have received in the base scenario in the form of coupled direct payments for livestock production.[12] This effect cannot be countered sufficiently through the allocation to livestock production implemented under the VCS in this analysis.

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[12] Average direct payments for livestock production amounts to MKD 31 300 for various mixed crops and livestock farmers.

Figure 8. Difference in average income compared to base scenario, mixed crops–livestock (in MKD)
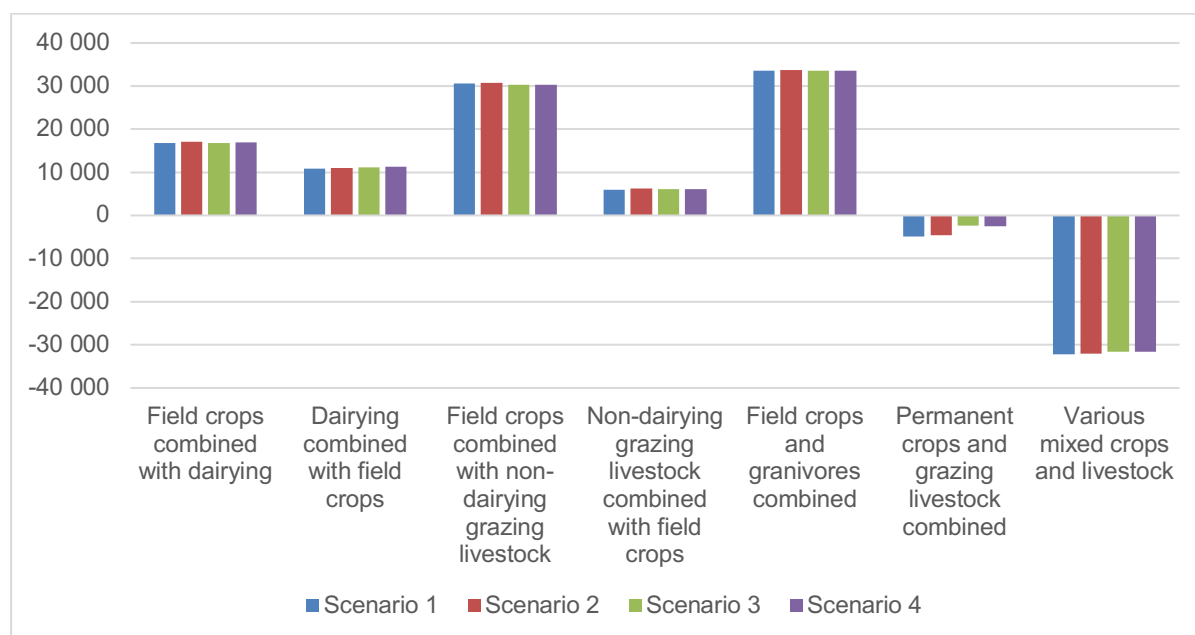
Source: Authors' elaboration.

Table 12. Mean income for mixed crops–livestock farmers (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Field crops combined with non-dairying grazing livestock	3 046 632	3 077 183	3 077 311	3 076 948	3 076 872
Difference to base scenario	0	30 551	30 678	30 316	30 240
Non-dairying grazing livestock combined with field crops	2 991 056	2 997 079	2 997 361	2 997 091	2 997 100
Difference to base scenario	0	6 023	6 304	6 035	6 044
Field crops and granivores combined	2 742 551	2 776 119	2 776 305	2 776 057	2 776 141
Difference to base scenario	0	33 569	33 754	33 507	33 590
Permanent crops and grazing livestock combined	2 877 954	2 873 110	2 873 433	2 875 599	2 875 406
Difference to base scenario	0	-4 845	-4 521	-2 355	-2 549
Various mixed crops and livestock	2 787 701	2 755 564	2 755 656	2 756 133	2 756 045
Difference to base scenario	0	-32 136	-320 44	-31 568	-31 655

Source: Authors' elaboration.

In the following, we show the remaining sub-groups that show a negative effect when disaggregated to the smallest possible level. This is to highlight those groups that would potentially lose from a reform. Nevertheless, and as highlighted before, most sub-groups would experience, and income increase through the reform (see annex A for a full list of all sub-groups). Figure 9 and Table 13 show the effect of decoupling direct payments on farmer income for farmers in the categories: cereals, oilseeds, protein crops and rice combined; specialist nuts; pig rearing and fattening combined; and mixed livestock: granivores and dairying combined. All these sub-groups are very small with cereals, oilseeds, protein crops and rice combined, and specialist nuts have only one observation in the sample and pig rearing and fattening combined and mixed livestock: granivores and dairying combined only have five observations in the sample.

The sub-group of cereals, oilseeds, protein crops and rice combined and mixed livestock: granivores and dairying combined, are associated with a relatively smaller loss. Specialist nuts, however, loses in all scenarios and is associated with the second largest negative impact, around MKD 12 000. The group pig rearing and fattening combined face the biggest loss, with over MKD 25 000 in all scenarios. Again, these farmers represent only a small fraction of the overall sample. In theory, this finding is along the expectation, given that no subsidies are allocated to the two sub-groups that have the largest loss. Nevertheless, the representation of the two groups in the sample is too small to draw rigorous conclusions and a more research is required to understand the full impact on the two sub-groups. All results by farm type, including the results with positive effects are shown in Table A4 in the annex.

Figure 9. Difference in average income compared to base scenario, other farm types (in MKD)
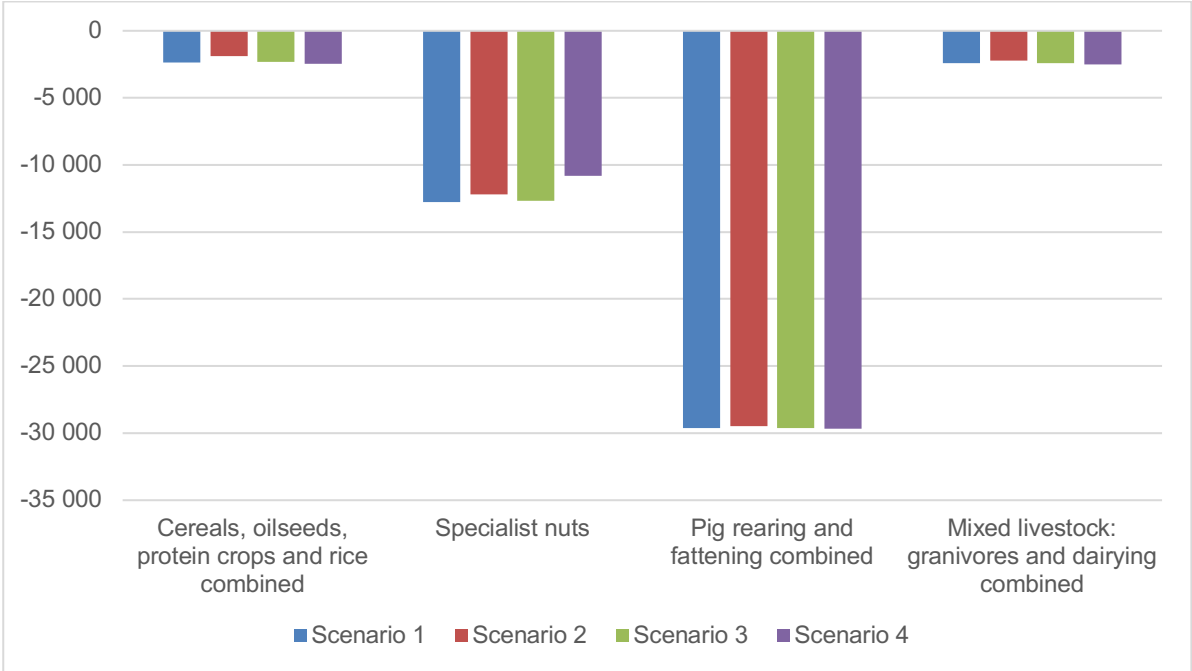
Source: Authors' elaboration.

Table 13. Mean income for "other farm type" (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Cereals, oilseeds, protein crops and rice combined	2 981 603	2 979 241	2 979 725	2 979 310	2 979 143
Difference to base scenario	0	-2 362	-1 878	-2 293	-2 460
Specialist nuts	3 576 373	3 563 601	3 564 164	3 563 680	3 565 572
Difference to base scenario	0	-12 773	-12 210	-12 693	-10 802
Pig rearing and fattening combined	3 040 642	3 011 022	3 011 182	3 011 018	3 010 972
Difference to base scenario	0	-29 619	-29 460	-29 624	-29 670
Mixed livestock: granivores and dairying combined	2 902 314	2 899 908	2 900 112	2 899 881	2 899 789
Difference to base scenario	0	-2 406	-2 203	-2 434	-2 526

Source: Authors' elaboration.

Finally, we analyse the impact of decoupling direct payments on farmer income along different farm size. The sample is categorised according to the FADN economic size methodology (see Table A3 in the annex for a description of each category). Figure 10 and Table 14 show the results by farm size. From Figure 10 it is visible that on average a reform would not contribute to a loss of income in the different economic groupings. Comparing the different payment schemes, it is also worth noting that the introduction of the small farmer scheme (scenario 3 and 4) increases the benefits of small farmers significantly (EUR <2 000, EUR 2 000–4 000) compared to redistributive payment scheme (scenario 2) and the payment for natural constraint areas (scenario 4).

Figure 10. Difference in average income by economic size (in MKD)
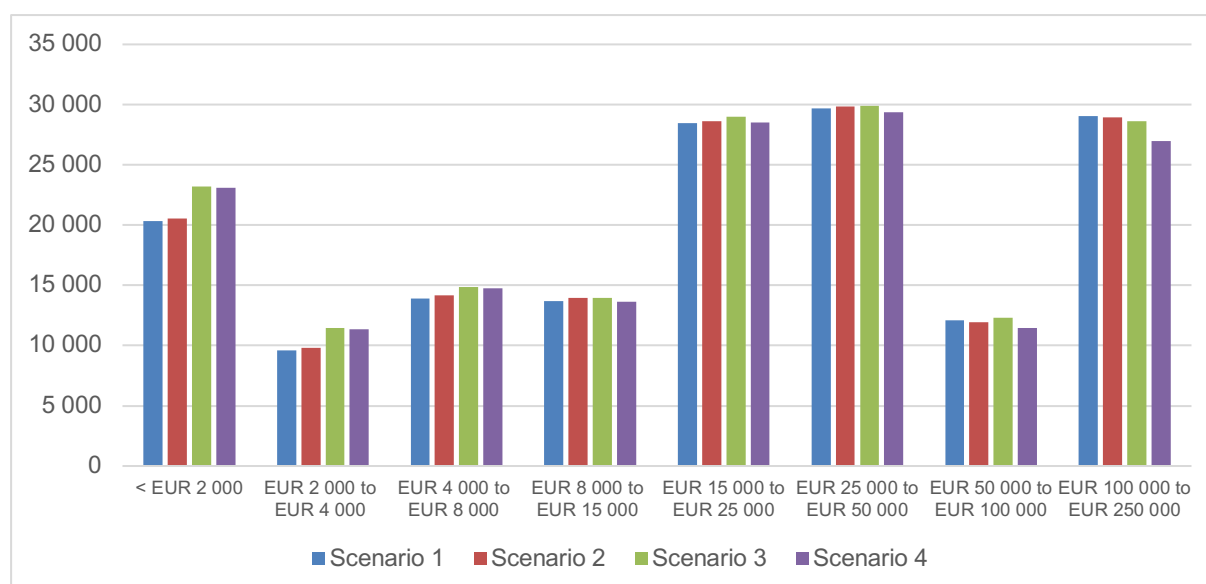
Source: Authors' elaboration.

Table 14. Difference in mean income by economic size (in MKD)

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Less than EUR 2 000	2 656 120	2 676 440	2 676 684	2 679 297	2 679 193
Difference to base scenario	0	20 320	20 563	23 176	23 073
EUR 2 000 to less than EUR 4 000	2 749 848	2 759 419	2 759 681	2 761 296	2 761 225
Difference to base scenario	0	9 571	9 833	11 448	11 377
EUR 4 000 to less than EUR 8 000	2 915 918	2 929 808	2 930 093	2 930 787	2 930 695
Difference to base scenario	0	13 889	14 175	14 869	14 777
EUR 8 000 to less than EUR 15 000	3 115 030	3 128 718	3 128 965	3 128 993	3 128 667
Difference to base scenario	0	13 688	13 935	13 962	13 637
EUR 15 000 to less than EUR 25 000	3 401 917	3 430 366	3 430 514	3 430 912	3 430 412
Difference to base scenario	0	28 450	28 597	28 995	28 496
EUR 25 000 to less than EUR 50 000	3 638 637	3 668 336	3 668 505	3 668 561	3 668 005
Difference to base scenario	0	29 698	29 867	29 924	29 368
EUR 50 000 to less than EUR 100 000	4 191 723	4 203 804	4 203 674	4 204 019	4 203 177
Difference to base scenario	0	12 082	11 952	12 296	11 454
EUR 100 000 to less than EUR 250 000	3 976 754	4 005 809	4 005 705	4 005 394	4 003 705
Difference to base scenario	0	29 055	28 951	28 640	26 951

Source: Authors' elaboration.

To conclude, the microsimulation shows that the effect of decoupling direct payments on farmer income in North Macedonia is on average positive, i.e. farmer income increases due to the reform. However, some farmers and groups are negatively affected.

The following farmers has been identified as candidates who potentially lose because of the reform: permanent crops and grazing livestock combined, and various mixed crops and livestock. Also, to the group of losing farmers – but to a smaller extend – belong farmers of the type cereals, oilseeds, protein crops and rice combined, specialist nuts, pig rearing and fattening combined, and mixed livestock: granivores and dairying combined. As stated above, these findings should be considered a first step and more rigorous analyses are required.

Comparing the different scenarios and therefore the different payment schemes shows that the biggest positive effect is achieved in scenario 3, with the introduction of the SFS. Scenario 3 is followed by Scenario 4, i.e. the reduction of VCS from 13 percent to 10 percent and the introduction of the NCS, in terms of largest positive effect. Nevertheless, it should be noted that the scenarios are relatively similar and so are the average income effects observed in the analysis. Furthermore, due to a lack of data on farmer age, this analysis is not able to allocate subsidies foreseen under the YFS. Hence, we underestimate the positive impact of the reform on young farmers.

This analysis should be considered a first step in terms of analyses that aim to understand the impact of reforming and decoupling North Macedonia's agricultural subsidy scheme. Due to data constraints the analysis is limited in terms of detail of different farm types and value chains. Further research with more detailed data is required to understand the full impact of the decoupling of North Macedonia's agricultural subsidies.

While our results indicate the overall impact on farm income to be positive, some sub-groups were identified as potential losers from the decoupling reform. Hence, those sub-group are expected to lose income that was previously allocated to them in form of subsidies. This loss of income generates disincentives for the affected farm types and agricultural activities and is likely to have a large negative effect on a variety of factors, such as production decisions, prices, wages, land value and competitiveness. This negative effect is unlikely to be politically desired, particularly, if those agricultural activities are considered a major livelihood source and important contributor to economic activity.

In this context, the importance of the different reform scenarios needs to be highlighted, i.e. their impact on results, but also their potential as a tool to fine-tune and tailor the CAP alignment to the national context. In our analysis, the different reform scenarios were developed based on a theoretical blueprint derived from the allocations observed in other Member States, and the coupled allocations through the VCS were based on the priority crops defined by MAFWE. Hence, scenario development is an essential part of our analysis and ultimately drives the results. Exploring different scenarios, beyond this initial analysis, could contribute to understanding how available channels, such as the VCS, could be used as a political tool to target specific farm types that were identified to lose out, to counter the above-mentioned negative effects for those agricultural activities.

6 Conclusion

This analysis examines the potential impact of decoupling direct payments on farmer income in North Macedonia. This reform seeks to align the agricultural subsidies system to the CAP in the context of North Macedonia's accession to the European Union. To the end, we derive four potential reform scenarios, which we estimate, using microsimulation and the representative FADN data set for 2014, 2015 and 2016. We find that, on average, the decoupling of direct payments in North Macedonia according to CAP regulation would have a positive impact on farmer income.

Furthermore, we test the results for heterogeneity along farm type and farm size. The microsimulation results show that the average effect is heterogenous across farm types and economics size and in some cases negative. Farmers who own less land would be more likely to experience a negative income effect as a result of the reform. They usually own livestock and a re-alignment of agricultural subsidies would see the reduction of direct payments per animal head (in our analysis, payments for livestock are only available through the Voluntary Coupled Support measure). Farm types with negative effects include Specialist cattle – rearing and fattening and various mixed crops and livestock farmers.[13] Overall, the biggest positive effect on income is found in the scenario that is based on all mandatory schemes, i.e. BPS, GPS and YFS, as well as the small farmers scheme (SFS), i.e. Scenario 3.

Based on the results, the decoupling of direct payments is, on average, associated with a positive impact on farmer income and is, hence, a viable strategy to reform and improve North Macedonia's current agricultural subsidy scheme. Furthermore, reforms of the current system in favour of a simpler, decoupled scheme, holds the opportunity to remove some of the bureaucratic burden on farmers when applying for subsidies. In addition, the decoupling of direct payment is a requirement if North Macedonia is to join the European Union. In terms of implementation strategy, the results indicate that Scenario 3, is the most beneficial scenario on average, with the introduction of the SFS. Yet, given the scale of the reform, North Macedonia could also choose to deploy a gradual phase-in strategy by starting with the simplest approach, based on mandatory schemes, BPS, GPS and YFS, and then gradually include more subsidy schemes.

Nevertheless, an alignment of North Macedonia's subsidy system to the CAP is a drastic reform, which is likely to have far reaching impacts on, e.g. production decisions, prices, wages, land value, entry and exit decision. Hence, the present analysis should be considered a first step to understand the alignment process considering only a singular aspect of the reform, i.e. farmer income, and its potentially positive impact.

Data constraints limit the scope and detail of the analysis, with the available FADN sample being too aggregated to analyse specific crops and missing key variables (e.g. farmer age to allocate payments under the YFS). The alignment of North Macedonia's agricultural policy to the CAP requires more rigorous analyses and models using detailed, up-to-date data on the agriculture sector and the various value chains to derive more comprehensive results and conclusions. Furthermore, large-scale reforms of the agriculture sector require the analysis of a multitude of factors, contributing the reform itself, such as the timing and time horizon of the phasing in and out of reforms, bureaucratic costs (at government and farmer level), as well as a rigorous analysis and modelling of the larger impact on, for example, the agriculture sector, the economy, trade and interactions with other sectors.

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[13] Also, affected negatively but to a lesser extend are farmers in the categories: cereals, oilseeds, protein crops and rice combined, specialist nuts, pig rearing and fattening combined, mixed livestock.

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Annex

Table A1. Direct payment scheme in North Macedonia 2014–2018

Payments based on output (price aids)	Description/specific requirements	Unit	2014	2015	2016	2017	2018
Dairy premium	Granted for cow, sheep and goat milk delivered to dairies	EUR/ litre	0.06	0.06	0.06	0.06	0.06
Tobacco premium	Granted for sold small leaf tobacco (paid for previous year harvest); in 2018 basic payment rate relate to third class tobacco	EUR/kg	0.97	0.97	0.97	0.97	0.97–1.30
Additional payment for barley	Granted for barley sold to buyout company (max. 4 000 kg/ha)	EUR/kg				0.02	
Additional payments for vegetables for processing	Granted for vegetables sold to processing industry (addition to payments per ha); 2011–2017 different amounts by vegetable spices	EUR/kg	0.02–0.04	0.02–0.11	0.02–0.05	0.02–0.05	0.05
Additional payments for fruits for processing	Granted for fruits sold to processing industry (addition to payments per ha)	EUR/kg	0.03	0.03	0.03	0,03–0,10	0.05
Payments for wine grapes	Granted to family farms for wine grapes sold to registered processing plants	EUR/kg	-	-	-	0.03	-
Payments for cereal seeds	Different payments for production of basic and pre-basic cereal seeds	EUR/kg	0.13–0.32	0.13–0.32	0.13–0.32	0.13–0.32	0.16–0.32
Payments for seedlings	Granted for production of seedlings and young plants						
	Coil vine and fruit seedlings; in 2018 higher amount for certified seedlings	EUR/ piece	0.41	0.41	0.41	0.41	0.49–0.57
	Vegetable planting material (min 500 000 seedlings/year)	EUR/ piece	0.08	0.08	0.08	0.08	0.10
Payments for seedlings	Flower planting material (min. 500 000 seedlings/year)	EUR/ piece	-	1.14	1.14	1.14	-
Payment for day-old chicks	Granted for broiler and female chicks; from 2013 different amounts for chicks produced for own farm and for market	EUR/ chick	0.03–0.06	0.03–0.06	0.05–0.08	0.05–0.08	0.05–0.08

Payments based on output (price aids)	Description/specific requirements	Unit	2014	2015	2016	2017	2018
Payments based on area	Description/specific requirements	Unit	2014	2015	2016	2017	2018
Payment for field crops excluding tobacco	Decreasing payments depending on area under cultivation (from 2010 full amount for 0.3–20 ha; from 2013 full amount for 0.3–10 ha)	max EUR/ha	146–195	130	114	97	97
Additional payment for field crops	Addition to payments for field crops; for area 10–50 ha; min yield 4 t/ha for wheat, 3 t/ha for barley, rye, oats, and 1.8 t/ha for sunflower	EUR/ha	-	-	78	78	94
Additional payment for cereals sown with certified seed	Addition to payments for field crops; decreasing payments depending on area under cultivation (from 2010 full amount for 0.3–20 ha; from 2013 full amount for 0.3–10 ha); in 2018 higher amount for area 5–50 ha	max EUR/ha	49	65	81	97	97–136
Additional payment for forage crops	Addition to payments for field crops; in 2018 higher amount for area 5–50 ha	EUR/ha	16	16	16	18	16–49
	Corn (from 2016 only drip irrigated)	EUR/ha	-	-	49	49	-
Additional payment for rice and sunflower	Addition to payments for field crops; from 2014 decreasing payments depending on area under cultivation (full amount for 0.3–10 ha)						
Additional payment for rice and sunflower	Rice and sunflower	max EUR/ha	49	49	49	49	49
	Drip irrigated sunflower	max EUR/ha	-	-	97	97	97
	Poppy seeds	max EUR/ha	-	-	49	49	49
Payments for vegetables	Granted for production in the open air and plastic tunnels; min eligible area 0.2 ha; different amounts depending on vegetable spices; in 2018 higher amounts for area 0.7–5 ha and 1.5–5 ha for melons and watermelons, respectively	EUR/ha	97–487	97–487	97–487	107–536	97–585

Payments based on output (price aids)	Description/specific requirements	Unit	2014	2015	2016	2017	2018
Additional payment for vegetables produced in controlled conditions	Granted for tomato, pepper, cucumber and cut flowers and from 2013 also for strawberries (addition to payments for vegetables); from 2013 min quantities sold: tomato 40 t/ha; pepper 20 t/ha; cucumber 80 t/ha for heated greenhouses; tomato 8 t/ha; pepper 4 t/ha; cucumber 16 t/ha for heated plastic tunnels	EUR/ha	1 461	1 461	1 461	1 462	1 608
Payment for orchards	Granted for area under orchards; min eligible area 0.2 ha; min seedlings/ha; different amounts depending on fruit spices; decreasing payments depending on area under cultivation (from 2010 full amount for 0.3–5 ha; from 2012 for 0.2–3 ha; from 2014 for 0.2–5 ha); in 2018 higher amounts for area 5–50 ha	max EUR/ha	244–536	244–536	243–536	268–590	244–643
Additional payment for orchards			-	-	-	-	73–161
Payments for vineyards	Granted for area under vineyards; min eligible area 0.2 ha; min 1 500 seedlings/ha; decreasing payments depending on area under cultivation (from 2012 full amount for 0.2–3 ha; from 2014 full amount for 0.2–5 ha); in 2018 higher amount for area 1–10 ha	max EUR/ha	649	649	649	650	650–779
Additional payment for vineyards	Payments for changing variety structure	EUR/ha					195
Additional payments for vegetables, orchards and vineyards						30	30
Payments for seeds	Granted for area under quality and certified seeds; different amounts for arable crops and tobacco seeds;	max EUR/ha	243–975	243–974	244–974	244–974	81–974

Payments based on output (price aids)	Description/specific requirements	Unit	2014	2015	2016	2017	2018
	decreasing payments depending on area under cultivation (from 2012 full amount for 0.3–10 ha)						
Payments for decorative and fast-growing seedlings		EUR/ha	-	-	97	97	97
Payment for snail farming	Min eligible area 0.2 ha	EUR/ha	1 461	1 461	1 461	1 462	-
Payments based on livestock numbers	Description/Specific requirements	Unit	2014	2015	2016	2017	2018
Payments for cattle	Granted for cattle rearing (all categories); decreasing amounts depending on the number of animals (from 2010 full amount for 1–80 heads; from 2012 full amount for 1–100 heads); in 2018 higher amount for herd size 5–20 animals	max EUR/ head	45	45	45	45	45–50
Additional payment for female cattle	Addition to payments for cattle for female animals aged 12–24 months; min 30 heads (for beef production only)	EUR/ head	24	24	24	24	24
Additional payment for calves	Addition to payments for cattle for calves produced by artificial insemination	EUR/ head	19	19	19	19	19–41
Payment for slaughtered cattle	Granted for cattle (all categories) delivered to registered slaughterhouse (until September)	EUR/ head	24	24	24	24	24
Additional payment for slaughtered young bovines	Addition to payments granted for slaughtered cattle for young cattle for beef production (Simental, orbital, montafon, sharole, Busha and hybrids)	EUR/ head	41	49	65	65	65
Payments for sheep and goats	Granted for sheep and goats rearing (all categories); min 30 heads; in 2010–2012 different amounts for sheep and goats; in 2018 higher amount for herd size 101–500 for sheep or 50–150 for goats	EUR/ head	16	16	16	16	16–18

Payments based on output (price aids)	Description/specific requirements	Unit	2014	2015	2016	2017	2018
Payment for breeding sows	Min 2 heads; in 2018 higher amount for herd size 6–50 animals	EUR/ head	16	16	16	16	16–18
Additional payment for sows	Additional payments for the heads evidenced in the Bookkeeping record (min. 20 heads)	%					20
Payment for ostrich farming		EUR/ head	28				
Payment for registered wintered beehives	Min 35 hives	EUR/ hive	10				

Notes: Direct payments are conditioned with the registration of farmers in the farm register and with CAP-like cross-compliance requirements. Livestock related payments are conditioned with registration of animals (except poultry) in the central database under animal identification and registration system. Modulation principle: i) payment for field crops excluding tobacco from 2013: 0.3–10 ha: 100 percent, 10–50 ha: 60 percent, 50–100 ha: 30 percent, 100 ha+: 10 percent; ii) additional payment for rice and sunflower from 2014: 0.3–10 ha: 100 percent, 10–50 ha: 60 percent, 50–100 ha: 30 percent, 100 ha+: 10 percent; iii) additional payment for cereals sown with certified seed from 2013: 0.3–10 ha: 100 percent, 10–50 ha: 60 percent, 50–100 ha: 30 percent, 100 ha+: 10 percent; iv) payments for vineyards from 2014: 0.2–5 ha: 100 percent, 5–30 ha: 60 percent, 30–50 ha: 30 percent, 50 ha+: 10 percent; v) payment for orchards from 2014: 0.2–5ha: 100 percent, 5–30 ha: 60 percent, 30–50 ha: 30 percent, 50 ha+: 10 percent; vi) payments for seeds from 2012: 0.3–10 ha: 100 percent; 10–50 ha: 75 percent; 50 ha+: 50 percent; vii) payments for cattle from 2012: 1–100 heads: 100 percent, 101–150 heads: 70 percent, 151–300 heads: 40 percent, 301 heads+: 20 percent; viii) payment for slaughtered pigs from 2014: 5–5,000 heads: 100 percent, 5 001–10 000 heads: 70 percent, 10 001–15 000 heads: 40 percent, 15 001 heads+: 20 percent.

Source: Agricultural Policy Plus. 2019. Agriculture and Agricultural Policy Database. In: *Agricultural Policy Plus*. Skopje. Cited 7 October 2019. http://app.seerural.org/agricultural-statistics

Table A2. Farm type classification, FADN

1.	Specialist field crops	15.	Specialist cereals, oilseeds and protein crops	151.	Specialist cereals (other than rice) oilseeds and protein crops
				152.	Specialist rice
				153.	Cereals, oilseeds, protein crops and rice combined
		16.	General field cropping	161.	Specialist root crops
				162.	Cereals, oilseeds, protein crops and root crops combined
				163.	Specialist field vegetables
				164.	Specialist tobacco
				165.	Specialist cotton
				166.	Various field crops combined
2.	Specialist horticulture	21.	Specialist horticulture indoor	211.	Specialist vegetables indoor
				212.	Specialist flowers and ornamentals indoor
				213.	Mixed horticulture indoor specialist
		22.	Specialist horticulture outdoor	221.	Specialist vegetables outdoor
				222.	Specialist flowers and ornamentals outdoor
				223.	Mixed horticulture outdoor specialist
		23.	Other horticulture	231.	Specialist mushrooms
				232.	Specialist nurseries
				233.	Various horticulture
3.	Specialist permanent crops	35.	Specialist vineyards	351.	Specialist quality wine
				352.	Specialist wine other than quality wine
				353.	Specialist table grapes
				354.	Other vineyards
		36.	Specialist fruit and citrus fruit	361.	Specialist fruit (other than citrus, subtropical fruits or nuts)
				362.	Specialist citrus fruit
				363.	Specialist nuts
				364.	Specialist subtropical fruits
				365.	Specialist fruit, citrus, subtropical fruits and nuts: mixed production
		37.	Specialist olives	370.	Specialist olives
		38.	Various permanent crops combined	380.	Various permanent crops combined

4.	Specialist grazing livestock	45.	Specialist dairying	450.	Specialist dairying
		46.	Specialist cattle-rearing and fattening	460.	Specialist cattle-rearing and fattening
		47.	Cattle-dairying, rearing and fattening combined	470.	Cattle-dairying, rearing and fattening combined
		48.	Sheep, goats and other grazing livestock	481.	Specialist sheep
				482.	Sheep and cattle combined
				483.	Specialist goats
				484.	Various grazing livestock
5.	Specialist granivore	51.	Specialist pigs	511.	Specialist pig rearing
				512.	Specialist pig fattening
				513.	Pig rearing and fattening combined
		52.	Specialist poultry	521.	Specialist laying hens
				522.	Specialist poultry-meat
				523.	Laying hens and poultry-meat combined
		53.	Various granivores combined	530.	Various granivores combined
6.	Mixed cropping	61.	Mixed cropping	611.	Horticulture and permanent crops combined
				612.	Field crops and horticulture combined
				613.	Field crops and vineyards combined
				614.	Field crops and permanent crops combined
				615.	Mixed cropping, mainly field crops
				616.	Other mixed cropping
7.	Mixed livestock	73.	Mixed livestock, mainly grazing livestock	731.	Mixed livestock, mainly dairying
				732.	Mixed livestock, mainly non-dairying grazing livestock
		74.	Mixed livestock, mainly granivores	741.	Mixed livestock: granivores and dairying combined
				742.	Mixed livestock: granivores and non-dairying grazing livestock
8.	Mixed crops–livestock	83.	Field crops-grazing livestock combined	831.	Field crops combined with dairying
				832.	Dairying combined with field crops
				833.	Field crops combined with non-dairying grazing livestock
				834.	Non-dairying grazing livestock combined with field crops
		84.	Various crops and livestock combined	841.	Field crops and granivores combined
				842.	Permanent crops and grazing livestock combined
				843.	Apiculture
				844.	Various mixed crops and livestock

Source: European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

Table A3. Economic size classification, FADN

Group	Size
1	< EUR 2 000
2	EUR 2 000–< EUR 4 000
3	EUR 4 000–< EUR 8 000
4	EUR 8 000–< EUR 15 000
5	EUR 15 000–< EUR 25 000
6	EUR 25 000–< EUR 50 000
7	EUR 50 000–< EUR 100 000
8	EUR 100 000–< EUR 250 000
9	EUR 250 000–< EUR 500 000
10	EUR 500 000–< EUR 750 000
11	EUR 750 000–< EUR 1 000 000
12	EUR 1 000 000–< EUR 1 500 000
13	EUR 1 500 000–< EUR 3 000 000
14	>= EUR 3 000 000

Source: European Commission. 2022. Farm accountancy data network. In: *European Commission*. Brussels. Cited 25 October 2022. https://agriculture.ec.europa.eu/data-and-analysis/farm-structures-and-economics/fadn_en

Table A4. Mean income by farm type

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Specialist cereals (other than rice), oilseeds and protein crops					
Mean income	2 875 069	2 888 783	2 888 695	2 888 367	2 888 323
Standard deviation	331 662	337 372	337 176	337 068	337 047
No. of observations	75	75	75	75	75
Difference to base scenario	0	13 714	13 625	13 297	13 254
Specialist rice					
Mean income	2 878 611	2 896 912	2 897 145	2 896 885	2 896 953
Standard deviation	151 052	145 514	145 482	145 411	145 560
No. of observations	6	6	6	6	6
Difference to base scenario	0	18 301	18 534	18 274	18 342
Cereals, oilseeds, protein crops and rice combined					
Mean income	2 981 603	2 979 241	2 979 725	2 979 310	2 979 143
Standard deviation	0	0	0	0	0
No. of observations	1	1	1	1	1
Difference to base scenario	0	-2 362	-1 878	-2 293	-2 460
Specialist root crops					
Mean income	3 245 670	3 341 215	3 341 642	3 342 567	3 343 718
Standard deviation	1 585 267	1 680 206	1 680 180	1 679 192	1 681 659
No. of observations	18	18	18	18	18
Difference to base scenario	0	95 545	95 972	96 897	98 048

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Cereals, oilseeds, protein crops and root crops combined					
Mean income	2 752 484	2 802 784	2 803 131	2 803 423	2 803 532
Standard deviation	213 292	2 29 201	229 345	229 914	230 152
No. of observations	14	14	14	14	14
Difference to base scenario	0	50 301	50 648	50 940	51 048
Specialist field vegetables					
Mean income	3 109 014	3 136 832	3 137 333	3 139 447	3 139 247
Standard deviation	514 866	526 178	526 238	525 203	525 112
No. of observations	80	80	80	80	80
Difference to base scenario	0	27 818	28 319	30 432	30 232
Specialist tobacco					
Mean income	2 982 233	3 013 322	3 013 815	3 014 012	3 014 494
Standard deviation	296 517	293 454	293 548	293 282	293 505
No. of observations	45	45	45	45	45
Difference to base scenario	0	31 090	31 582	31 779	32 261
Various field crops combined					
Mean income	3 038 151	3 067 351	3 067 641	3 067 984	3 067 958
Standard deviation	707 017	750 105	749 926	749 511	749 415
No. of observations	126	126	126	126	126
Difference to base scenario	0	29 201	29 490	29 834	29 808
Specialist vegetables indoor					
Mean income	3 023 855	3 087 844	3 088 301	3 091 593	3 090 928
Standard deviation	386 357	409 010	40 9183	409 242	409 343
No. of observations	101	101	101	101	101
Difference to base scenario	0	63 989	64 446	67 737	67 073
Specialist quality wine					
Mean income	2 891 839	2 903 821	2 904 099	2 906 209	2 905 547
Standard deviation	260 300	256 227	256 286	255 001	254 774
No. of observations	82	82	82	82	82
Difference to base scenario	0	11 983	12 260	14 370	13 708
Specialist table grapes					
Mean income	3 011 232	3 090 527	3 090 513	3 093 282	3 092 517
Standard deviation	51 1435	561 253	560 968	559 222	558 759
No. of observations	4	4	4	4	4
Difference to base scenario	0	79 295	79 281	82 050	81 285
Other vineyards					
Mean income	2 897 222	2 958 560	2 958 917	2 960 649	2 960 060
Standard deviation	26 1031	250 362	250 453	248 082	247 828
No. of observations	5	5	5	5	5
Difference to base scenario	0	61 338	61 696	63 427	62 839

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Specialist nuts					
Mean income	3 576 373	3 563 601	3 564 164	3 563 680	3 565 572
Standard deviation	0	0	0	0	0
No. of observations	1	1	1	1	1
Difference to base scenario	0	-12 773	-12 210	-12 693	-10 802
Specialist fruit, citrus, tropical fruits and nuts: mixed production					
Mean income	2 909 312	2 933 848	2 934 206	2 936 148	2 936 194
Standard deviation	396 596	394 796	394 900	394 375	394 364
No. of observations	116	116	116	116	116
Difference to base scenario	0	24 536	24 895	26 836	26 883
Various permanent crops combined					
Mean income	2 814 061	2 839 552	2 839 881	2 843 335	2 843 198
Standard deviation	23 2255	231 031	23 1078	231 064	231 026
No. of observations	47	47	47	47	47
Difference to base scenario	0	25 491	25 820	29 274	29 137
Specialist dairying					
Mean income	3 422 823	3 436 441	3 436 598	3 436 368	3 436 113
Standard deviation	1 037 607	1 027 224	1 027 005	1 026 867	1 026 485
No. of observations	137	137	137	137	137
Difference to base scenario	0	13 618	13 775	13 545	13 290
Specialist cattle-rearing and fattening					
Mean income	2 804 575	2 782 924	2 783 147	2 782 995	2 783 166
Standard deviation	343 161	331 452	331 504	331 470	331 473
No. of observations	13	13	13	13	13
Difference to base scenario		-21 651	-21 428	-21 579	-21 409
Cattle-dairying, rearing and fattening combined					
Mean income	3 236 500	3 246 677	3 246 814	3 246 652	3 246 615
Standard deviation	714 332	709 516	709 365	709 314	709 730
No. of observations	43	43	43	43	43
Difference to base scenario	0	10 177	10 314	10 152	10 115
Specialist sheep					
Mean income	3413407	3420902	3421010	3420905	3419483
Standard deviation	741280	723414	723375	723290	722875
No. of observations	174	174	174	174	174
Difference to base scenario	0	7494	7602	7498	6076
Specialist goats					
Mean income	2 967 059	2 982 943	2 982 980	2 983 755	2 981 714
Standard deviation	262 714	269 111	269 166	270 336	270 297
No. of observations	9	9	9	9	9
Difference to base scenario	0	15 884	15 921	16 696	14 655

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Various grazing livestock					
Mean income	3 065 533	3 085 986	3 086 128	3 085 860	3 086 023
Standard deviation	566 750	563 167	562 990	562 893	562 831
No. of observations	59	59	59	59	59
Difference to base scenario	0	20 453	20 595	20 327	20 490
Specialist pig rearing					
Mean income	2 889 483	2 931 031	2 931 311	2 931 079	2 931 468
Standard deviation	160 581	171 192	171 119	171 091	171 305
No. of observations	4	4	4	4	4
Difference to base scenario	0	41 548	41 827	41 596	41 984
Specialist pig fattening					
Mean income	2 926 214	2 978 156	2 978 156	2 978 156	2 975 913
Standard deviation	87 665	92 711	92 711	92 711	92 584
No. of observations	3	3	3	3	3
Difference to base scenario	0	51 943	51 943	51 943	49 699
Pig rearing and fattening combined					
Mean income	3 040 642	3 011 022	3 011 182	3 011 018	3 010 972
Standard deviation	749 632	674 850	674 743	674 828	674 854
No. of observations	5	5	5	5	5
Difference to base scenario	0	-29 619	-29 460	-29 624	-29 670
Specialist laying hens					
Mean income	2 629 321	2 657 120	2 657 392	2 658 367	2 658 321
Standard deviation	126 295	114 802	114 785	114 438	114 103
No. of observations	32	32	32	32	32
Difference to base scenario	0	27 800	28 071	29 046	29 000
Field crops and horticulture combined					
Mean income	3 215 992	3 278 065	3 278 608	3 279 398	3 278 999
Standard deviation	622 334	659 171	659 224	658 260	658 040
No. of observations	28	28	28	28	28
Difference to base scenario	0	62 073	62 617	63 406	63 008
Field crops and vineyards combined					
Mean income	3 115 310	3 129 958	3 130 187	3 131 522	3 131 542
Standard deviation	813 495	806 393	806 101	805 545	806 074
No. of observations	50	50	50	50	50
Difference to base scenario	0	14 648	14 877	16 212	162 32
Field crops and permanent crops combined					
Mean income	2 881 148	2 927 666	2 928 011	2 930 363	2 930 350
Standard deviation	526 797	537 495	537 453	537 709	537 575
No. of observations	41	41	41	41	41
Difference to base scenario	0	46 518	46 863	49 215	49 202

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Mixed cropping, mainly field crops					
Mean income	3 001 105	3 047 372	3 047 592	3 047 317	3 047 038
Standard deviation	483 978	469 674	469 607	469 484	469 135
No. of observations	11	11	11	11	11
Difference to base scenario	0	46 267	46 487	46 212	45 933
Other mixed cropping					
Mean income	3 002 426	3 028 909	3 029 369	3 032 277	3 032 144
Standard deviation	344 402	342 048	342 175	342 128	341 781
No. of observations	15	15	15	15	15
Difference to base scenario	0	26 483	26 943	29 851	29 718
Mixed livestock, mainly dairying					
Mean income	3 051 012	3 095 090	3 095 209	3 094 920	3 095 490
Standard deviation	443 695	407 652	407 307	407 185	406 787
No. of observations	12	12	12	12	12
Difference to base scenario	0	44 078	44 197	43 908	44 478
Mixed livestock: granivores and dairying combined					
Mean income	2 902 314	2 899 908	2 900 112	2 899 881	2 899 789
Standard deviation	429 647	428 510	428 426	428 359	428 330
No. of observations	5	5	5	5	5
Difference to base scenario	0	-2 406	-2 203	-2 434	-2 526
Mixed livestock: granivores and non-dairying grazing livestock					
Mean income	2 661 601	2 730 699	2 730 969	2 730 780	2 731 506
Standard deviation	7 563	7 532	7 483	7 467	7 735
No. of observations	2	2	2	2	2
Difference to base scenario	0	69 099	69 369	69 179	69 906
Field crops combined with dairying					
Mean income	3 050 339	3 067 131	3 067 440	3 067 150	3 067 344
Standard deviation	410 014	402 163	402 231	402 137	402 165
No. of observations	46	46	46	46	46
Difference to base scenario	0	16 793	17 102	16 811	17 005
Dairying combined with field crops					
Mean income	3 013 731	3 024 532	3 024 714	3 024 858	3 025 092
Standard deviation	439 689	426 741	426 565	426 334	426 588
No. of observations	40	40	40	40	40
Difference to base scenario	0	10 801	10 983	11 127	11 361
Field crops combined with non-dairying grazing livestock					
Mean income	3 046 632	3 077 183	3 077 311	3 076 948	3 076 872
Standard deviation	318 872	340 235	340 377	340 269	339 989
No. of observations	8	8	8	8	8
Difference to base scenario	0	30 551	30 678	30 316	30 240

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Non-dairying grazing livestock combined with field crops					
Mean income	2 991 056	2 997 079	2 997 361	2 997 091	2 997 100
Standard deviation	343 751	341 335	341 438	341 359	341 220
No. of observations	8	8	8	8	8
Difference to base scenario	0	6 023	6 304	6 035	6 044
Field crops and granivores combined					
Mean income	2 742 551	2 776 119	2 776 305	2 776 057	2 776 141
Standard deviation	226 576	213 678	213 475	213 364	213 357
No. of observations	13	13	13	13	13
Difference to base scenario	0	33 569	33 754	33 507	33 590
Permanent crops and grazing livestock combined					
Mean income	2 877 954	2 873 110	2 873 433	2 875 599	2 875 406
Standard deviation	173 523	169 190	16 9247	170 394	170 215
No. of observations	9	9	9	9	9
Difference to base scenario	0	-4 845	-4 521	-2 355	-2 549
Various mixed crops and livestock					
Mean income	2 78 7701	2 755 564	2 755 656	2 756 133	2 756 045
Standard deviation	222 511	222 752	222 792	222 895	222 906
No. of observations	270	270	270	270	270
Difference to base scenario	0	-32 136	-32 044	-31 568	-31 655

Source: Authors' elaboration.

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