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REGIONAL ECONOMIC IMPACT OF COMMON AGRICULTURAL POLICY DIRECT PAYMENTS

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Regional economic impact of Common Agricultural Policy direct payments

Doctoral dissertation

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Table of Contents

List of tables and figures

List of abbreviations

Abbreviation	**English expression**
ABM	agent-based modelling
AGMEMOD	Agricultural Member State Modelling
AgriPoliS	Agricultural Policy Simulator

ARDECO	Annual Regional Database of the European Commission
BPS	Basic Payment Scheme
CAP	Common Agricultural Policy
CAPCEE model	CAP Central-Eastern Europe model
CAPRI	Common Agricultural Policy Regionalized Impact
CATS	Clearance Audit Trail System
CGE	computable general equilibrium
DEA	Data Envelopment Analysis
DREMFIA	Dynamic Regional Sector Model of Finnish Agriculture
EFA	Ecological Focus Area
EU-SILC	EU Statistics on Income and Living Conditions
FADN	Farm Accountancy Data Network
GAEC	Good Agricultural and Environmental Condition
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GFCF	Gross Fixed Capital Formation
GMM	Generalized Method of Moments
GVA	Gross Value Added
LPIS	Land Parcel Identification System
NMS	New Member States: Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia
NUTS	Nomenclature of territorial units for statistics
OMS	Old Member States: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
POLTERM	The Enormous Regional Model - Poland
PPS	Purchasing Power Standard

SAPS	Single Area Payment Scheme
SFP	Single Farm Payment
SPS	Single Payment Scheme
WTO	World Trade Organization

1. INTRODUCTION

The Common Agricultural Policy (CAP) is one of the European Union's key policies, encouraging the development of the European agricultural economy, the catching-up of rural areas and the achievement of certain environmental and climate protection objectives through its diversified support system and market regulation instruments.

CAP resources accounted for about 36% of the EU's 2018 budget. The most significant of the CAP subsidies are the so-called direct payments, which are generally available to farmers based on the size of their land or livestock. Direct payments are income transfer measures aimed at strengthening agricultural production, stabilizing farmers' incomes, contributing to the production of safe food and compensating farmers for the production of certain public goods (such as nature protection and landscape conservation).

In the 2018 grant year, a total of € 41.74 billion of CAP direct aid was disbursed to 6.38 million beneficiaries across Europe. These figures well reflect the importance of direct payments in the life of the European agricultural economy. The subsidies have also had a significant impact on agricultural activity in Hungary since the 2004 accession.

The aim of this dissertation is to analyze the economic effects of CAP direct payments in the European Union. It is important to emphasize that the research does not include an examination of the environmental, sustainability, food security and classic rural development objectives of the agricultural policy, but focuses on economic consequences in the traditional sense (e.g. analysis of income, production, productivity issues). My research is motivated by personal, practical and scientific reasons. As for personal reasons, I have been working on the implementation of CAP subsidies in Hungary as a government official at the Hungarian paying agency since 2003. Accordingly, my interest in the effects of direct payments is natural. The topicality of the research is given by the fact that the forthcoming reform of the CAP is already underway, one of the important topics of which is the future of direct payments. At the heart of the research's scientific interest is the understanding of how

different economic policy instruments affect the operation of a given sector, as well as how they influence the economic decisions of the actors involved.

The research focuses on the regional economic effects of direct payments in the European Union and how these effects are balanced in different parts of Europe. I am also interested in how the effects differ between old and new Member States. The basic assumption of my research is that direct subsidies increase regional agricultural income, have a positive effect on productivity and efficiency, and that they alleviate regional poverty and income inequalities.

These hypotheses were tested by quantitative, ex-post impact analysis methods, which were based on NUTS2 regional data from 2008-2018. I chose the regional level as the basic unit of the applied quantitative models because it allows for a much more detailed level of research than examining aggregated data by country. Studies published on the subject so far most often include analyzes at Member State level; regional research is relatively rare or, if available, usually deals with comparative analysis of a small number of regions. The scientific relevance of the present research is reinforced by examining the economic impact of CAP direct payments through a comprehensive analysis of the vast majority of EU regions.

In the second chapter following the introduction of the dissertation, I present the history of direct payments. This is followed by a third chapter with a detailed review of the literature, in which I summarize previous scientific research on the subject, grouped according to the different economic effects of direct subsidies. The fourth chapter contains the research questions, the hypotheses derived from them, the description of the data on which the analysis is based, and the methods used. The fifth chapter contains the results of the research, after which a summary concludes the doctoral dissertation.

I would like to point out that the doctoral dissertation is a scientific work created within the framework of my individual research activities; what is stated in it cannot be linked in any way to my paying agency activities or be considered an official state position.

2. HISTORY OF CAP DIRECT PAYMENTS

2.1 The birth of direct payments with the MacSharry reform

The initial purpose of the CAP was the encouragement of significantly reduced agricultural production after World War II. In addition to organizing the unity of the internal market and taking uniform action against external market effects, the CAP aimed to achieve this through a system of guaranteed minimum prices (so-called intervention prices) on the main agricultural markets. Under this market mechanism, agricultural products were bought in by the European Community at the guaranteed minimum intervention price, so that the market price could not fall below this price level. Thanks to the operation of the intervention, the price level in the Community was able to remain permanently above world market prices, which greatly increased the supply of agricultural products, and accordingly the CAP successfully achieved its initial goal of expanding production (Jámbor and Mizik, 2014).

The first problems arose in the 1970s, when production exceeded self-sufficiency levels and huge stocks of products under intervention began to accumulate. Prices kept artificially above world market prices have become increasingly difficult for the Community to finance. The intensification of production raised environmental concerns, and the global market crisis of the 1970s also did not have a positive effect on the public perception of the CAP. In addition, in the 1980s, external pressures on the agricultural policy increased among global competitors who did not approve of the impact of CAP protectionism on their trade positions. As a result, the CAP plunged into a crisis in the 1980s, which it sought to address by reducing intervention prices, maximizing CAP spending and introducing measures to limit agricultural production (i.e. the introduction of quotas), but these measures were only partially successful (Buday-Sántha, 2011).

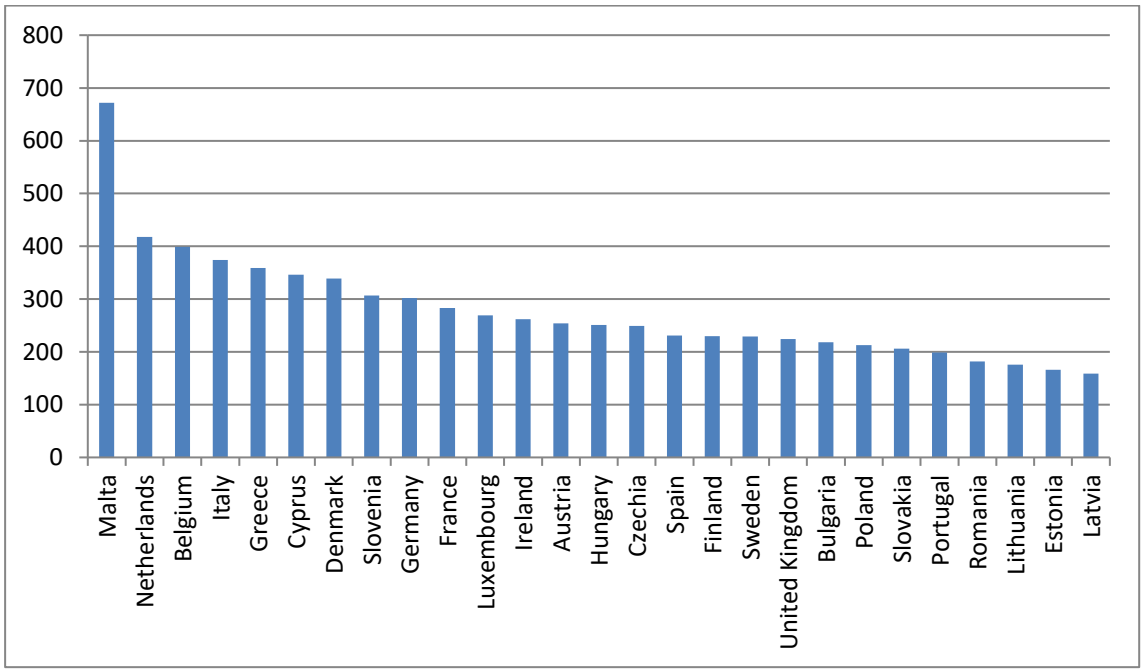
Thus, a fundamental reform of the CAP became inevitable by the early 1990s. The 1992 MacSharry reform, named after the then Commissioner for Agriculture, brought innovations in several areas (Buday-Sántha, 2011):

- The reform significantly reduced the level of guaranteed intervention prices. The decrease was most spectacular in case of cereals (-30%) but was also significant for other products.
- To compensate for the reduction in intervention prices, **direct payments** were introduced. Unlike the previous system, in which the amount of CAP aid depended on the quantity of crop delivered to intervention, the amount of aid was determined on the basis of the size of the agricultural land used for production and the number of animals farmed. In this sense, the introduction of direct payments was the first, albeit only partial, step of breaking the close link between subsidies and agricultural activity (i.e., decoupling from production) (Daugbjerg, 2003). Direct payments are non-repayable income transfer measures; the amount of aid becomes part of the farmer's general income.
- The reform introduced a number of new accompanying measures, such as the agri-environmental program, which was designed to address the environmental and nature conservation problems arising from the increase in agricultural production. In addition, an early retirement scheme was introduced, which encouraged the generational change needed in agricultural production. These measures went already beyond the traditional objectives of the CAP. In addition, a support scheme for afforestation of agricultural land has been set up to curb overproduction.
- The introduction of compulsory set-aside was also aimed at limiting agricultural output, according to which certain direct payments were granted to farmers only if 10% of their production area was withdrawn from production for a given year. In addition, there was an increased amount of support for livestock keepers who were engaged in extensive livestock farming.

The amounts available for direct payments were calculated by determining the size of the production area (or livestock herd) and the reference yield by country, averaged over the years 1986 to 1990, excluding the highest and lowest values. The yield thus calculated had to be multiplied by the support rate set by the Union in EUR / tonne. As the reference yields in the Member States varied significantly, there were large differences in the aid intensities between countries. These disparities,

recorded in the 1990s, have been more or less maintained to this day by the system of direct payments, which creates significant competitive tensions in the Member States of the Union. The following figure illustrates the difference between the average annual direct payments per hectare of each Member State for the period 2014-2020.

Figure 1. – Annual direct payment per Member State (EUR / hectare), 2014-2020 average



Source: Matthews, 2013

The MacSharry reform successfully reduced the prices of some agricultural crops, therefore the demand increased for these products. As a result, fewer intervention purchases were required, and the accumulated crop stocks were reduced. The reform of the subsidy system was successful in addressing external trade pressures, with direct subsidies meeting the requirements of the Uruguay Round of GATT (General Agreement on Tariffs and Trade) negotiations (Cunha and Swinbank, 2011). However, the amount spent on agricultural policy did not decrease; on the contrary, it increased because of the reform. The reason for this was that direct payments were in

principle intended to compensate farmers for the loss of income due to declining intervention prices, but the amount of aid was set so high that it significantly exceeded the savings due to reduced intervention. As market prices decreased to a lesser extent than intervention prices (Buckwell et al, 1997), farmers' incomes have risen significantly, but overproduction dropped only slightly, and the CAP became more complex and bureaucratic due to the many new types of support introduced. State bodies implementing agricultural policy began to exercise too much administrative control over farmers (Tangermann, 1998).

2.2 Adjusting the CAP: The Agenda 2000 reform process

The above-mentioned contradictions of the 1992 reform, the renewed external pressure induced by world market competitors after the expiry of the GATT agreements, and the approaching enlargement of the Union to the east made a further adjustment of the CAP by the turn of the millennium inevitable. This happened in 1999, when the Heads of State and Government agreed on the exact content of the Agenda 2000 reform package in Berlin. The main achievement of the reform is the transformation of the CAP into two pillars: the existing competitiveness and market organization measures (intervention system, direct payments, and some market regulation instruments) formed the first pillar, while the emphasis on the multifunctional nature of agriculture was included in the second pillar. This included various environmental and nature protection instruments, measures to restructure agriculture, and subsidies to diversify agricultural activity (Serger, 2001).

There have also been important changes in the way the first pillar works. Following the trends set by the MacSharry reform, intervention prices continued to fall, while the level of direct payments increased. Agenda 2000 measures for the main product lines developed as follows (Ackrill, 2000a):

- In the case of arable crops, the intervention price for cereals was reduced by 15% and, in parallel, the direct payment for cereals was increased by a similar amount (from EUR 54 / tonne to EUR 63 / tonne). The aid for oilseeds and flax was also fixed at this level, while the aid for protein crops received a

higher aid of EUR 72.5 / tonne. Although the set-aside obligation was to be abolished, it was included in the final agreement unchanged (at the 10% level).

- In the beef sector, intervention prices fell by 20%, while direct payments rose at a bigger rate. The beef cattle premium has been increased from EUR 135 per animal to 210 and the suckler cow premium has been increased from 150 to 200. Moreover, a new slaughter premium was introduced, amounting to EUR 80 per head (for most animals).
- In the dairy sector, the intervention price fell by 15% and quotas were slightly increased by 2%. Direct aid for milk was introduced, allowing producers to expect aid of around € 100 per dairy cow.

It can be concluded that Agenda 2000 carried on the lines set by the MacSharry reform. The measures taken were a step in the right direction, with further reductions in intervention prices bringing intra-Union and world market prices closer together and preventing the accumulation of additional intervention stocks. In addition, with the introduction of the second pillar, it has taken the first steps towards making the support system multifunctional. At the same time, the reform did not solve the problem of the growing CAP budget. Direct payments cost more than could be saved by reducing intervention buying-in. During the reform process, several instruments were envisaged to reduce costs: degressivity (which then meant a gradual, year-to-year reduction in direct payments); national co-financing (according to which part of the grants should have been provided from the Member States' budgets); and modulation (which at the time meant more targeted support for small farms). By the end of the negotiations, however, only modulation was included in the final agreement, but only on a voluntary basis (Ackrill, 2000b). Moreover, the protectionist nature of the CAP also persisted. Overall, the Agenda 2000 process did not bring about as much change in the area of direct payments as the MacSharry reform, but rather carried on the processes launched there, and it did not address the tensions of the support system.

2.3 The 2003 Fischler reform and decoupling

The reform process, named after Commissioner Franz Fischler, originally started out as a mere mid-term review of the new Agenda 2000 measures, but ultimately led to the most significant reform of the CAP. The major change was due to the traditional criticisms of the CAP that had already been made (overspending, deteriorating competitiveness, external pressure on the world market, sustainability issues). Increasing external pressure presented itself in the form of The Doha Round of World Trade Organization (WTO) negotiations, which aimed to reduce trade barriers worldwide, and accordingly highlighted some protectionist measures in the CAP (Swinbank and Daugbjerg, 2006). This was accompanied by new problems around the turn of the millennium: the enlargement of the Union to the East, and the loss of consumer confidence in the quality of European food due to the spread of infectious animal diseases. As a result of the latter, the CAP – perhaps for the first time in its existence – came under criticism not only from professionals and academics, but also from the wider public.

The basic idea of the 2003 CAP reform is to separate (decouple) direct payments from production activities, according to which agricultural production is not a condition for the payment of subsidies anymore. If farmers comply with certain basic farming standards, they will receive the aid regardless of the production activity. The theoretical background of decoupling is that as a result, farmers will be able to make their production decisions on a purely market basis, they do not have to be influenced or distorted by the logic of subsidies. As a result, farmers can get rid of unnecessary, inefficient production activities that were previously maintained for the sole purpose of receiving support (Beard and Swinbank, 2001). In addition, due to the reduction of their market distorting effect, decoupled subsidies have also been much more favoured in the WTO negotiations, which greatly helped their acceptance by external trading partners.

The Fischler reform implemented the decoupling of direct payments by introducing the Single Farm Payment (SFP). The support measure was later renamed Single Payment Scheme (SPS). The SFP replaced almost all forms of coupled direct aid that existed until then (but coupled subsidies could still be granted for certain agricultural

products). In the year of introduction, payment entitlements were allocated to each farm as a property right. To determine the number and value of payment entitlements, each Member State had three options (Kilian and Salhofer, 2008):

- In the historical model, the number of entitlements of the holding was based on the average amount of land used by the holding (in hectares) in the reference period of a few years before the introduction. The total value of the holding's entitlements corresponded to the average value of previous aid received during the reference period. Thus, entitlements with different unit values were allocated to different holdings, in order to maintain the past distribution of support payments.
- In the regional model, the number of entitlements was equal to the size of the land used in the year of introduction, while its value was calculated by aggregating the support of all farms in the region during the reference period and dividing it by the total area used in the region. As a result, equal payment entitlements were created for all farmers in a given region, which significantly rearranged the distribution of support compared to previous periods.
- The hybrid model was created by combining the above-mentioned two solutions. Payment entitlements were divided into two components, one based on a historical basis and the other on a regional basis.

Very few Member States opted for a purely regional allocation method, presumably due to the high degree of support redistribution, which would have raised sensitive policy issues. Accordingly, most countries voted in favour of historical or hybrid models.

The essence of the SFP is that the payment entitlements have to be activated by agricultural land every year. The farm must have as many hectares of land as it has entitlements. For example, if a farm has 10 entitlements and 10 hectares of land, it will receive the value of all entitlements as support payment. However, if the land is reduced to 8 hectares for some reason, the farm will not be able to use the value of two entitlements. If the same farmer buys land in addition to his ten existing hectares, but does not buy payment entitlements with them, they will not receive direct support for the additional area. Payment entitlements can be transferred with or

without land, although part of the value of the entitlement transferred without land can be withheld by the state. Many Member States have made use of this possibility in order to avoid the appearance of "bare" land that is not eligible for support, and therefore its value and marketability declines (Popp, 2004). It should also be noted that instead of introducing the SFP, new Member States had the option of using a simpler, decoupled support scheme until 2010, with a single level of support for all farmers for their utilized agricultural area (Single Area Payment Scheme, SAPS). Almost all new Member States made use of this possibility.

In addition to the establishment of the SFP, an achievement of the 2003 CAP reform was the mandatory introduction of cross-compliance. It is a set of conditions combining environmental, food safety, animal health and animal welfare requirements that farmers must comply with in order to receive the full amount of direct payments. There are two kinds of conditions: the Good Agricultural and Environmental Conditions (which is primarily a means of keeping the land in an agriculturally and environmentally acceptable state) and the Statutory Management Requirements (which set out animal health, food safety and nature conservation conditions). Direct payments to farmers who do not comply with the criteria are reduced or cancelled altogether (in the event of intentional non-compliance). In addition to cross-compliance, the reform introduced the modulation of support, whereby a small part of higher direct payments was withdrawn and the resources released were reallocated to the rural development pillar. Rural development was strengthened financially and supplemented by new measures (e.g. measures to support innovation and investment). In addition, the common market regulation of certain products was substantially redesigned and simplified (Swinnen, 2008).

Overall, the Fischler reform transformed the system of direct payments most radically of all CAP reforms. Subsidies were decoupled from production, which increased the efficiency of agricultural production. Greater emphasis was placed on environmental and food safety issues, in line with the wishes of European citizens. In addition, the introduction of the SFP support system has met the main demands of WTO negotiating partners (Swinnen, 2010). Rural development policy was also reformed, setting new directions.

2.4 Mid-term review: the Health Check

During the 2003 CAP reform, Member States agreed to review the functioning of the revised CAP in 2008. This process was called the Health Check, which led to further refinement and adjustment of the results of the Fischler reform. On the one hand, the number of sectors in which decoupling could be maintained while the SPS was operating decreased. Apart from the beef, sheep and goatmeat sectors, other coupled payments have been abolished and the resources allocated to them have been merged into the value of SPS payment entitlements. The reform introduced the so-called 'specific support', to which Member States could allocate 10% of their direct support envelope. These subsidies were intended to help certain disadvantaged sectors, to improve the quality of agricultural products and to contribute to the payment of agricultural insurance premiums. The degree of modulation also changed, with 5% previously deducted from direct payments above € 5,000, rising to 10%. In addition, an additional 4% deduction was applied to payments above € 300,000 (progressive modulation). The amounts withdrawn under modulation were transferred to the Rural Development (II. pillar), the financial importance of which further increased within the CAP budget. In addition, the compulsory set-aside obligation, which has been in place since 1992, was abolished and the possibility of applying SAPS support to the new Member States was extended until 2013 (Meyn, 2008).

The Health Check also made some changes outside the area of direct payments. The importance of the intervention buying-in system further diminished, with buying-in conditions significantly restricted or abolished altogether. Because of this, the system of guaranteed prices lost its importance in the tools of European agricultural policy after 2008. In addition, the volume of milk quotas was increased by 1% per year, with the aim of being completely phased out in 2015. The reform also simplified cross-compliance controls. Overall, the Health Check cannot be considered a fundamental reform of the CAP, but rather an interim review aimed at adapting EU agricultural policy to the changing economic and social environment (Henning, 2008). This is reflected in the strengthening of the rural development pillar and the further reduction of some market-distorting measures.

2.5 The 2013 CAP reform

The strengths and weaknesses of direct payments crystallized by the beginning of the 2010s, when they had been in operation for 20 years. Direct payments raised farmers' incomes, effectively offsetting losses from the abolition of the intervention system. In addition, due to the gradual strengthening of decoupling, they had less and less market-distorting effects. Because of these aspects, they played an important role in supporting European agriculture. At the same time, critics of the policy have pointed out that direct payments were not sufficiently targeted and effective in the long run: they could not significantly affect the level of agricultural employment, there were serious disparities in the distribution of aid (large farms receive the majority of payments) and the transfer efficiency was low because a significant part of the payments do not go to farmers but to landowners and suppliers of other production factors. As the level of subsidies was determined by the size of the agricultural land used, land prices rose sharply. In addition, income stabilization could be more effectively supported by targeted measures (Swinnen, 2009). Accordingly, support policy was ripe for another reform, which took place in 2013, in line with the timing of EU budgetary cycles.

The reform brought about changes of direct payments in the following areas (Anania and D'Andrea, 2015):

- External convergence: it was agreed to reduce the differences in unit support intensities between Member States by reducing the direct aid budgets of countries with above-average support amounts year by year and reallocating the relevant amounts to countries below the EU average.
- Internal convergence: in order to reduce the differences between the values of SPS payment entitlements (due to calculations based on a historical reference period), the values of entitlements have been approximated in year-by-year steps. Thus, the renewed SPS support (renamed the Basic Payment Scheme / BPS after the reform) eased tensions arising from the disproportionate payment of support.
- Degressivity: Member States were required to reduce the part of the BPS payment above EUR 150,000 by at least 5% to alleviate the disproportions in

the distribution of aid. The amounts thus withdrawn were used to finance support for the rural development pillar. The rate of withdrawal has been determined differently in each country: from a minimum reduction of 5% to 100% capping.

- Greening: the reform introduced greening support into the system of direct payment, for which Member States have had to use 30% of their total direct payment envelope. Greening is a direct area payment: all farmers who receive a single basic area payment must also comply with the conditions for greening, in return for which they receive an additional amount of aid per hectare. Greening sets requirements for farmers in three main areas (Bureau et al, 2012). First, farmers must comply with certain crop diversification requirements. Farms with more than 10 hectares of arable land have to grow at least two different types of crops, while farms with more than 30 hectares of arable land must grow at least three. Secondly, farmers have to maintain permanent grassland; its proportion must not decrease compared to a national reference rate set when greening was introduced. Thirdly, producers with arable land larger than 15 hectares have to maintain Ecological Focus Areas (EFAs). These EFA elements are part of the ecological network or other areas beneficial for the climate or for the environment. They include fallow land, landscape features, water protection zones, agroforestry systems, forest edge areas, short rotation coppice, afforested agricultural areas, and areas sown with certain secondary or nitrogen fixing crops. Farmers must maintain EFA corresponding to 5% of their total arable land (as any combination of different elements of choice). If this ratio is violated, the amount of greening support is reduced proportionately (Szerletics, 2018a).
- In addition to greening, support for young farmers has also become a mandatory element of direct payments, according to which producers under the age of 40 can expect an increased amount of area-based support. In addition, Member States could introduce the support scheme for small farmers, whereby beneficiaries can receive a maximum amount of aid of € 1,250 per year, under simplified application and control conditions. The aim of the measure was clearly to simplify the implementation of the CAP. It was also an option for Member States to decide on the introduction of redistribution aid, which shifts payment amounts from larger farms to smaller

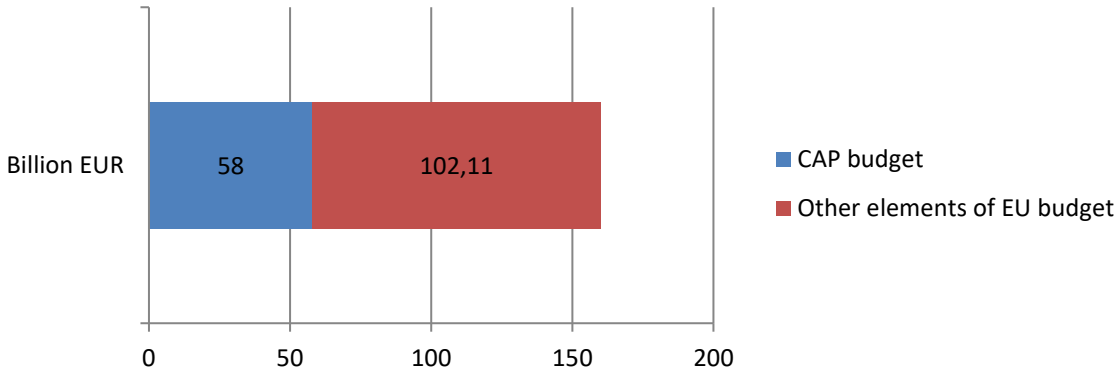
farms. Moreover, Member States have had the opportunity to grant support to areas with natural constraints. In addition, if the Member State so decided, 15% of the direct support envelope could be paid to farmers in the form of coupled payments in certain agricultural sectors.

- An active farmer condition was introduced to increase the transfer efficiency of direct payments. According to this, applicants who technically are entitled to receive direct payments through their land, but whose activities are mainly of a non-agricultural nature (e.g. airports, sports grounds, real estate development companies), are excluded from support.

In addition to direct payments, the 2013 reform also brought changes to common market organizations. Measures related to the abolition of milk and sugar quotas were strengthened, support for producer groups was expanded, and a crisis fund was set up to mitigate the effects of market shocks. Rural development measures were organized into a Common Strategic Framework, the essence of which is that all EU financial funds (including those outside the field of agriculture and rural development) are managed according to a common set of rules and procedures. A number of simplification measures were also introduced, and the level of co-financing was standardized in Pillar II.

The following two figures present the financial weight and budget of direct payments. The financial weight of the CAP within the European Union (EU) budget is illustrated in Figure 2.

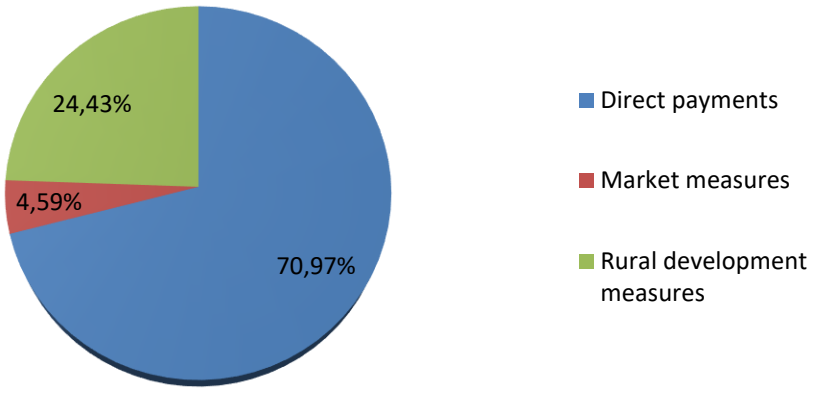
Figure 2 – Proportion of CAP expenditure within the EU budget, 2018



Source: European Commission, 2020

Direct payments account for the largest share of the CAP budget, as illustrated in Figure 3.

Figure 3 – Components of the 2018 CAP budget

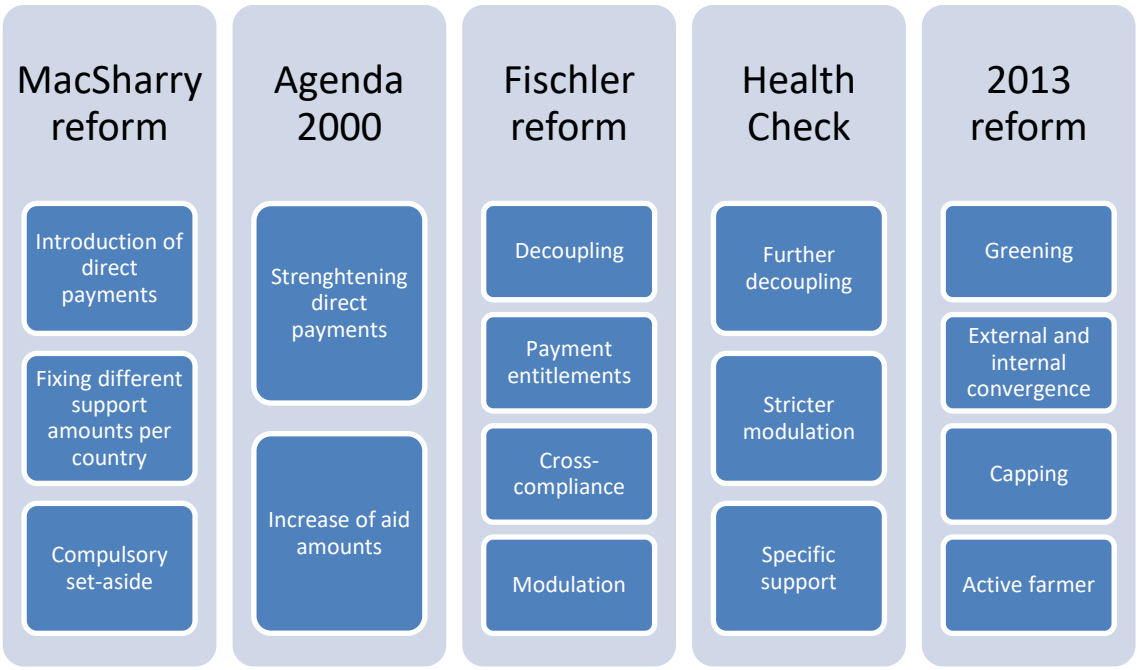


Source: European Commission, 2020

Based on this, we can conclude that about 26% of the total EU budget was spent on direct payments after the 2013 reform. There are a number of merits to the 2013 CAP reform: direct payments, perhaps for the first time since their inception, have moved towards achieving environmental goals. In addition, agricultural policy has placed greater emphasis on reducing the unequal distribution of aid. At the same time, critics of the reform say that these steps were taken in the good direction; however, their extent was not sufficient. The level of redistribution has not been ambitious enough, and the environmental conditions for greening have been too diluted by the political compromises made in the reform process. Consequently, farmers do not have to restructure their farming practices to any great extent in order to meet support expectations. According to some analyzes, the reform sought to reconcile the interests of the farmers' lobby (to maintain the level of direct support), the growing environmental expectations and the views of economic experts (on the greater targeting of the support system). While the reform was successful in the first aspect, the implementation of the other two aspects was far from successful (Swinnen, 2015).

The history of direct payments, in the light of each CAP reform, is illustrated in Figure 4.

Figure 4 – Evolution of direct payments in light of CAP reforms



Source: own composition

2.6 The future of the CAP: the forthcoming reform

The forthcoming CAP reform is already underway (Szerletics, 2018b). In early 2017, the Commission conducted a wide-ranging public consultation with various actors in the sector, the results of which were presented at a conference in July 2017. This was followed in November by a communication on the new CAP, in which the Commission outlined its strategic vision for the future of the Common Agricultural Policy. The draft Commission regulation was made public in early June 2018 and already contains detailed information on how the future CAP will work. An agreement on the future rules of the CAP was reached in the Council in October 2020, which is going to be followed by consultations with the European Parliament as part of the co-decision process. Final agreement on the agricultural policy is planned to be reached in the first half of 2021.

An important innovation of the post-2021 CAP is that the details of the program are determined by the Member States, who draw up their own country-specific CAP strategic plans. Programming was already used in the field of rural development before 2020, but it is a new phenomenon in terms of direct payments. The strategic plans leave more freedom to the Member States in developing the CAP toolbox, as well as the possibility to adapt the CAP to local conditions to a greater extent. The draft Commission legislation describes in detail exactly what elements the strategic plans should cover as a minimum (European Commission, 2018):

- SWOT analysis should be performed separately for each of the specific objectives of the CAP;
- an intervention strategy must be developed, i.e. monitoring indicators have to be established and target values have to be set, specific support measures have to be designed;
- a description of the common regulatory elements for different support measures;
- a description of various support instruments, detailing the territorial and individual scope of each aid scheme, the eligibility criteria for the support, the planned aid intensity;
- a plan should be drawn up to achieve the target value of the monitoring indicators, which contains the various target values in tabular form, and sets milestones in annual breakdown in order to gradually achieve the targets;
- the national institutional context for the implementation of the CAP has to be outlined, with particular reference to the division of the various functions required by Community law;
- a separate chapter should be devoted to explaining how the implementation of the CAP Strategic Plan will contribute to the modernization of agriculture, highlighting the importance of knowledge transfer and innovation and the digitalisation of agriculture.

Under the draft regulations on the future of the CAP, direct payments will continue beyond 2020 in the form of decoupled and coupled payments. The scope of the planned decoupled measures is as follows (European Commission, 2018):

- Basic Income Sustainability Support: a fixed amount per hectare for agricultural land, conditional not on production but on maintaining the area in good condition (successor to the BPS / SAPS support).
- Complementary redistributive income support: used to reallocate support from large farms to small and medium-sized farms by providing additional support amounts for a limited amount of eligible land on the farms. This way, smaller farms can achieve higher aid intensities.
- Complementary income support for young farmers: additional support to young farmers starting their agricultural activity in excess of the basic payment.
- Support scheme for environment and climate protection: farmers who undertake additional obligations in the field of environment and climate protection can receive additional aid in the form of an area-based support premium.

Community agricultural policy continues to be fundamentally based on direct payments, despite the fact that there has already been a great deal of criticism in the scientific literature for conserving existing structures and distributing aid unequally between beneficiaries (Severini and Tantari, 2013a). The draft regulations outline a direct support system with a structure very similar to the 2013 reform, whereby the main income distribution principles remain unchanged. However, due to increased subsidiarity, it will be the responsibility of Member States to ensure that a more targeted direct support system is set up in the next programming period.

3. LITERATURE REVIEW OF THE ECONOMIC IMPACT OF CAP DIRECT PAYMENTS

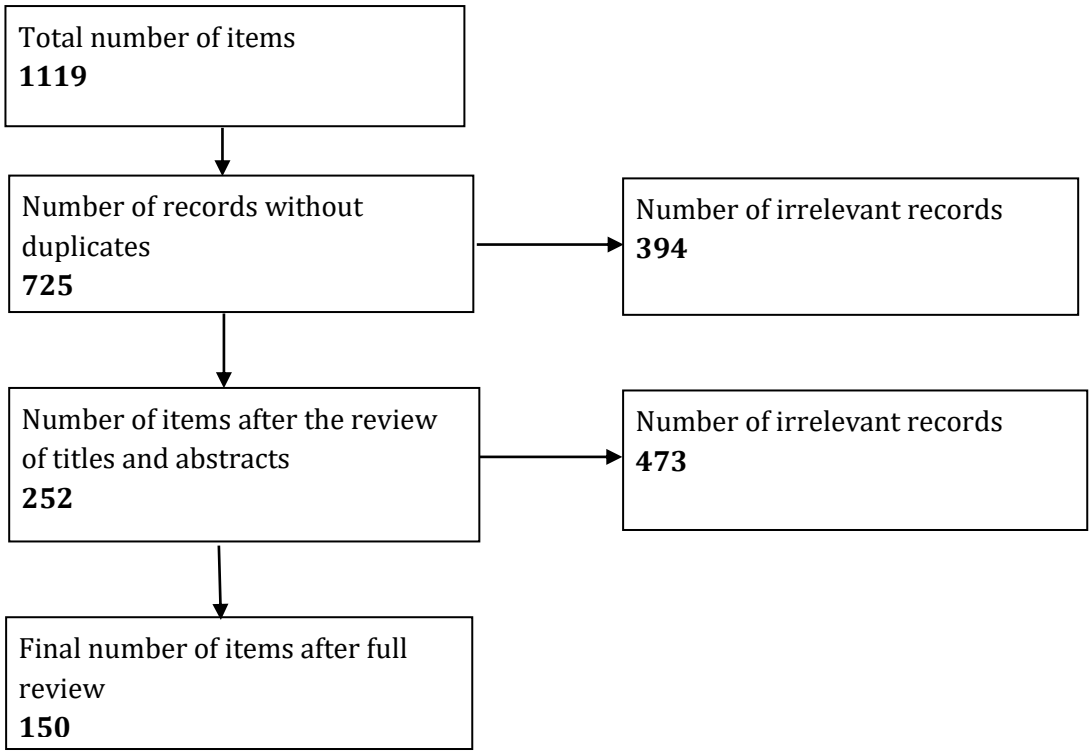
3.1 Identification of relevant research items

It is worth starting the study of the effects of direct payments with a systematic literature review to find out who has already dealt with the topic, what methods have been used and what results have been achieved. In the Web of Science and Scopus databases, I used the words “direct” “support” and “impact” as a joint search. These words had to appear in the title, abstract, or between keywords. I was only looking for articles published in English, but I didn't apply further restrictive conditions during the search.

This search returned 1119 items in total. After having filtered out duplicates, 725 items were left. After reading the abstracts of these articles, I started processing them systematically. By the end of the process, after a reading of the title and abstracts, and the reading of the remaining research material in full, I found that 150 articles were specifically about the economic effects of the CAP direct payments.

I found it very important to be strict and consistent in my selection. A great many articles have been written on a topic which deals only tangentially with direct payments, but not with their effects. There were also many general agricultural policy reflections on the impacts and challenges expected, but these were not in the focus of my search either. There have also been many articles on describing the reforms of the Common Agricultural Policy, which I also did not consider to be relevant for this part of my research. In addition, there were articles in the search results that did not specifically address economic, but rather environmental or sustainability impacts; these were also not part of my research topics. The entire selection process is presented in Figure 5.

Figure 5 – Number of literature items on the effects of direct payments

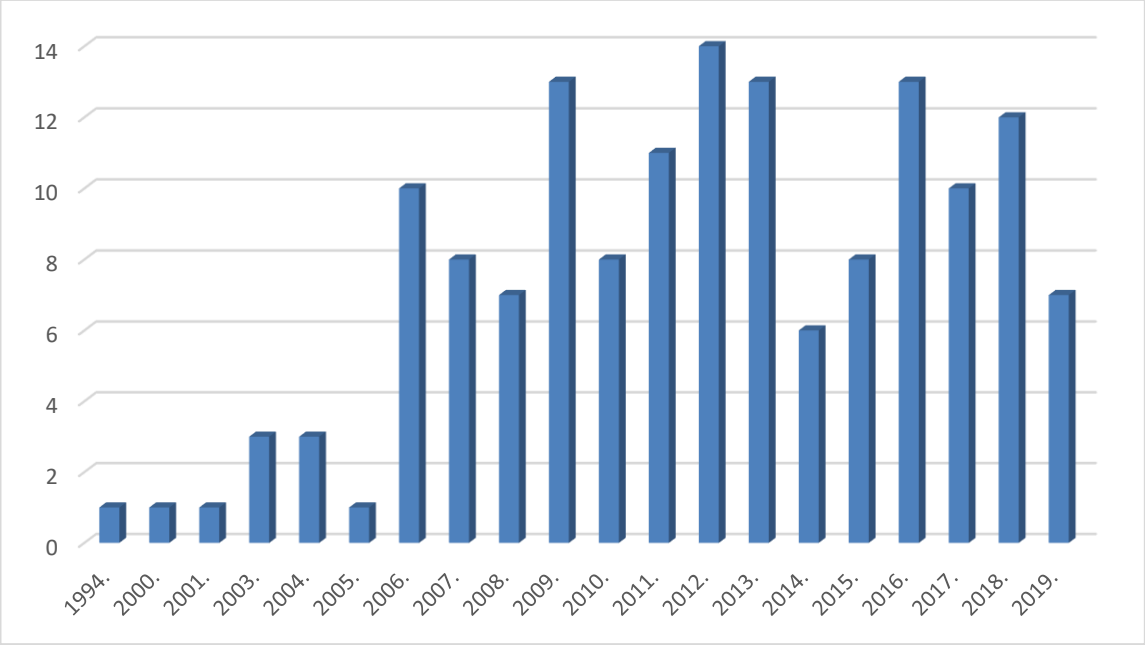


Source: own composition

3.2 Main features of the reviewed scientific literature

The distribution of the reviewed research items by year of publication is shown in Figure 6.

Figure 6 – Year of publication of reviewed research articles



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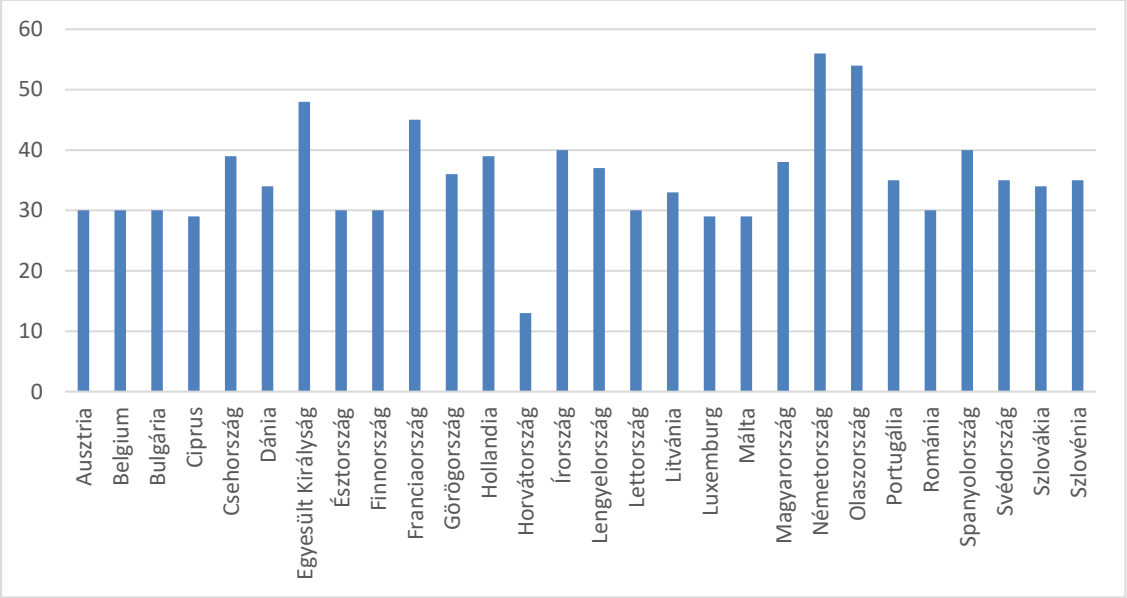
The figure above shows that the studies in the literature review are relatively recent, with their rounded average and median also falling to 2012. Moreover, the highest number of studies was published this year (14). Interest in the topic was lower in the early 2000s (one article was written on the topic in 2000, 2001, and 2005). Overall, the figure is a good reflection of the ongoing scientific interest in the topic, especially in the period from 2006 to the present. This also confirms the scientific relevance of my dissertation.

The distribution of the literature items by analyzed countries is shown in Figure 7.

Figure 7 – Member States analyzed by the reviewed research articles



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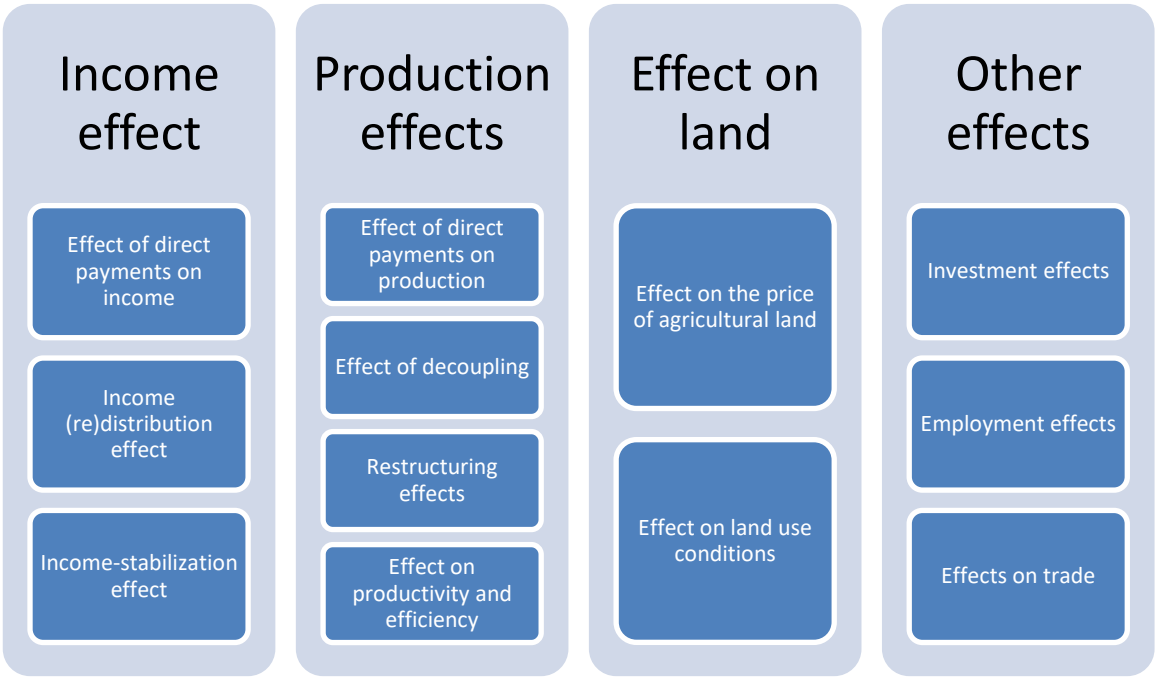
The variance in the number of countries examined is not particularly large, due to the fact that a significant part of the articles contains findings for all Member States or for a larger group of Member States. An average of 35 articles deal with a given country (of course, it should be borne in mind that an article may deal with several Member States). Interest in Germany, Italy, the United Kingdom and France was particularly high in the articles examined, but the number of Hungarian analyzes was also above average. Based on all this, it can be said that the studies included in the literature review provide a balanced, complete picture of all the Member States of the European Union.

I coded the relevant literature research according to the economic effects they analyzed. For each article reviewed, I noted the economic implications of direct support covered by that article. During the coding of the various economic effects, I did not have predefined categories, i.e. the classification was completely open. When I processed half of the literature items, I reviewed the categories, consolidated them, filtered out duplications, and continued the process accordingly. After reviewing all

literature items, I repeated this step (Mayring, 2000). The finalized categories of the reviewed literature are shown in Figure 8.

Figure 8 – Categorization of reviewed studies based on economic impacts



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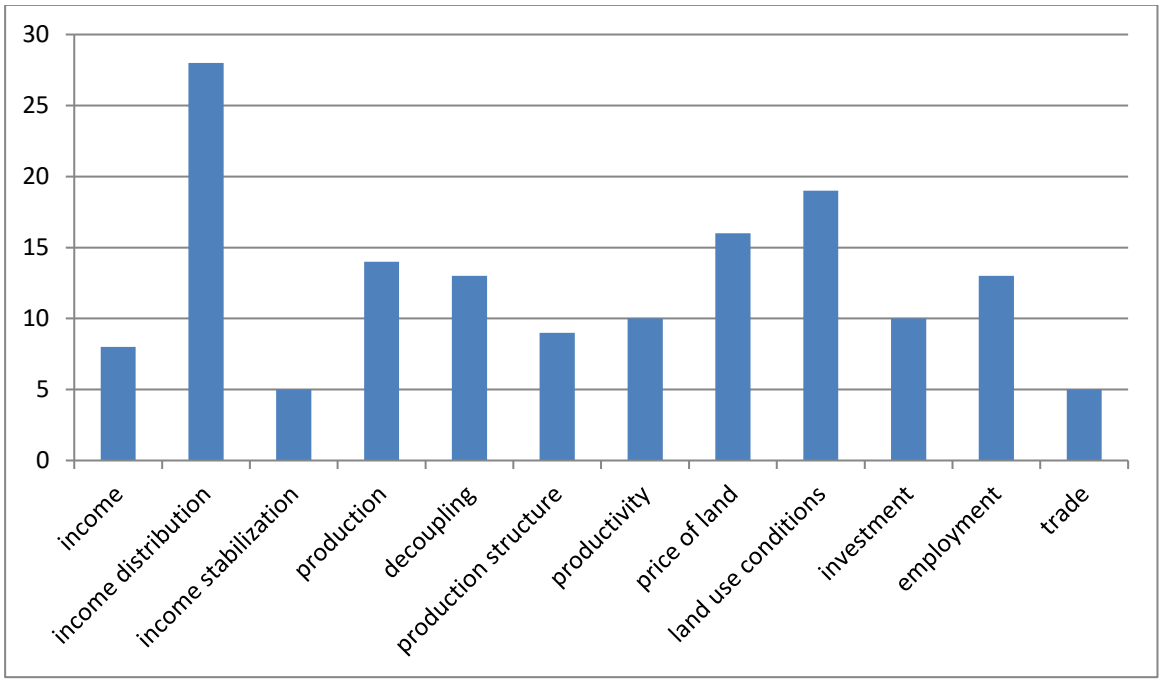
The distribution of reviewed articles among the above topics is shown in Figure 9:

Figure 9 – Number of reviewed articles by the analyzed economic effects



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The rest of this chapter presents the main findings of the studies reviewed according to the categories above.

3.3 Impact of direct payments on agricultural incomes

3.3.1 Subsidy effects on agricultural income

CAP direct payments are income-type subsidies by nature. This is especially true in case of decoupled payments, where the support is only loosely linked to actual production activities (although they are still linked to one of the production factors, i.e. agricultural land). Therefore, it is hardly surprising that direct payments are generally considered to raise gross farm incomes. This is reflected in the study of Boysen et al (2016), who analysed the impact of the 2003 CAP reform on, inter alia,

Irish farmers' income by applying a Computable General Equilibrium (CGE) model on Irish farm data. CGE models in a general allow for analyzes that seek to predict, based on specific economic data, how the economy would respond to changes in technology, economic policy, or other external factors. The authors found that besides small GDP gains, more efficient and targeted direct payments would increase farmers' real income by 7% in the medium and 10% in the long run.

Ciaian et al. (2015) also investigated the income effects of coupled direct payments, the single payment scheme and rural development programme. By using a large set of cross-country farm level data between 1999 and 2007, the authors found that farmers gained 66–72%, 77–82% and 93–109% income from these programmes, respectively. This means that there is a sizeable positive income effect of direct payments. On the other hand, rural development support seems to be more efficient in income transmission in this sense. This result is in line with the Commission's intention to shift the CAP from a production based to a rural development and public goods based policy.

Income effects of direct payments were also studied in new Member States. Nková et al (2009) studied the utilization of direct payments in the Slovak Republic after the 2003 CAP reform. Using industry reports, information from the Paying Agency and other sources, the authors made a comparative study of direct payments before and after the country's EU accession. It was found that there was a significant increase in the level of subsidies after joining the EU, whereby Slovakia opted for the use of the Single Area Payment Scheme (SAPS), which is a decoupled basic income payment. To compensate for the phasing-in mechanism, Slovakia decided to apply complementary national payments for certain sectors of the agriculture. As a result, Slovakian farmers could access funds that were 53.1% of the average funding in old Member States in 2004. The incrementally growing subsidies in the phasing-in period had a positive effect on agricultural income.

Kozar et al (2006) examined different CAP policy options after the accession of Slovenia, and their effects on agricultural income. A survey was carried out with 120 farmers for the year 2001, and on this basis a static deterministic total income model was utilized on different scenarios: a baseline pre-accession scenario from 2001; a post-accession scenario with coupled payments from before the 2003 reform; a

scenario with flat-rate decoupled payments (SAPS); with regionalized decoupled payments differentiated for arable land and permanent grassland (SPS); a scenario with SPS complemented by certain coupled payments. It was found that the overall farm income situation would improve under all post-accession scenarios.

In another study in this topic, Fragoso et al. (2011) analyzed the economic effects of the CAP on the Alentejo region of Portugal by applying a positive mathematical supply model and concluded that agricultural income increased with Single Farm Payments (though foreseen price increases did not compensate the loss of the Agenda 2000 area payments with regards to competitiveness).

Galluzzo (2016, 2018a) also found positive effects of the CAP on farms income in Slovenia and Romania, respectively, especially in less favoured rural areas, by applying SEM models on FADN data over 2007 and 2015. Galluzzo (2018b) reached similar conclusions when analysing the role of CAP in Irish farm income by applying multiple regression model and DEA analysis on Irish FADN data.

The relevant articles on the effects of direct payments on income are summarized in table 1.

Table 1 – Income effects of direct payments

Author	Topic	Country	Method	Result
Boysen et al (2016)	Impact of CAP on Irish farmers' income	Ireland	CGE model applied on Irish farm data	Direct payments have a positive effect on farm income, but they could be better targeted.
Ciaian et al. (2015)	Income effect of various CAP subsidies	Several Member States	Analysis of cross-country farm level data from 1999-2007	Positive income effect of direct payments, the efficiency of income transfer could be improved.
Nková et al (2009)	Effect of introducing the CAP in Slovakia	Slovakia	Comparative study (pre/post-accession)	Direct payments raised agricultural incomes following the EU-accession.
Kozar et al (2006)	Comparative study of post-accession scenarios	Slovenia	Static deterministic total income model	Overall farm income situation improved after the EU accession.
Frogoso et al. (2011)	CAP economic effects in Portugal	Portugal	Positive mathematical supply model	Directs payments increased income, though not necessarily

				competitiveness.
Galluzzo (2016)	CAP income effects on less favoured areas	Slovenia	Structural equation model	Positive effect of CAP on farm income.
Galluzzo (2018a)	CAP income effects on less favoured areas	Romania	Structural equation model	Positive effect of CAP on farm income.
Galluzzo (2018b)	Farm income analysis	Ireland	Multiple regression model	Positive effect of CAP on farm income.

Source: own composition

It can be stated that all relevant articles found a positive relationship between direct payments and farm income levels. Income subsidies by nature, direct payments raise the income of agricultural producers, although there are some doubts as to the efficiency of this income transfer. A few studies suggest that direct payments should be better targeted in order to have more impact on raising agricultural income. Furthermore, direct payments were able to improve the income situation of farms in new Member States after their EU accession.

3.3.2 The effect of direct payments on income distribution

The uneven distribution of direct payments among beneficiaries has been a much debated subject by policy-makers, farmers and the general public alike. This is also reflected in the scientific literature, which analyzes the income distributional effect of direct payments extensively. The question here is not whether the subsidies have a positive effect on income, but rather if they are distributed in a justifiable way (so that the result is economically reasonable, and socially acceptable).

3.3.2.1 External convergence

One of the main criticisms concerning CAP direct payments that they do not allocate financial resources equally between Member States. This is due to many historic reasons. As a result, a few countries (particularly the Baltic States) receive substantially lower unit amount of payments than the EU-average. To alleviate this situation, a so-called external convergence procedure needs to be put in place,

whereby support intensity differences are eliminated or reduced. Volkov et al. (2019a) state that the unit value of direct payments (i.e. euro per hectare or euro per animal) is significantly lower in the new Member States than in the old Member States. From time to time, the European Commission attempts to reduce these inequalities in its legislative proposals on the CAP, but the study argues that these measures are not sufficient to achieve true convergence between Member States. The authors propose an alternative way of allocating direct payment amounts, based on production cost ratios. Based on Eurostat data from 2014-2016, the cost of producing agricultural commodities with a value of 1 euro was calculated for all Member States. Where the costs are higher, a higher amount of direct payments should be allocated, according to the study (although this raises questions of competitiveness). The method would result in a major restructuring of direct payments, with the Baltic States, Slovakia and Finland receiving significantly higher amounts of direct support, while Malta, Greece, Cyprus, and the Netherlands receiving significantly lower amounts.

Rumanovska (2016) examined the same question on the example of Slovakia, by looking at the effects of the 2014-2020 CAP reform on the Slovakian agricultural sector. Despite the policy efforts on converging the level of support per hectare, Slovakian farmers were still less intensively subsidized than their counterparts in several Member States. Because of this, the author argues that CAP direct payments should be much more in favour of less productive regions – this is the only way for the CAP to reach its economic and social goals throughout the EU.

Furthermore, Ackrill (2003) showed that direct payments should be reduced if all Member States wanted to receive the same level of payments. By using a CAPCEE (CAP Central-Eastern Europe) model based on 1995-1999 data, the author called for a change in the system of direct payments to be financially fair and socially equal. (The entry of new Member States after the publishing of the article probably further nuanced the picture of external convergence.)

Erjavec et al. (2011) took a different approach to the same problem, by investigating the possibility to introduce an EU-wide flat area payment system and their impacts. Using the AGMEMOD 2020 (Agricultural Member State Modelling) combined model, the authors concluded that some minor negative impacts on production would

occur, though impacts varied by sector, an especially beef turned out to be an exception. AGMEMOD is a dynamic, partial equilibrium model that makes medium-term forecasts for agricultural production, productivity, prices, market supply, and other economic factors. In any case, the introduction of a single level of support would greatly redistribute CAP resources between Member States (and, of course, between individual beneficiaries), thus making a significant contribution to alleviating inequalities in support levels between countries.

The focus of the study of Gocht et al (2013) was similar. They investigated farm-type effects of an EU-wide decoupled payment harmonisation by using different scenarios in the CAPRI model. The CAPRI (Common Agricultural Policy Regionalized Impact) model is a partial static equilibrium model for ex-ante impact assessments. In the scenario where equalised per-hectare rates are given inside each Member State together with a partial harmonisation of the SPS, new Member States were found to gain and old Member States to lose, implying a serious redistribution of existing payments.

The study of the accession procedure of Member States in 2004 yielded further result in the topic of external convergence. For a period after their accession, new Member States did not immediately have access to the level of direct payments of old Member States; instead, support amounts started out from a reduced level (25%) and were increased year-by-year until it reached 100% (phasing-in). To compensate for this, new Member States could introduce complementary direct payments financed by the national budget. Rednak et al (2003) analyzed the potential effects of phasing-in on farm income by utilizing the extended economic account for agriculture (EAA) model and a partial equilibrium sector model. It was found by both models that the reduced amount of direct payments (even when complemented by national funds) is simply not sufficient to compensate for the expected drop in agricultural prices after accession; therefore a significant decrease in farm income would be likely to take place. The authors argued that new Member States should have been able to access 100% of direct payments directly after accession, in order to prevent deterioration in important agricultural sectors. From this finding we can also conclude that external convergence procedures were hindered by the phasing-in mechanism put in place.

Rancheva et al (2012) studied the impact of the CAP on Bulgarian farm development through a survey completed by 65 experts on agriculture. The participants had to rank the perceived effect of different aspects of the CAP on main economic indicators like income, competitiveness, market orientation and employment. The results were then analyzed by statistical methods to identify rank correlations, concordance coefficients and to check their significance. It was found that the most significant effect of the CAP was the improvement of competitiveness of farms. The experts pointed out that the CAP can only be effective if simplification of procedures and the increase of the amount of direct payments were to take place in the future. This also hints at the need for further effort in converging payment levels among different regions in Europe.

3.3.2.2 Internal convergence

An old criticism concerning CAP payments is that 20% of the beneficiaries get 80% of the total funds spent on agriculture. Direct payments are highly concentrated; the majority of the payment amount is collected by a few large-scale producers. The situation was not alleviated by the accession of new Member States, either. During the recent history of the CAP, a number of attempts have been made at the internal convergence of payments, but these instruments seem to have had only partial results so far. The highly skewed distribution of payments hinders desirable structural change processes, limits the efficiency of income transfer and constitutes a sensitive social issue which is not only a subject of scientific enquiry, but also of often emerging public criticism.

Trnková et al (2012) analyzed the distribution of the economic results of 140 Czech arable farms in the period 2005-2010, and the effect of CAP subsidies on the inequalities of economic results. The quantification of inequalities was performed with the utilization of the Gini coefficient, the effect of subsidies was measured through calculating its elasticity.

The Gini coefficient is intended to show the degree of variance of a variable, usually used in economics for income inequality calculations. The results show a high level of inequality of economic results across the farms in question. CAP support did not

appear to have a significant redistributive effect on economic result, therefore failing to reach its objective in this respect.

Other studies have also shown the limits of the CAP concerning the achievement of a fairer distribution of funds. Severini et al. (2015b) examined the distribution of direct payments among farmers in different Member States. Data was drawn from the Commission publication on all payments of direct support from 2005 to 2010, as well as Eurostat structural farm data. Concentration ratios were then regressed against policy, structural and economic variables (like labour intensity, gross output per hectare of land, intensity of decoupling, model of SPS utilized in given Member State etc). It was found that the concentration of direct payments is very heterogeneous among Member States, and it can reach very high levels in some of them. Payment concentration is mainly driven by land concentration, and it does not seem to be in correlation with direct payment policy choices. Therefore, the available policy tools (for example, level of decoupling and other measures) could not affect the distribution of funds in a significant way.

Allanson (2006) arrived at a similar conclusion concerning the redistributive effects of the Common Agricultural Policy on Scottish farm incomes, by measuring differences of the Gini-coefficients of pre-support and post-support incomes on farm survey data. Results suggest that the distribution of support in 1999/2000 in Scotland was regressive with respect to pre-support farm incomes. Consequently, direct payments were ineffective and inefficient as redistributive instruments because of the re-ranking of farms. The decoupling of payments can be a much better instrument in this regard, according to the author.

Some studies focused on the introduction of direct payments into the toolkit of the CAP. Keeney (2000) analyzed the distributional effects of the MacSharry reform on income of Irish farmers. The Gini Coefficient was decomposed by different components of income, based on national farm survey data from 1992 to 1996. It was found that direct payments introduced by the MacSharry reform had a small but beneficial effect on the distribution of farm income in Ireland, in a sense that they channelled more funds towards less well-off farms (compared to previous CAP market interventions). The share of market income reduced, but it was still the largest single income component in the study period. Although the distribution of farm

income became a little bit less asymmetric with the introduction of direct payments, the situation was far from settled (the top three deciles of farms received more than 98% of market incomes). To tackle issue of disproportional incomes, a more targeted payment system would be called for.

Deppermann et al. (2016) took a different approach. The authors used an ex-ante policy model to analyse the redistributive effects of CAP liberalisation and found that the abolishment of the main components of the CAP, including direct payments, resulted in a more unequal distribution of income in relative terms but a more equal distribution of income in absolute terms. These results call for more targeted policy instruments, according to the authors.

Spatial analysis of direct payment distribution also yielded interesting results. Bonfiglio et al (2016) analysed the distributional effects of CAP payments by applying a multiregional input-output model on the European space and found that CAP expenditure redistributes its effects towards richer and urban regions, though the magnitude largely depends on intersectoral and interregional linkages. This is contrary to the basic goal of the CAP to support and develop rural regions and economies.

Decoupling and further reforms

From the above-mentioned studies, the conclusion can be drawn that direct payments have no or low income redistributive effect. But does the situation change with the decoupling of direct payments and further reforms of the CAP? Relevant studies present that the income effect in this case is ambiguous, or its magnitude is small, therefore it could not solve the distributional problems associated with CAP direct support.

For example, Viaggi et al. (2010) investigated the effect of the decoupling of CAP direct payments on farm income and investment. It was found that decoupling can have a negative or a positive effect on income, depending on the variable reactions of different farms to decoupling. Furthermore, Ahmadi et al. (2015) analysed the impacts of greening and found that changes in the CAP had no major impact on the net margins of Scottish beef and sheep farmers. By using an optimising farm-level

model, they also showed that all farm types analysed were better off by adopting new greening measures than not qualifying for the green payments.

The income effects were also found to be ambiguous in case of the study conducted by Gelan and Schwarz (2008), who analysed the effects of the decoupled Single Farm Payment on Scottish farms by using a CGE modelling framework. A special emphasis was put on farms characterised by low productivity because of unfavourable natural conditions. Results suggest that decoupling affected farms from least favoured areas (LFA) negatively and non-LFA farms positively. This is contrary to the cohesion and environmental goals of the CAP, which aim at the heavier subsidization of marginal areas.

Rednak et al (2006a and 2006b) studied the redistributive effect of the 2003 CAP reform on farm income in Slovenia. They utilized a static deterministic model on a large sample of farms, comparing the income distribution of the pre-2003 period to different options set out by the 2003 CAP reform. The results showed that the introduction of a fully lump-sum decoupled payment would cause a significant drop in payments for 23% of the farms. Since these farms had been paid nearly half of all direct payments before the reform, this would clearly be a sensitive issue. Moreover, the negative effects would be concentrated in the beef and milk sectors. To alleviate the negative redistributive effects, the Member State should make use of the partial coupling options of the reform, introduce the new decoupled schemes gradually over time, or opt for a mixed-model of decoupling whereby a part of the amount of payments is determined by the farm subsidy level of a past reference period.

The study conducted by Solazzo et al (2014) on the 2013 reform of the CAP yielded somewhat similar results concerning the Italian tomato sector. The impact of dividing direct payments into a basic support and a greening component was analyzed, with a focus on convergence of payments and the possible effects of greening on production decisions of farms. They analyzed data from Italian tomato farms, using Positive Mathematical Programming methodology to run different scenarios. They found that greening – as proposed originally by the Commission – could have a major impact on production by significantly reducing cereal production and agricultural income. The version proposed by the Council (which prevailed later on) would only have minor impact. Later criticism of the greening instrument often

pointed this out as a shortcoming of the policy in the field of environmental protection and climate change. The study furthermore found that tomato farms would not change their land use conditions, but the convergence of basic payments would cause reducing levels of income in the sector.

Ciliberti and Frascarelli (2018) analysed the redistributive effects of decoupled payments and their impacts on farm income in Italy by using a model based on Italian FADN data from 2014 to 2020. The FADN is a network through which sample economic data on agricultural production units are collected in all Member States. Results suggest that CAP reform somewhat decreases the concentration of direct payments. However, the reform is also expected to generally limit the reduction in farm income inequality.

Regionalization and convergence of basic payments

Another policy tool to tackle income distributional problems is the (somewhat misleadingly) so-called regionalization of the Single/Basic Payment Scheme. In the course of the 2003 decoupling, Member States could opt for different models of the Single Payment Scheme (the basic direct income support to farmers). Under the historic model, payment entitlements for individual farmers were fixed based on the amount of support received in a previous reference period. The utilization of this payment model led to disproportionate differences in the levels of payment of different farmers. Under subsequent policy reforms, the Commission therefore sought to review the allocation of payment entitlements in order to converge payment amounts towards a uniform intensity. A move towards the equally distributed regional model of SPS (whereby payment entitlements are equal for the whole region or country) is basically beneficial in this regard, as documented by Severini and Tantari (2013a and 2013b), who examined the effects of the 2013 CAP reform on income distribution. Their most important finding was that the regional implementation of the Single Payment Scheme seems to lower the level of concentration of direct payments and household income, as opposed to the so-called historic model (whereby previous years' reference data served as a basis for the calculation of support amounts). On the other hand, converging payments involves reallocation of funds between regions and sectors, which lead to tensions and may

contradict other policy goals. Therefore, the convergence of payment entitlements has been a rather slow-going process in a number of Member States.

Convergence of payments can move the focus of the CAP to less intensive sectors. Matthews et al (2013) set up a spatial analysis framework from both biophysical and socio-economic data to model the effects of CAP policy changes on Scottish farms. The focus of the study was on the possibility of Member States to depart from the former, historic entitlement-based direct payments towards a flat-rate area payment in the course of the 2013 reform. The analysis showed that such a move would result in smaller income gains for a large number of farms, while a few farms would be negatively affected to a high extent. Crops with a high significance in the agri-food industry (cereals, dairy, and livestock) would experience reduced amounts of support. Generally, funds would be redistributed from intensively managed farms to extensive holdings, a fact worthy of the attention of policy-makers. This change would also occur at the regional level, shifting the focus from the Southern areas with more serious agricultural production to the Northern areas.

Vosough Ahmadi et al (2015) arrived at similar conclusions. They examined the possible impacts of the 2013 reform of direct payments, particularly the regionalization of the basic payment scheme. The study used data on 247 Scottish cattle on sheep farms, which were analysed by an optimizing linear programming farm level model. It was found that moving from a payment scheme based on historic payment entitlements to a regional flat-rate payment decreased the net margins of most farm types, except for extensive sheep farms (those were unfavourably affected by the previous historic model). The regionalization of payment had a much more important impact on farm margins than the introduction of greening, which did not affect farms fundamentally.

Convergence of payments can put certain agricultural subsectors in an unfavourable position. Instead of fixing payment entitlements for farms based on a previous reference period (whereby the payment intensity differs for individual farms), the Health Check proposed to converge the level of individual payments to a uniform per hectare amount. Roselli et al (2009) studied the possible effects of such an approximation process on the olive growers of Apulia province in Italy. The authors set up a simulation of farm economic balance, which was based on representative

olive-growing farms. The data was gathered from official statistics and a structured survey conducted in the region. Based on this, olive growers were classified into representative categories. Three policy scenarios were analysed: no changes in payments, 50% approximation of payments, and 100% convergence of payments. The results showed that maintaining the status quo would be the best scenario for olive farmers, while a total convergence of payments would cause significant income losses, especially for middle-sized farms and farms located in the most productive areas.

Kozar et al (2006) also identified undesired side-effects in connection with regionalization. In their study, they found that the SPS regionalization scenarios were characterised by strong redistribution effect towards less intensive farms, and therefore deemed to be an economically risky instrument.

Chatellier (2004) analysed the impacts of the 2003 CAP reform on French farms by using own simulations on FADN data and found that regionalisation without a transitional period would decrease farmers' income specialised in field crops and those located in diversified areas (beef, sheep or extensive dairy production).

Modulation

During the Health Check process, it was agreed that direct payments over EUR 5000 would be reduced by 10%, and payments above EUR 300 000 would be reduced by further 4 percentage points. The corresponding amounts would be transferred to the second pillar to fund rural development measures. The so-called modulation seems to have had a beneficial effect in terms of uniform distribution of payments, but the magnitude of the effect could only be called slight at best. Moreover, starting from the 2014-2020 budget cycle, Member States have been given the option of redistributing 15% of CAP resources from Pillar I to Pillar II. and vice versa. With this option, the redistributive effect of modulation between pillars has been substantially eliminated by several Member States.

Medonos et al (2009) made an ex-ante impact assessment of the compulsory modulation of direct payments in the Czech Republic. Based on data on support amounts from the Czech paying agency, the authors modelled the possible effects of modulation, taking certain regional aspects also into consideration. The results

showed that modulation would have a significant effect on direct payment levels, mainly because of the large average size of Czech farms. Mountainous regions with grasslands, environmentally sensitive areas and a high share of family farms were least affected by modulation, while agricultural landscapes with large corporate farms were more heavily influenced. On the whole, modulation could be a good tool to channel funds from direct payments to more targeted rural development measures, but its effects could in practice be limited by the artificial splitting-up of farms to avoid reduction of support.

A further study on modulation by Sinabell et al. (2013) examined the distribution of direct payments in 27 Member States of the EU from 2000 to 2010. On a basis of statistical data on subsidy amounts in different EU-countries, they calculated different indicators of distribution (mean/median ratio, concentration ratio, Lorenz curve, Gini index). Based on the results, the concentration of direct payments is high in Malta, Slovakia, Portugal and the Czech Republic and it is low in Luxembourg, Finland, Ireland and Slovenia. It was expected that the concentration would decrease in the studied period, because of the decoupling of direct payments and the introduction of modulation. Contrary to this, the study failed to find a definite pattern for the change in the distribution of payments (in some countries it increased, while in others it decreased). It seems that the dynamics of distribution issues is highly country-specific, and is not sufficiently influenced by modulation measures.

Further articles reinforce this finding. Severini et al. (2015a) examined inequalities in the distribution of support by analyzing a large sample (9722 units) of Italian family farms from the FADN in 2011 with Gini index decomposition by income source. It was found that direct payments can somewhat mitigate the unequal distribution of funds, and particularly modulation can be a beneficial instrument in this regard, although its effects are limited by relative low financial weight it represents. Transferring funds between direct payments and rural development, however, does not influence the concentration of support (contrary to the beliefs voiced in this regard). The article also points out that a uniform approach to the subject may not be correct, because significant differences were found between plains, hill and mountain farms' subsamples.

Capping

From 2013, the Commission attempted to alleviate the inequalities by introducing a compulsory reduction of certain high-amount direct payments. Furthermore, Member States have the option to put in place an absolute threshold (cap), beyond which no payment can be made to the beneficiary concerned. Szerletics (2018) examined whether the results of capping are in line with the original goals of the CAP, based on data on Hungarian beneficiaries. It was found that capping often leads to artificial splitting of large farms, which prevents the desired redistributive effects to take place. On the other hand, capping may have an adverse effect on competitiveness and productivity. Therefore, the future utilization of capping instruments has to be carefully evaluated in this regard.

In a study on the same subject, Sahrbacher et al (2012) examined the possible effect of capping by using a spatial-dynamic agent-based model of structural change and policy response on a study region in East Germany dominated by large farms. In the model, individual farm decisions are simulated as a response to policy change. Two scenarios were implemented and then compared (a reference scenario and a scenario with capping). The results showed that capping causes far a smaller redistribution effect than expected by policy-makers. Furthermore, in the long run it causes losses in profits that are far greater than the redistributed amount 'gained'. Capping can be a burden on the growth of the most efficient farms, may cause intra-sectoral distortions and promote inefficient but labour-intensive production. The latter effect is partly due to the fact that the agricultural wages can be deducted by the beneficiaries from the amount of aid on which the reduction is based (in those Member States where this option is used).

Redistributive payment

The 2013 reform of the CAP gave Member States the option to introduce a redistributive payment, whereby direct payment funds are reallocated from large farms towards smaller ones. Severini et al. (2014) analyzed Italian FADN data from 2011 on all individual farms. They defined different measures of concentration, and looked at their decomposition by income types. It was found that redistributive payments may help in reducing inequalities (because they allocate higher amounts of support to relatively smaller farms). On the other hand, defining a 'strong' active

farmer condition (whereby many previous beneficiaries would be excluded from payment) usually increases concentration and contributes to further inequalities.

Potori et al (2013) were more critical on the subject of redistributive payments. They examined the implications of the 2013 CAP reform, particularly the economic effects of the redistributive payment and the capping of payments. These can be considered as somewhat overlapping policy tools, because both aim at redistributing funds from larger enterprises towards smaller ones. The authors presented six policy scenarios, in which redistribution and capping is used to a different extent. These scenarios were then modelled in an agent-based simulation, using subsidy data from the Hungarian paying agency and the FADN. The evidence coming from the model suggested that the application of capping can be preferable compared to redistributive payment, because the latter draws funds away not only from bigger farms, but also middle-sized family enterprises. Furthermore, the simulation did not show any considerable restructuring effect of the redistributive payment on farms' arable production or livestock farming.

Hansen and Offermann (2016) examined the effect of the 2013 CAP reform on the distribution of direct payments among beneficiaries. By analyzing the components of the Gini-index and other concentration indices based on FADN data on German farms, they found that the introduction of the so-called redistributive payment (whereby funds are directed towards beneficiaries with fewer hectares at the cost of large-area farms) did decrease the inequalities in the distribution of direct payments, but it could only marginally influence income inequalities. This is mainly due to the limited budget allocated to redistributive payment in Germany. The simulations also showed, however, that if the full budget was utilized for this instrument, the distribution of income would only slightly improve. The reason for this is probably the limited correlation between size of agricultural area and income level of a farm. Therefore the redistributive payment is not a very efficient tool for redistributing income.

The reviewed articles analyzing the income distributional effects of direct payments are summarized in table 2.

Table 2 – Effect of direct payments on income distribution

Author	Topic	Country	Method	Result
Volkov et al. (2019a)	Differing CAP amounts in Member States	All Member States	Analysis of support amounts and production cost ratios	Subsidy amount differ significantly among Member States. Less productive/efficient regions should receive more CAP funds.
Rumanovska (2016)	CAP payment levels	Slovakia	Analysis of support amounts in light of the 2013 CAP reform	CAP direct support is still significantly lower in Slovakia, despite the conversion efforts. Less advance economies should receive more aid.
Ackrill (2003)	Equalization of CAP payments among Member States	New Member States	CAPCEE model based on 1995-1999 data	If all countries were to receive the same unit amount of direct support, overall payment levels would have to be reduced.
Erjavec et al. (2011)	Introduction of EU-wide flat-rate payment	All Member States	AGMEMOD 2020 combined model	The introduction of an EU-wide flat-rate payment would significantly reduce differences in support levels, but result in a significant change in budget allocation between Member States.
Gocht et al (2013)	EU-wide decoupled payment harmonisation	All Member States	Comparison of different policy scenarios in the CAPRI model	Conversion of payment levels causes a serious redistribution in budget allocation between old and new Member States.
Rednak et al (2003)	Analysis of payment levels after the EU-accession	Slovenia	Extended economic account for agriculture (EAA) model and a partial equilibrium sector model	The gradual increase of direct payments in new Member States (phasing-in) hindered external convergence processes for a period after the accession.
Rancheva et al (2012)	Economic effects of CAP in Bulgaria	Bulgaria	Agricultural survey	Increase of direct payments of Bulgarian farms is called for, in order for the CAP to be able to reach its economic goals.
Trnková et al (2012)	Distribution of economic results of Czech arable farms	Czech Republic	Analysis of Gini-coefficient elasticity	CAP support did not appear to have a significant redistributive effect.
Severini et al. (2015b)	Distribution of direct payments among beneficiaries	Several Member States	Analysis of payment concentration ratios	Concentration of direct payments is high; it is not influenced by the policy in a beneficial way.
Allanson (2006)	Distribution of CAP support	Scotland	Comparison of pre/post-support	Direct payments were inefficient as income

			Gini-indices	redistributive instruments.
Keeney (2000)	Income distributional effects of the MacSharry reform	Ireland	Decomposition of Gini-coefficient	The distribution of farm income became a little bit less asymmetric with the introduction of direct payments, but it still remained heavily concentrated.
Deppermann et al. (2016)	Redistributive effects of CAP liberalisation	Germany	Ex-ante policy model	The abolishment of direct payments resulted in a more unequal distribution of income in relative terms but a more equal distribution of income in absolute terms.
Bonfiglio et al (2016)	Spatial analysis of distributional effects of CAP	All Member States	Multiregional input-output model	CAP expenditure redistributes its effects towards richer and urban regions, though the magnitude largely depends on inter-sectoral and interregional linkages.
Viaggi et al. (2010)	Effect of the decoupling of CAP direct payments on farm income	Several Member States	Dynamic multi-objective household model	Decoupling can have a negative or a positive effect on income, depending on the variable reactions of different farms to decoupling.
Ahmadi et al. (2015)	Impacts of the introduction of greening	Scotland	Optimising farm-level model	Changes in the CAP had no major impact on the net margins of Scottish beef and sheep farmers.
Gelan and Schwarz (2008)	Effect of the Single Farm Payment on Scottish farms	Scotland	CGE modelling framework	Results suggest that decoupling affected farms from least favoured areas (LFA) negatively and non-LFA farms positively.
Rednak et al (2006a and 2006b)	Redistributive effect of the 2003 CAP reform on farm income	Slovenia	Static deterministic model on pre- and post-reform policy scenarios	Introduction of a fully lump-sum decoupled payment would cause a significant drop in payments.
Solazzo et al (2014)	Effect of the 2013 CAP reform	Italy	Positive Mathematical Programming	The convergence of basic payments causes reducing levels of income in the sector.
Ciliberti and Frascarelli (2018)	Redistributive effects of decoupled payments on farm income	Italy	Own model based on panel (FADN) data	The 2013 CAP reform somewhat decreases the concentration of direct payments but it also limits the reduction in farm income inequality.
Severini and Tantari (2013a and 2013b)	The effects of the 2013 CAP reform on income distribution	Italy	Gini-coefficient decomposition	The regionalization of the Single Payment Scheme seems to lower the level of concentration of direct payments and household income.
Matthews et al	The effect of	Scotland	Biophysical and	Converging basic

(2013)	regionalization of basic payments during the 2013 reform		socio-economic spatial analysis framework	payment amounts does have an equalizing effect on farm income distribution. Income is redirected from intensively managed farms to extensive holdings.
Vosough Ahmadi et al (2015)	Possible impacts of the 2013 reform of direct payments	Scotland	Optimizing linear programming farm-level model	Regionalization helped in achieving a fairer distribution of income, but decreased the net margins of most farm types, except for extensive sheep farms.
Roselli et al (2009)	The effect of regionalization during the Health Check	Italy	Farm economic balance simulation	A total convergence of payments would cause significant income losses for certain subsectors.
Kozar et al (2006)	SPS regionalization scenarios	Slovenia	Static deterministic total income model	SPS regionalization has a strong redistribution effect towards less intensive farms.
Chatellier (2004)	Impact of 2003 reform on French farms	France	Own simulations applied on FADN data	Regionalisation without a transitional period would decrease farmers' income specialised in field crops and those located in diversified areas.
Medonos et al (2009)	Modelling the effects of compulsory modulation	Czech Republic	Ex-ante impact assessment	Modulation could be a good tool to redistribute CAP payments, but its effects could be limited by the artificial splitting-up of farms to avoid reduction of support.
Sinabell et al. (2013)	Analysis of the distribution of direct payments	All Member States	Indicators of distribution (mean/median ratio, concentration ratio, Lorenz curve, Gini index)	Concentration of direct payments is high in several Member States. It was not influenced by the introduction of modulation in any definite manner.
Severini et al. (2015a)	Inequalities in the distribution of direct support	Italy	Gini index decomposition by income source	Modulation mitigates inequalities of income distribution, but its effects are limited.
Szerletics (2018)	Analysis of the maximum threshold of direct payments (capping)	Hungary	Analysis of support application data	Capping often leads to artificial splitting of large farms, which prevents the desired redistributive effects to take place.
Sahrbacher et al (2012)	Possible effect of capping	Germany	Spatial-dynamic agent-based model of structural change	Capping results in smaller redistribution effect than expected, and in the long run it causes losses in profits.
Severini et al. (2014)	Analysis of redistributive payment	Italy	Decomposition of different concentration	Redistributive payments may help in reducing inequalities, because they

			indices	allocate higher amounts to smaller farms.
Potori et al (2013)	Economic effects of capping and redistributive payment	Hungary	Agent-based simulation on FADN data	Redistributive payment draws funds away not only from bigger farms, but also middle-sized family enterprises. The simulation did not show any considerable restructuring effect of the redistributive payment.
Hansen and Offermann (2016)	Effect of the 2013 reform on income distribution	Germany	Analysis of the components of concentration indices	Redistributive payment decreased the inequalities in the distribution of direct payments, but it can only marginally influence income inequalities.

Source: own composition

The extensive scientific literature on the distributional issues concerning direct payments has identified several study aspects of the problem. One such aspect is the uneven allocation of CAP funds among Member States and regions, and the efforts to reduce or eliminate the differences (external convergence). Studies established that there are significant differences in the unit amount of direct payments among Member States (certain new Member States receive below-than-average payment amounts). The total elimination of such differences would result in serious budget reallocation between countries, which is a politically sensitive issue, therefore the convergence procedure moves forward slowly. The elimination of differences in support level was hindered by the phasing-in mechanism in certain new Member States.

Another aspect of income distribution is the disproportionate allocation of direct payments between farmers of a given country. Almost all relevant articles established that the concentration of direct payments can reach very high levels in several Member States. Consequently, CAP support has none or very low income redistributive effect.

The third studied aspect is the so-called internal convergence procedure, whereby the policymakers tried to alleviate the unfavourable income distributional situation by introducing a wide range of new policy tools:

- Decoupling in itself has had no major income effect, or its effect varies from sector to sector, therefore in itself it could not solve the problems associated with disproportionate support amounts;
- Regionalization of the basic direct payment (SPS/BPS), on the other hand, is an effective tool in reallocating subsidy funds in the desired direction. However, it comes with certain unwanted side-effects: it may cause serious budget tensions, and may shift funds towards less intensive sectors, raising questions of competiveness. In addition, it is able to correct inequalities in income transfer within a region, but it does not have a positive effect between regions;
- Modulation was also beneficial in remedying income distribution problems, but its effects were limited in practice by the relatively low financial weight it represented, and the artificial splitting-up of farms in order to avoid modulation;
- The same could be stated about redistributive payment;
- Capping has had a far smaller redistributive effect than expected; the reason for this was also the artificial splitting-up of farms.

To sum it up, the internal convergence procedure was partially successful in reaching a more equal income distribution among farmers, but the problem is far from settled.

3.3.3 The effect of direct payments on income stabilization

As a relatively stable source of financial support, direct payments are generally expected to reduce fluctuations in agricultural incomes. In practice, research has failed to confirm this supposed theoretical effect of direct support on a number of occasions. Severini et al (2017) made a study into the income stabilizing effect of direct payments. Being a relatively stable source of revenue, direct payments aim at reducing the variability of agricultural incomes. The article analyzed balanced panel data on Italian farms from the period 2003-2012, with non-linear regression techniques in order to measure the effects of direct payments, farm size, specialization, labour intensity and other factors on income variability. The results

show that on each subsample direct payments increased (and not reduced) income variability. This may be the case because direct payments reduce the risk farmers perceive and prompts them to engage in riskier activities. All in all, direct payments are not that effective in stabilizing agricultural income. Moreover, they partially collide with the risk management instruments of the CAP, reducing their basis and efficiency.

In a similar study the authors (Severini et al, 2016) analyzed the data of all Italian farms in FADN from 2003 to 2012, with mean of variance decomposition by income components. The results show that income variability is high in the agricultural sector, particularly in case of smaller farms. The main source of variability comes from the revenue component. In contrast to this, subsidies are stable parts of agricultural income. However, direct payments do little to reduce the volatility of other income components, and their effect is highly dependent on farm size. Because of this, the targeting of direct payments is not efficient in terms of income stabilization.
Linking the level of direct payments to the market situation could be a solution to the problem, but it raises a number of political and practical problems.

Bojnec and Ferto (2019) arrived at a similar conclusion. They analysed the role of direct payments in stabilising Hungarian and Slovenian farmers' income and by applying a panel regression model on national FADN data, the found that although direct payments represented a stable source of income, they had limited countercyclical role. These subsidies were not found to be well-targeted and thus inefficient in stabilising farm income.

Further study on the subject was performed by Judez et al (2001), who analyzed the possible effects of the „Agenda 2000" reform of CAP on arable and beef producers with Positive Mathematical Programming methods in the study region of Navarra, Spain. The model considered three different size categories of farms both in the arable and the beef sector. The results showed that the increase of unit values (euro per hectare, euro per animal) of direct payments proposed by the reform is not sufficient to compensate the drop in prices assumed by the model. Therefore, the revenues of farmers were likely to drop after the reform took place. The authors

speculate that the fluctuations of income may somewhat be reduced because of the subsidies, but revenues following market conditions are not sufficiently affected.

As researchers realized the limited effects of direct payments on income stabilization, they also came up with alternative policy tools. Möllmann et al (2019) explored the possibility of substituting the income stabilization effect of direct payments with subsidized agricultural insurance. A survey was conducted among German farmers to measure their willingness to pay for agricultural insurance in a scenario where direct payments would be significantly reduced. The focus of the study was on whole-farm income insurance, and single-crop revenue insurance, which were considered to be more cost-effective than simple yield insurance. A generalized multinomial logit model was applied on the gathered data, whose results showed a positive willingness to pay for subsidized agricultural influence, even if direct payments were abolished (in order to finance insurance premiums). Farmers would pay more for whole-farm insurance than for single-crop insurance; publicly administered insurance policies would be more popular compared to those of the private sector; insurance with broader coverage would also be more sought after. The results suggest that insurance subsidies could be used to offer an alternative to direct payments in agriculture, although whether the farmers' expected payments could cover the costs of such insurances still remains to be seen. In addition, market-based insurers do not currently typically provide general insurance covering all agricultural risks, so some level of public involvement would continue to be needed.

The reviewed articles analyzing the income stabilization effects of direct payments are summarized in table 3.

Table 3 – Effects of direct payments on income stabilization

Author	Topic	Country	Method	Result
Severini et al (2017)	Income stabilizing effect of direct payments	Italy	Non-linear regression techniques	Direct payments increased (and not reduced) income variability.
Severini et al	Farm income components	Italy	Variance decomposition by	Direct payments are stable parts of agricultural

(2016)	analysis		income components	income, but they do little to reduce the volatility of other income components. The targeting of direct payments is not efficient in terms of income stabilization.
Bojnec and Ferto (2019)	Income stabilizing effect of direct payments	Hungary and Slovenia	Panel regression methods	Direct payments represented a stable source of income, they had limited countercyclical role.
Judez et al (2001)	Effects of Agenda 2000	Spain	Positive Mathematical Programming	The fluctuations of income may somewhat be reduced because of the subsidies, but revenues following market conditions are not sufficiently affected.
Möllmann et al (2019)	Substituting direct payments with subsidized agricultural insurance	Germany	Generalized multinomial logit model	Insurance subsidies could be used to offer an alternative to direct payments in agriculture.

Source: own composition

Based on the review of the relevant articles, we can state that while direct payments constitute a stable part of agricultural income, they have little influence over other income components; therefore they have little income stabilization effect. More targeted support is called for in this matter, which specifically aims at mitigating risks (insurance premiums, mutual funds, income stabilization tools).

3.4 The effect of direct payments on production

3.4.1 Subsidy effects on production

The reviewed articles usually measure the effect of direct payments in an indirect way: how production would be affected if payments were abolished, or significantly reduced. Based on these calculations, most studies established that direct payments

have a positive effect on agricultural production, but there is no consensus as to the magnitude of this effect.

Some articles detect a major production effect of direct payments. Bednarikova and Doucha (2009) analysed the impacts of different policy scenarios related to decreasing the amount of direct payments in two Czech districts by using a CGE model. Generally the authors found that even a slight decline in direct payments had negative impacts to the local economy – GDP losses, adverse social impacts and employment loss.

In another example from Romania, Jitea et al (2011) explored various policy scenarios prior to the 2013 reform of the CAP. Data was collected from 21 mixed livestock farms from Cluj county, Romania in 2010-2011, which was then used in a programming model under different policy scenarios (status quo; reformed direct payments with greening element; abolishment of support). The results showed that the greater the change in policy, the bigger losses the sector has to bear in terms of average gross margin. The smallest farms would be hardest hit by the reduction of payments.

Furthermore, Barnes et al. (2016) analysed Scottish livestock farmers' intentions towards future food production regarding past CAP reforms and found that most farmers desired to continue business as usual even if payments were about to increase. Under the declining payments scenario, however, 9% of the farmers would exit the industry and around half of them would decrease herd size and intensity. Past reforms were found to be significant determinants of future farm decisions.

Other articles found that while direct payments probably encourage agricultural production, this effect is slight (because the abolishment of payments would not lead to significant losses in production). Kozar et al (2012) explored policy effects related to restructuring and development. The authors performed a scenario analysis by the CAPRI model to explore likely effects of possible CAP reforms. A baseline scenario (the continuation of CAP direct payments as introduced by the Health Check) was compared with a reform scenario, in which all coupled support was abolished, the amount of direct payments was cut by half, and the Single Farm Payment was allocated on flat-rate basis in all Member States, corrected for purchasing power disparities between regions. It was found that there would be an overall 9% drop in

agricultural gross value added in case of the reform scenario. The reduction in agricultural income varies by Member State and region, by the share of directs payments in agricultural income, intensity of production and the sector concerned. Beef and suckler cow breeding would be affected more, because of the abolishment of coupled payments that these sectors are highly dependent upon. The conclusion of the article was that even a radical cut and modification of direct payments would not cause a drastic drop in overall agricultural production.

Chantreuil et al. (2013) investigated the effects of different direct payment policy scenarios on agricultural markets in the New Member States (NMS) by applying AGMEMOD's dynamic partial equilibrium models and found that the reduction or abolishment of direct payments would not result in any dramatic medium-term changes to agricultural markets of the NMS by 2020, calling for future CAP reform.

Erjavec and Salputra (2011) conducted a similar study, where they used the AGMEMOD 2020 model to analyse the impacts of different direct payment policy scenarios on agricultural markets in the New Member States (NMS). Results suggest that the preservation of pre-2013 policy would have increased production quantities in NMS except for dairy and beef. More interestingly, the decrease or abolishment of direct payments was not found to have any dramatic medium-term changes in NMS agricultural markets.

Espinosa et al. (2014) reached similar conclusions when analysing a 30% reduction in direct payments together with an introduction of an EU-wide flat rate payment. By applying a recursive dynamic regional CGE model, results here suggest that overall GDP effects are not significant, though agricultural sector impacts are important and differ according to the nature of the policy shock.

The scientific literature seems to establish that production effect of direct payments varies from sector to sector. While certain products, regions or group of farmers would not be heavily affected by the elimination of direct payments, some other vulnerable sectors would be harder hit. These sectors have particularly grown dependent on direct support, without which they could not respond to market challenges anymore. The reasons for this are manifold: they are partly due to former subsidy structures or policy choices, dire market conditions in certain sectors, or the absence of restructuring that would have been necessary. For example, Uthes et al

(2011) analyzed the possible outcome of the elimination of direct payments with the aid of both quantitative and qualitative methods in four different European regions from Denmark, Germany, Italy and Poland. The main message of the study is that the effects differ widely across regions. Areas less suited to agricultural production, with unfavourable marketing structures and a higher dependency on direct support are affected most negatively by the abolishment of CAP payments (German region). Regions that have a competitive agricultural sector, where the share of CAP support is not so high (Denmark), or where the agriculture is highly diversified (Italy) are not affected so badly. Direct support can stabilize the economies in transition (Polish region), which is a desirable effect, but in the long run they can conserve existing structures and thus hinder further restructuring and development.

These finding were partly confirmed by Vosough Ahmadi et al (2015), who also found in their study on Scottish cattle and sheep farms that more diversified farms (keeping both cattle and sheep) would respond better to a theoretical abolishment of payments than specialized farms (that were too dependent on the financial support).

With a view to the possibility of decreasing CAP funding after 2020, Lehtonen and Niemi (2018) analysed the potential effects of a drastic reduction in subsidies. The non-linear optimisation-based Dynamic Regional Sector Model of Finnish Agriculture (DREMFIA) was used to evaluate different policy scenarios, taking into account aggregate and regional effects as well. The south of Finland is mainly oriented towards cereal production; a reduction of CAP decoupled aid here would result in a significant (20-25%) drop of agricultural income. Central and northern Finland, on the other hand, would not be so sensitive to cutting decoupled aid, but the loss of coupled support in the cattle and milk sectors would lead to serious economic problems. These sectors have been dependent on coupled aid since the early 2000s, which were effective in maintaining the status quo and keeping the market situation stable but could not initiate any restructuring which would be sorely needed for the long-term competitiveness of dairy and cattle farms.

Another example of a sector where direct payments hinder restructuring is provided by Jitea et al (2015), who assessed the possible impacts of the 2013 reform of the CAP in the North-Western NUTS2 (Nomenclature of territorial units for statistics) of Romania. The Positive Mathematical Programming model was utilized on data

collected from 207 mixed-sheep farms on the basis of a structured survey delivered through face-to-face interviews by individual farmers. A baseline scenario was compared to different reform scenarios, with different levels of total Pillar I financial allocation and share of coupled support. The results showed a decrease in utilized permanent grasslands and number of livestock, especially by small, extensive farms with high nature value pastures. Their vulnerability is grounded in the fact that these farms are typically the most dependent on direct payments (the share of Pillar I support in their total income is highest in their case). These negative effects can be counteracted by increasing targeted agri-environment payments, by diversification of activities, or by seeking off-farm employment.

Coupled support granted to specific sectors can also lead to high dependency on financial aid. Hanrahan et al (2012) utilized the AGMEMOD model to make projections on possible CAP reform scenarios. AGMEMOD is a dynamic, partial equilibrium, multi-product modelling system. A ten-year simulation is produced with the model in a baseline scenario (policy status quo as per the Health Check in 2008), which is then compared to a policy reform scenario, where all coupled support is abolished and the differing direct payment systems across Member States are substituted by a flat-rate, 100 Euro/hectare decoupled payment. The results showed that in this case wheat production would fall by 2,1% in the EU; the drop would be more significant in Member States where arable production is not very widespread, and where the change would constitute a larger drop in subsidy levels (mainly old Member States). The impact on beef production would be more articulate, whereby a 5% decrease in production was foreseen. The negative change is greater in countries that have previously granted coupled support to the beef sector in the baseline scenario (which would then be foregone in the reform scenario). This suggests that higher dependency on subsidies leads to vulnerabilities in a given sector.

The dependency on direct support can reach high levels in certain examples (where the market situation became extremely unfavourable or economic structures became obsolete), where entire sectors are sustained solely by CAP direct payments. In these cases, subsidy is vital for the continued production in those sectors, but also has the unwanted side-effect of slowing much-needed transformation processes down in farms whose activities sometimes are barely viable in economic terms. In such cases,

the question arises as to whether production should be artificially maintained or how producers could be encouraged to engage in economically sustainable activities.

To demonstrate this, Rezbova et al (2012) studied the effects of Complementary National Direct Payments on the cattle breeding sector in the Czech Republic. To compensate for the phasing-in process (whereby the amount of direct payments in new Member States only gradually reached the level of support in old Member States), new Member States were allowed to make complementary payments for certain sectors. By analysing data for the period 2007-2012 of the Czech Paying Agency, Statistical Office and various breeding organizations, the authors studied the link between support and various index numbers characterizing the cattle breeding sector. The results showed that the costs were higher than the revenues in the dairy sector, a deficit which should be compensated through financial support. Taking into account the level of Complementary National Direct Payments, as well as the indirect effect of area-based direct payments, it can be said that dairy production was just about self-sufficient in the study period. The situation is not so grave in the suckler cow sector, where the number of animals was gradually rising. Further growth can be obtained by restructuring the production and a more targeted support system.

A much-debated subject concerning the CAP is the subsidization of the European tobacco-growing sector. Manos et al (2010) analysed different decoupling scenarios of direct payments made to the tobacco sector in for important Spanish and Greek production regions. For the purposes of the study, a multicriteria mathematical programming model was developed, and an extensive survey was performed in the study regions for the period 2000-2005. The results showed that each study region would react slightly differently to the decoupling of tobacco aid, due to variations in the percentage of tobacco cultivated in each region, the alternative crop suggested and other factors. It was found, however, that in all study regions tobacco production would be discontinued if the support was fully decoupled. Decoupling would have a slight negative effect on farmers' income, a more profound negative impact on rural employment. From an environmental point of view, decoupling of sectoral support would be beneficial, as agricultural pollution would decrease in all study regions. To remedy the short- and medium-term negative social impact of decreasing tobacco

production, the study of alternative crops should be given more attention (the stevia plant looks most promising in this aspect).

The reviewed articles analyzing the production effects of direct payments are summarized in table 4.

Table 4 – Effects of direct payments on agricultural production

Author	Topic	Country	Method	Result
Bednarikova and Doucha (2009)	Analysis of decreasing direct payment scenarios	Czech Republic	CGE model	Even a slight decline in direct payments had negative impact on economic activities.
Jitea et al (2011)	Analysis of 2013 CAP reform scenarios	Romania	Programming model	The greater the change in policy, the bigger losses the sector has to bear in terms of average gross margin.
Barnes et al. (2016)	Farmers' intentions related to CAP reforms	Scotland	Multinomial logistic regression	Under the declining payments scenario, however, 9% of the farmers would exit the industry and around half of them would decrease herd size and intensity
Kozar et al (2012)	Policy scenario analysis	All Member States	CAPRI model	Even a radical cut and modification of direct payments would not cause a drastic drop in overall agricultural production.
Chantreuil et al. (2013)	Effect of different policy options	New Member States	AGMEMOD dynamic partial equilibrium model	The reduction or abolishment of direct payments would not result in any dramatic medium-term changes to agricultural markets of new Member States.
Erjavec and Salputra (2011)	Policy impact assessment in new Member States	New Member States	AGMEMOD dynamic partial equilibrium model	Reduction in direct payment levels would not cause drastic changes in agricultural markets.
Espinosa et al. (2014)	Analysis of a 30% reduction in direct payments together with an introduction of an EU-wide flat rate payment	All Member States	Recursive, dynamic regional CGE model.	Overall GDP effects are not significant, though agricultural sector impacts are important and differ according to the nature of the policy shock.
Uthes et al (2011)	Possible outcome of the elimination of direct payments	Several Member States	Mixed-method approach	Areas less suited to agricultural production, with unfavourable

				marketing structures and a higher dependency on direct support are affected most negatively by the abolishment of CAP payments.
Vosough Ahmadi et al (2015)	Study on Scottish animal keepers' reactions to policy change	Scotland	Optimising linear programming farm-level model (ScotFarm)	More diversified farms would respond better to a theoretical abolishment of payments than specialized farms.
Lehtonen and Niemi (2018)	Potential effects of a drastic reduction in subsidies	Finland	Non-linear optimisation-based DREMFIA economic agricultural sector model	The loss of coupled support in the cattle and milk sectors would lead to serious economic problems; these sectors have been dependent on subsidy since the early 2000s.
Jitea et al (2015)	Possible impacts of the 2013 reform	Romania	SIMULCAP model (based on Positive Mathematical Programming)	Reduction of aid would affect the production of small, extensive farms with high nature value pastures most negatively - these farms are typically the most dependent on direct payments.
Hanrahan et al (2012)	Analyzing the effect of abolishing coupled support	All Member States	AGMEMOD model	The impact on beef production would be most severe. The negative change is greater in countries that have previously granted coupled support to the beef sector. Higher dependency on subsidies leads to vulnerabilities in a given sector.
Rezbova et al (2012)	Effect of Complementary National Payments	Czech Republic	Correlation analysis of subsidy figures and economic indices	Dairy production was just about self-sufficient in the study period, owing to agricultural subsidies.
Manos et al (2010)	Effect of decoupling in the tobacco sector	Greece, Spain	Multi-criteria mathematical programming model	Tobacco production only continues because of the coupled nature of subsidies. If they were decoupled, all production would be discontinued.

Source: own composition

All in all, CAP direct payments do seem to influence agricultural production in a positive way. There is no consensus on the extent of this effect, however. While some studies claim direct support is a strong incentive towards production, others detect only a slight effect. Higher dependency on subsidies leads to vulnerabilities in

a given sector, meaning if direct payments were abolished or reduced, these sectors (mainly beef and milk) would be more negatively affected than others. Coupled support can particularly make a given sector more dependent on subsidies, so much so that in certain examples all production would be finished in the absence of coupled payments.

3.4.2 The effect of decoupling on agricultural production

Another field of study concerning direct support's effect on agricultural production is whether the decoupling of subsidy influences production in any significant manner. In theory, decoupled payments are less market distortive, leave more freedom to farmer when determining their production choices and therefore can be expected to have an impact on agricultural production. Before decoupling took place, there were fears of massive land abandonment and decline in agricultural production. In practice, this did not prove to be the case. The overall effect of decoupling on production was small, although the effect varied from sector to sector.

This was shown in a comprehensive study, in which Phelps (2007) described how the CAP's objectives had been gradually moving from purely economic goals towards sustainability and the protection of the environment. Traditionally, CAP aimed at the increase of agricultural supply, but increased consumer demand for food safety, decreasing rural population, international trade concerns, and raising public awareness on the environment resulted in a series of reforms which shifted the CAP towards a more diverse set of goals. The study examined the effects of the 2003 decoupling on nature protection issues. In theory, decoupling was expected to bring major benefits for the environment, since subsidies were no longer tied to agricultural production. The study argues that decoupling in itself would not bring significant changes in production decisions, so there would be little impact on the environment.

Rude (2008) also examined the production effects of the 2003 decoupling of direct payments. Lump-sum subsidies can alter the way farmers perceive wealth and economic risks, change their investment possibilities, influence productivity and -

through all these factors – affect the level of production. The study set up a theoretical static production function and reviewed general and partial equilibrium models to study the production effect of decoupling. It was found that decoupling reduced incentives towards production, but this effect is modest at best. The effect's magnitude depends on the different levels of decoupling introduced in the country/region concerned.

Katranidis and Kotakou (2012) simulated different policy scenarios and their effects on cotton production. Based on FADN data of 438 cotton producers for 1994-2002, they estimated the level of cotton supply in case of coupled payments, full decoupling, and in case all support is abolished. The results showed that higher levels of decoupling led to gradual decrease of agricultural production. However, decoupled payments were not entirely production-neutral: the level of cotton supply was higher in the decoupled support scenario than in the no-CAP scenario. The wealth effect of decoupled payments seems to influence production decisions; they are not entirely based on market conditions. The strength of this effect is also related to the risk preferences of farmers (the less risk averse they are, the higher the decrease in production).

Other studies focused on sectors or groups of farmers that were more negatively affected by decoupling. Areal et al. (2007) investigated the effects of the 2003 CAP reform on arable crops in England by building a farmer profit maximisation model. They found that with decoupled payments, small scale farmers will increase their output by allocating more land to cereals, while large farms will decrease their arable lands and cereals production, resulting in an overall downturn in cereal areas in the UK. Barley and oilseeds will be the most affected sectors, according to the projections of the authors.

Balkhausen et al. (2008) were also in search for the production-related effects of decoupling by comparing eight selected simulation model results. According to their results, all models predicted that decoupling would result in a decrease in cereal, beef and sheep production areas in the EU-15, while fodder area would increase. However, there is a large diversity among the models due to different specifications.

The focus of the study performed by Dixon and Matthews (2007) was similar, which evaluated the 2003 mid-term review of the CAP in Ireland by using a CGE model.

Their results suggested reductions in output of previously subsidised goods as cattle, sheep and cereals, while livestock, fruit and vegetables and forestry production would increase. Gross value added was about to slightly increase, according to the model.

Esposti (2017) also analysed the impact of the 2003 CAP reform by applying a multi-valued treatment approach on Italian FADN farm data for 2003-2007 and found that decoupled direct payments had an impact in reorienting farm production choices but this response was found heterogeneous and concentrated in the lower levels of support.

Giannoccaro et al. (2015) analysed the impacts of the 2013 CAP reform on the European livestock sector based on a survey of 1301 specialised livestock farms across nine EU members carried out in 2009. Results suggest that NMS were more sensitive to policy changes along with organic and LFA farms. Generally, decoupled payments were found to decrease livestock numbers throughout Europe, while specialist dairy units were expected to increase.

Gohin (2006) assessed previous CAP modelling results on farm production with a sensitivity analysis and found that decoupled payment effects were negative both on arable crop and beef production, especially if land market imperfections and eligibility rules are taken into account.

A very particular production effect of the CAP concerns the uptake of organic farming. In this regard the decoupling appears to have had uniquely positive production results. This is reflected by the study of Offermann et al (2003), which is focused on the influence of CAP on the competitiveness of organic farms. They based their study on the analysis of the structure of relevant CAP payments, as well as a survey carried out on 110 organic farms in Germany in 1995. Organic farms usually received less-than-average amounts of direct payments, because the crops they grow are only partially eligible for support, and the extensive animal breeding that is a specificity of organic farms are also less heavily subsidized. Minimum price support mechanisms also favoured conventional farms, as prices of organic products are usually higher. Organic farms could compensate these negative effects with

participating in agri-environment programs and the voluntary set-aside scheme, which were more popular with them than with conventional farms. On the whole, the 1992 reform of the CAP had a positive effect on the competitiveness of organic farming, but some policy instruments remained biased towards conventional farming.

In another article on the same subject, Offermann et al (2009a) studied organic farms with a special emphasis on the effects of the 2003 CAP reform and the Eastern enlargement of the EU. Data came from an extensive survey carried out on 50 organic farms in ten Member States in 2004, farm accountancy data and information gathered with the aid of local agricultural experts. The results showed that the 2003 reform had beneficial effects on organic farming in old Member States, mainly because of the increase of direct payments, which were decoupled from production and thus easier to access to a greater extent for organic farms. Redistribution of first pillar payments also favoured organic farms where the regional model of the basic payment was adopted. In new Member States, the introduction of the CAP was expected to a significant increase in organic production. Income levels of organic farms would be greatly increased, which could generate economic growth in the sector. On the other hand, the prices of production factors would also increase, as well as the dependency of farms on direct payments.

In a similar study, Offermann et al (2009b) compared a 2003 reform scenario to a non-reform scenario in a model where projection of exogenous variables was based on other model results. The aim was again to identify reform effects on organic farms. In line with former findings (Offermann et al 2009a), it was shown that the level of increase in farm income depends on the level of redistribution regarding direct payments in the given Member State. Where a historical model was opted for, which based payments on a former reference period, the income gain of organic farms was not so substantial. This is due to the fact that the reference period's coupled payments were more in favour of conventional farms. On the other hand, in Member States selecting the regional model (whereby direct payments are more levelled) the increase of income regarding organic farms is much higher.

Jaime et al (2016) studied the effect of different CAP subsidies on the uptake of organic farming by beneficiaries, especially in light of the 2003 CAP reform. Panel data was drawn from the Swedish FADN for the period 2000-2008 on a large sample

of organic farms. A dynamic non-linear unobserved effects probit model was used to analyze the relationship between subsidies and the likelihood of organic farming. In line with theoretical expectations, it was found that before the reform coupled direct payments had a negative effect on the uptake of organic farming, while after decoupling the effect changed to positive (although its magnitude was small). Decoupled subsidies influence production decisions to a lesser extent, and therefore reduce the opportunity costs of organic farming. Consequently, decoupling can mitigate the negative effects of coupled market support, but it cannot significantly contribute to increasing the share of organic farming. Second pillar support (agri-environmental programs in particular), however, were more effective in incentivizing organic production, and were also able to compel farmers to choose certified organic farming over non-certified organic production.

The reviewed articles analyzing the production effects of decoupling are summarized in table 5.

Table 5 – Effects of decoupling on agricultural production

Author	Topic	Country	Method	Result
Phelps (2007)	Effects of the 2003 decoupling on production choices	All Member States	Analysis of detailed policy data	decoupling in itself would not bring significant changes in production decisions
Rude (2008)	Production effects of the 2003 decoupling	All Member States	General and partial equilibrium models	Decoupling reduced incentives towards production, but this effect is modest at best.
Katranidis and Kotakou (2012)	Different policy scenarios on cotton production	Greece	Estimation of the supply function under different policy scenarios	Decoupled payments are not entirely production-neutral, the influence it through the wealth effect. Production loss is not so significant.
Areal et al. (2007)	Effects of the 2003 CAP reform	England	Farmer profit maximisation model	With decoupled payments, small scale farmers will increase their output, while large farms will decrease their cereals production.
Balkhausen et al. (2008)	Production-related effects of	Old Member	Simulation models	Decoupling would result in a decrease in cereal,

	decoupling	States (EU-15)		beef and sheep production areas, while fodder area would increase.
Dixon and Matthews (2007)	Evaluation of the 2003 review of the CAP	Ireland	CGE model	Reductions in output of previously subsidised goods as cattle, sheep and cereals, while livestock, fruit and vegetables and forestry production would increase.
Esposti (2017)	Impact of the 2003 CAP reform	Italy	Multi-valued treatment approach	Decoupled payments had an impact in reorienting farm production choices but this response was heterogeneous and concentrated in the lower levels of support.
Giannoccaro et al. (2015)	Impact of the 2013 CAP reform on the livestock sector	Several Member States	Survey of specialised livestock farms	Decoupled payments were found to decrease livestock numbers throughout Europe, while specialist dairy units were expected to increase.
Gohin (2006)	Effects of decoupling	All Member States	Sensitivity analysis of CAP modelling results	Decoupled payment effects were negative both on arable crop and beef production.
Offermann et al (2003)	The influence of CAP on the competitiveness of organic farms	Germany	Analysis of the structure of relevant CAP payments	The introduction of direct payments had a positive effect on the competitiveness of organic farming.
Offermann et al (2009a)	The effect of the 2003 CAP reform on organic farms	Several Member States	Analysis of the results of an extensive survey	The 2003 reform had beneficial effects on organic farming, mainly because payments were decoupled from production and thus easier to access to a greater extent for organic farms.
Offermann et al (2009b)	The effect of the 2003 CAP reform on organic farms	Several Member States	Estimation where projection of exogenous variables was based on other model results	The level of increase in organic farm income depends on the level of redistribution regarding direct payments.
Jaime et al (2016)	The effect of different CAP subsidies on the uptake of organic farming	Sweden	Dynamic non-linear unobserved effects probit model	Before the reform coupled direct payments had a negative effect on the uptake of organic farming, while after decoupling the effect changed to positive.

Source: own composition

To sum it up, the overall result of decoupling can be a slight reduction of production in certain sectors (although the effect varies sector by sector). The effect is not so

profound as previously expected, this may be due to the fact that a majority of decoupled payments are not linked to production but still linked to an important production factor (i.e. agricultural land). Also, decoupled payments were found to be incentivizing production through the wealth effect. The reduction of production is greater in sectors that have become too dependent on support (beef, sheep, and cereals), with farmers who are less risk-averse, and larger farms. Decoupling can also lead to increase in production under certain circumstances (the former logic of coupled subsidies do not influence production decisions any more, therefore farmers can allocate grow the most productive crops and allocate better quality land). This holds especially true for organic farming, where former coupled subsidies had a negative effect on the uptake of organic production (they did not reflect the higher costs associated with organic products, therefore encouraged conventional production instead).

3.4.3 The effect of direct payments on promoting structural change in agriculture

Direct payments have been criticised for not being able to promote structural change in Member State economies. On the contrary, they sometimes seem to slow beneficial transformation processes down, or preserve old structures and production systems. This might have a stabilizing effect in the short run, but in the longer run it hinders restructuring and puts a halt on further development in the agricultural sector.

This is confirmed by the study of Lobley and Butler (2010), who considered farmers' plans for the future in light of the changes brought about by the 2003 CAP reform. The study was based on a survey conducted in Southwest England with 1852 farms. To identify patterns in responses, a factor analysis was performed, whose results then served as basis for a hierarchical cluster analysis, with the factor scores as clusters. It was found that the CAP did not promote the rapid restructuring of agriculture, but it reinforced some already existing trends (increasing diversification, growing gap between small and big farmers). Decoupling affected different groups of farmers in a different way: large dairy and arable farms were likely to further expand, while many

of the small livestock farmers would have to withdraw from agriculture. A sizeable group of farmers, however, did not alter their economic behaviour in light of the 2003 CAP reform. Decoupling led to increased influence of market conditions on economic decisions, which is certainly a goal decoupling had aspired to achieve. On the whole, it seems that this 'freedom to farm' could only be fully exploited by a limited number of farmers, whose economic weight was likely to increase after the reform.

A further study on farm structures was conducted by Happe et al (2009), who examined the evolution of single-holder farms in Slovakia, with a special focus on the impact of the introduction of direct payments. In several new Member States the farming sector is dualistic, with a few large corporate holdings and a high number of small, single-holder farms. An agent-based simulation model of structural change in agriculture (Agricultural Policy Simulator, AgriPoliS) was applied with data on farms in the Nitra region of Slovakia. Starting from base year 2002, the model scenarios were run for a 25-year period, which included a few years with pre-accession agricultural policies and then the gradual phasing-in of direct payments. The results showed that the gradually increasing direct payments made a strong impact on farm structures in the short run: single-holders considering exiting the sector usually changed their minds because of the increasing level of subsidies. Yet in the phasing in period, cost of labour and land steadily increased (in the latter case, mainly because direct payments were capitalized into rental prices), so the amount of direct payments also had to increase in order to compensate for rising costs. When direct payments reached their final level, the structure collapsed: the small single-holder farmers who remained only because of rising payments levels left once the phasing-in period was over. In this fashion, the CAP can aid transitional agricultural sectors preserve their old structure in the short-run, but it cannot contribute to defining long-term structural trends that would be necessary for these economies.

Experience was gathered on farm restructuring through the example of new Member States. Sahrbacher et al (2009) studied the effects of introducing CAP on transition economies, by looking at the example of the Czech Republic. On the one hand, an ex-post analysis on the structural change and farm incomes was performed, based on statistical data from 2001 to 2007 on the whole country. On the other hand, an ex-ante analysis is also done on the Vysoĉina region by utilizing a spatial-dynamic

agent-based model (AgriPoliS). The focus of this simulation was to identify the structural changes of farms as a response to accession (from pre-accession support policy to coupled support after the accession). Furthermore, the effects of a possible decoupling of CAP support were also studied. It was found - both by the ex-ante and ex-post methods - that structural change (which was mainly driven by the transition process) was slowed down by the introduction of direct payments.

As a major production factor, agricultural land and its supply has a major impact on agricultural transformation processes. Milczarek-Andrzejewska et al (2018) found that mainly agricultural regions the effect of the CAP on land prices made farmers unwilling to sell land, therefore the land market turnover slowed down. This led to the conservation of unfavourable farm structures, difficulties in acquiring land for agricultural production, and even the slowing down of potential urbanization processes.

Another aspect of economic change is spatial restructuring. Martinho (2015) assessed the impact of the Single Payment Scheme (basic direct payment) on the output, employment and productivity of the Portuguese agricultural sector, by setting up a Cobb-Douglas production function with the aid of municipality-level data on support measures and other statistics for 2010. The analysis showed that the support should be better suited to Portuguese conditions, because it did not explicitly raise agricultural output, and it could not incentivize farming outside the traditional agricultural regions. Direct payments might have helped the sector in some aspects, but it did not seem to be able to promote spatial restructuring.

Hecht et al (2016) modelled restructuring by simulating a scenario where direct payments were shifted towards permanent grassland. They utilized FARMIS, which is a comparative, static programming model for farm groups, which was used on FADN data on German, Welsh and Swiss farms. The baseline scenario was compared to a situation in which direct payments for extensive use of permanent grassland areas are significantly increased, at the cost of diminishing arable payments. In such a scenario, a strong increase (80%) of utilized permanent grasslands can be foreseen. Income is redistributed from arable to extensive livestock farms. All in all, the scenario would efficiently increase the preservation of permanent grasslands, but the impact on milk and beef production and the number of

total livestock is minimal, and there would also be unintended side effects like the increase of the price of fodder and land rent prices of permanent grasslands. Therefore, strong restructuring would not be achieved in this case, either.

Further studies also underline that direct payments cannot promote structural change. Sarov and Kostanerov (2019) set up an optimization model in order to study the impact of CAP subsidies on production structure. A typical Bulgarian mountain farm served as basis for the calculations, taking into consideration its special circumstances and restraints. The analysis also included factors like agricultural prices, availability of rented land and its costs, labour resources. It was found that while direct payments may increase gross margins, they have no effect on the production structure of farms. Furthermore, Rumanovska (2016) found that despite the policy efforts of the CAP in Slovakia, the agricultural sector is still characterized by low labour productivity, low levels of diversification of farm activities, and structural problems concerning the ownership of land (Slovakian farms only own about 10% of their utilized area). The structural anomalies from before the accession to the EU continue to hinder development in the sector.

Biró et al. (2017) also found no significant effects of the latest CAP reform, and especially green direct payments, on the agricultural production in Hungary by using the national CAPRI model simulations. Hungarian agricultural producers do not seem to change their basic production decisions after 2014, according to the authors.

The reviewed articles analyzing the effects of direct payments on promoting structural change are summarized in table 6.

Table 6 – Effects of direct payments on promoting structural change

Author	Topic	Country	Method	Result
Lobley and Butler (2010)	Farm production decisions in light of the 2003 CAP reform	England	Factor analysis and hierarchical cluster analysis	CAP did not promote the rapid restructuring of agriculture, but it reinforced some already existing trends.

Happe et al (2009)	Evolution of single-holder farms in Slovakia	Slovakia	Agent-based simulation model of structural change in agriculture (AgriPoliS)	The CAP can aid transitional agricultural sectors preserve their old structure in the short-run, but it cannot contribute to defining long-term structural trends.
Sahrbacher et al (2009)	The effects of introducing CAP on transition economies	Czech Republic	AgriPoliS model	Structural change (which was mainly driven by the transition process) was slowed down by the introduction of direct payments.
Milczarek-Andrzejewska et al (2018)	Effect of CAP on land prices	Poland	Regional Computable General Equilibrium Model (POLTERM)	The effect of the CAP on land prices led to the conservation of unfavourable farm structures, difficulties in acquiring land for agricultural production.
Martinho (2015)	Spatial restructuring of agricultural production	Portugal	Cobb-Douglas production function	Direct payments might have helped the sector in some aspects, but it did not seem to be able to promote spatial restructuring.
Hecht et al (2016)	Shifting direct payments towards permanent grasslands	Several Member States	Comparative, static FARMIS programming model	Some restructuring would be achieved concerning grassland preservation, but the effect in the milk and livestock sectors would be minimal.
Sarov and Kostanerov (2019)	The impact of CAP subsidies on production structure	Bulgaria	Production optimization model	While direct payments may increase gross margins, they have no effect on the production structure of farms.
Rumanovska (2016)	The policy effects of the CAP	Slovakia	Policy paper comparison and analysis	Despite the policy efforts of the CAP in Slovakia, the agricultural sector is still characterized by low labour productivity, low levels of diversification of farm activities, and structural problems concerning the ownership of land.

Biró et al. (2017)	The effects of the 2013 reform on production decisions	Hungary	CAPRI model simulations	Hungarian agricultural producers do not seem to change their basic production decisions after the reform.

Source: own composition

In summary, it can be stated that the reviewed articles found no strong production restructuring effect of CAP direct payments. On the contrary, they preserve old production and land allocation structures, which may stabilize the economic situation in the short run, but hinder development in the long run. In new Member States, the introduction of direct payments helped the agricultural sector in increasing its income and production but did not offer a solution to eliminating old structural problems.

3.4.4 The effect of direct payments on productivity, technical efficiency

The effect of CAP on the productivity and efficiency of farms is an extensively studied subject. Zhu et al (2012) made a study of the effects of CAP direct payments on the technical efficiency of German, Dutch and Swedish dairy farms between 1995 and 2004. The article theorizes that subsidies influence technical efficiency mainly through the income effect (change in the level of income), the insurance effect (stability of income makes farmers less risk averse), and - in case of support coupled to inputs or outputs - the coupling effect. To reflect these effects, three subsidy-related variables were set up that were then entered into an Inefficiency Effects Model. The results show that higher percentage of directs subsidies within the total agricultural income of farms leads to lower technical efficiency in all countries concerned. Furthermore coupled support had an additional negative effect on technical efficiency in Germany and the Netherlands (but no significant effect in Sweden), as compared to decoupled support. This suggests that the farmers' motivation to innovate and work ever more efficiently is reduced when they become increasingly dependent on subsidies as a source of income.

In another article on the same subject (Zhu et al, 2010), the authors find that the level of efficiency is highest in the Netherlands, followed by Sweden and Germany. Positive contributors to technical efficiency are farm size and level of farm specialization. The share of agricultural subsidies in total income is a negative contributor in all three countries.

Further studies also suggest a negative effect on farm efficiency. Using microeconomic data from the Polish FADN on 1212 dairy farms over the period 2004-2011, Marzec and Pisulewski (2017) estimated the translog production function in order to measure the effect of CAP subsidies on technical efficiency of farms. The stochastic frontier analysis revealed that although there was some technical development in the study period among Polish dairy farms, CAP subsidies on the whole had a negative influence on efficiency.

Mary (2013) also arrived at a similar conclusion. FADN data of 1529 French crop farms from the period 1996-2003 was used to assess the impact of CAP on total factor productivity, by estimating a production function based on the generalized method of moments approach. The calculations showed that CAP measures that are more or less automatically granted to farmers on a per hectare or per animal basis (all direct payments and certain rural development measures, like support to less-favoured areas) had a significant negative effect on the productivity of farms. On the other hand, selective measures like investment or environmental support had no sizeable effect. Moreover, the decoupling of direct payments seems to have had positive influence on farm efficiency.

In a study on the same subject, Latruffe et al (2017) examined the association between CAP subsidies and the technical efficiency of European dairy farms. FADN data from nine EU countries was used from the period 1990-2007, and on this basis a stochastic production frontier was estimated with the Method of Moments, to account for possible endogeneity issues. The analysis produced mixed results: direct payments influenced technical efficiency positively in two study countries, negatively in two other countries, while no effect was detectable in others. Furthermore, it was shown that decoupling did not change the direction in which CAP support influences technical efficiency, but it generally reduces its magnitude (compared to coupled payments).

Based on the above-mentioned articles, we could arrive at the general conclusion that CAP direct payments tend to lower the efficiency of farms. However, it seems that the decoupling of payments can somewhat alleviate this unwelcome policy effect. For example, Rizov et al (2013) estimated the impact of CAP on total farm productivity using a structural semi-parametric procedure. Data from the Farm Accountancy Data Network (FADN) on a large sample of farms from the EU-15 countries for the period 1991-2008 served as basis for the calculations. Total productivity was aggregated by country and farm type. The results showed that in the years before the 2003 decoupling of direct payments, the subsidies had a negative effect on the productivity of farms. After the decoupling, the situation became somewhat mixed, in some countries the effect on productivity even became positive. These empirical findings are in line with the theoretical background: subsidies in general distort market conditions, and therefore lower the efficiency of farms. On the other hand, decoupled direct support is less distortive and therefore has a more positive (or less negative) effect on farm productivity.

Decoupling was also the focus of a study performed by Kazukauskas et al (2010), which explored the effect of decoupling on the productivity of Irish dairy farms. Based on national farm survey data for the period 2001-2007, a productivity estimation model was set up based on the proposal of Olley and Pakes, as well as on Stochastic Frontier Analysis. The models controlled for the significant capital investment grants in the study period, and for the increased price volatility caused by the uncertainties associated with decoupling. With the exclusion of these effects, the models found a significant and positive relationship between decoupling and total productivity in the dairy sector.

In a similar study on the same subject (Kazukauskas et al, 2014), the authors used Irish, Danish, and Dutch farm-level data from national agricultural surveys in the period 2001-2007. Once again, they found a positive relationship between decoupling and farm productivity, which was especially significant in the case of Ireland. Moreover, decoupling seemed to alter farmers' choices on specialization, in a sense that they moved their production towards more productive farming activities.

Note has to be taken that while the majority of studies detect a negative relationship between direct payments and efficiency, there are some exceptions. Martinez Cillero

et al (2018) performed a stochastic frontier analysis to measure the effect of direct payment on the technical efficiency of Irish beef farms. The calculations were based on panel farm-level data from the FADN for the period 2000-2013. The analysis showed a low overall technical efficiency in the Irish beef sector. The situation was improving from 2000 to 2007, but from 2008 to 2012 a slight decline was detectable. In contrast to the general findings of other studies, it was shown that the effect of direct payments on technical efficiency was positive. In case of coupled payments (which were present during the beginning of the study period), this could be due to the fact that headage based animal premiums incentivized farmers towards intensification, in order to gain higher amounts of support. Decoupled payments, on the other hand, decreased production risks and therefore aided farm investments, which raised technical efficiency levels. The authors note, however, that decoupling might have had different effects in Member States where a more radical decoupling took place (Ireland opted for the historic model of decoupling, which did not redistribute payments to a great extent). In similar articles, Cillero et al. (2018, 2019) analysed technological heterogeneity in the Irish beef sector and by applying a latent class stochastic frontier model, they again found that decoupled direct payments had significant positive effects on technologically advanced farms.

The reviewed articles analyzing the effects of direct payments on technical efficiency are summarized in table 7.

Table 7 – Effects of direct payments on technical efficiency of farms

Author	Topic	Country	Method	Result
Zhu et al (2012)	Effects of CAP direct payments on technical efficiency of farms	Germany Sweden Netherlands	Inefficiency Effects Model	Higher percentage of directs subsidies within total agricultural income of farms leads to lower technical efficiency in all countries concerned. Coupled support had an additional negative effect (as compared to decoupled support).
Zhu et al	Effects of CAP	Germany	Inefficiency	Positive contributors to

(2010)	direct payments on technical efficiency of farms	Sweden Netherlands	Effects Model	technical efficiency are farm size and level of farm specialization. The share of agricultural subsidies in total income is a negative contributor in all three countries.
Marzec and Pisulewski (2017)	Study of technical efficiency of Polish farms	Poland	Stochastic frontier analysis	Although there was some technical development in the study period among Polish dairy farms, CAP subsidies on the whole had a negative influence on efficiency.
Mary (2013)	Impact of CAP on total factor productivity	France	Generalized method of moments	CAP measures that are automatically granted to farmers on a per hectare basis had a negative effect on productivity. Decoupling can offset this effect to a certain extent.
Latruffe et al (2017)	Association between CAP subsidies and farm technical efficiency	Several Member States	Stochastic frontier analysis	Direct payments influenced technical efficiency positively in two study countries, negatively in two other countries, while no effect was detectable in others.
Rizov et al (2013)	Effect of decoupling on productivity	Old Member States (EU-15)	Structural semi-parametric estimation procedure	Decoupled direct support is less distortive and therefore has a more positive (or less negative) effect on farm productivity than coupled support.
Kazukauskas et al (2010)	Effect of decoupling on productivity	Ireland	Stochastic frontier analysis	There is a significant and positive relationship between decoupling and total productivity in the dairy sector.
Kazukauskas et al (2014)	Effect of decoupling on productivity	Ireland Denmark Netherlands	Stochastic frontier analysis	Decoupling seems to alter farmers' production choices: a shift towards more productive farming activities was detected.
Cillero et al (2018, 2019)	CAP policy effects on efficiency	Ireland	Stochastic frontier analysis	Decoupled payments decrease production risks and therefore aid farm investments, which can raise technical efficiency levels.

Source: own composition

All in all, most studies made in the subject of technical efficiency established a negative relationship between direct payments and productivity. Being a relatively

stable source of income, direct support does not incentivize farmers towards innovation, newer technologies, reorganization of economic activities or investment. Coupled support seems to be especially disadvantageous in this manner, because it influences and distorts production decisions to a higher extent. Decoupling, on the other hand, appears to be at its best when it comes to tackling issues related to productivity. In the previous chapters, we have seen that decoupling has mixed results in the areas of income and absolute production levels; however, the reviewed articles unanimously underline that decoupling has a beneficial effect on the technical efficiency of farms. This can alleviate, but not eliminate negative policy effects.

3.5 The effect of direct payments on agricultural land

3.5.1 The effect of direct payments on the price of agricultural land

One of the main criticisms concerning direct payments is that support amounts are likely to get capitalized into the sale and lease prices of agricultural land. Consequently, land owners are able to capture a significant proportion of direct support, which raises serious questions about the overall efficiency of direct payments. In an article on this subject, Patton et al (2008) studied the effects of direct payments on land rental prices. In theory, coupled area-based payments increase rents because they increase the returns of production, which raises the demand for inputs such as land. Furthermore, farmers need to own or lease agricultural land to access decoupled payments, a fact that also leads to a raise in rent prices. To test these theories, the authors conducted GMM estimation with instrumental variable techniques based on panel data from a farm business survey of 400 farms in Northern Ireland in the period 1994-2002. The calculations revealed that the effect on rental prices depended on the type of direct payment. Concerning coupled support, the payment to the sheep sector (where production is largely dependent on land but few other inputs are used) was fully capitalized into land rent; while payment to the beef sector was not (where production is much less dependent on land but other inputs are

widely used). The higher the input demand for land in the sector, the greater the effect on land rent prices of coupled payments. In case of decoupled payments, support was fully capitalized into rental values. These findings raise serious payment distribution issues between landowners and farmers, and they question the overall efficiency of direct payments.

O'Neill (2016) also found evidence on support being capitalized into land rent prices in Ireland. The model is based on the assumption that the rent is a function of expected market returns and expected amount of support. On this foundation, a two-step GMM estimation was set up, using data on 1200 farms from a national farm survey. The results showed that coupled direct payments had been heavily capitalized into land rent prices (67-90 cent per each euro of support), seriously hindering the transfer efficiency of such payments. The long-run effect is strongest among crop farms, which use land as a major input for production. After the 2003 decoupling of payments, the capitalization effect remained present, but its extent was reduced by half. This observation is contrary to the findings of Patton et al (2008), and may be attributed to the option of Irish farmers to consolidate their payments from rented land where the rent had expired to their remaining agricultural area, a fact that prevented landowners to increase rental prices. Pillar II area-based payments were not capitalized into lease rates.

The study of the market of agricultural land can also yield interesting results in the topic. Milczarek-Andrzejewska et al (2018) studied the land use conflicts generated by the CAP. A bottom-up, multi-regional Computable General Equilibrium model called POLTERM was used to identify distortions on the market of agricultural land. The simulation revealed that there was a 27% yearly average increase in land prices due to the CAP in Poland in the period 2004-2013. Direct payments contributed to 77% of this rise. The policy effect depends on the socio-economic conditions, farm structure and level of urbanization of the region concerned. In less developed and urbanized regions with small farms, the influence of CAP on land prices is too strong: because of the future expectations on area-based subsidies and the steeply rising prices, farmers are not incentivized to sell land, therefore the land market turnover slows down. This leads to difficulties in buying land for agricultural production. In highly urbanized regions, however, economic processes drive the price of land much higher than the effect attributable to CAP, which remains

relatively minor in this regard. In this case, farmers are willing to supply land, which is often converted to non-agricultural purposes.

A game theory research on the likely behaviour of landowners in New Member States after the EU accession also shed some light on the dynamics of land rent prices. Latruffe and Davidova (2007) studied the distributional effects of CAP subsidies for corporate farms within new Member States. The paper focused on the question whether private landowners were likely to withdraw rented land from professional farms once CAP direct subsidies were introduced, so as to keep the subsidies for themselves. Using game theory, and the data form a survey conducted in the Czech Republic and Slovakia, they found that while renegotiating the rental price would be a widespread phenomenon, only in a few cases would landowners withdraw their rental contracts from farms. The willingness to change depends on the current rental price, as well as the relationship between landowners and farmers (landowners with a close relationship to farms would be less likely to change the current rental conditions). After the accession to the EU, rental prices were bound to increase as a result.

A Bavarian example further confirms the heavy capitalization of CAP support into land prices. Klaiber et al (2017) made a study into the effects of CAP direct payments on land rental prices. For the purposes of the analysis, FADN data of a large sample of Bavarian farmers for the period 2005-2011 was used. A fixed-effects, reduced form equation was estimated, whose result showed a strong capitalization effect of the Single Payment Scheme (basic direct payment) into land rental prices (37 cent of each additional euro of SPS). The study also looked at the effect of the 2013 CAP reform, which required the harmonization of the amounts of basic direct payments (to move the individually varying unit amounts of payments between farmers, regions and Member States towards a uniform, flat-rate level). It was found that this process further increased capitalization into land rent prices (53 cents per each support euro). After the harmonization of payments, an even higher proportion of CAP payments could be captured by landowners.

The decoupling of direct payments could also not remedy the distributional questions between landowners and farmers. Kilian et al (2012) investigated the effect of the 2003 reform of the CAP on land rental prices. For this purpose, a graphical analytical

model was developed, which represented the situation both before and after the reform. The theoretical findings of the model were then compared to empirical evidence from a regression using data of Bavarian farms and land prices for 2005. The results showed that decoupling increased the capitalization of direct payments into land rental prices (compared to the previous coupled direct support schemes). One additional euro of direct payments increased land rental prices by 28-78 cents in Bavaria. The results suggested that the closer the relationship between a support instrument and agricultural land, the higher the level of capitalization. The Fischler reform might have severed the link between direct support and agricultural production, but the relationship to agricultural land remained intact (decoupled payment entitlements still have to be activated by hectares of land at the farmer's disposal). To solve the problem of capitalization, a subsidy system less connected to production factors could be introduced (like the bond scheme proposed by Swinbank and Tangermann, 2004).

Furthermore, Brady et al (2009) also analysed the impacts of the 2003 reform of the CAP by an agent-based modelling scheme and added that increased land rental prices will reduce the ability of the CAP to provide income security for farmers. Britz et al (2012) applied the CAPRI model to investigate the income effect of the 2003 reform and Health Check and expected land values to increase considerably, especially in the case of grasslands. The authors applied the CAPRI model to investigate the income effect of the 2003 reform and Health Check and found significant income shifts only for specific product groups. Income was found to be redistributed away from traditional cultures to fodder production which was caused by the capitalisation of decoupled payments on previously unsubsidised land. Bartolini and Viaggi (2013) analysed the determinants of changes in farm size in the EU with a sample of 2363 farm households from nine European countries. They found, in relation with direct payments, that the different implementation models affected the willingness to pay for land. More specifically, they found that countries where hybrid or SAPS models were implemented had more farmers with a higher probability of paying more for land. Therefore it seems that the more direct link between support amounts and agricultural land (as in case of SAPS and hybrid models) increases the extent of capitalization into land prices.

Further studies also provide confirmation on capitalization and increase of land prices. Latruffe et al (2010) analysed the effect of CAP introduction on Lithuanian agriculture. It was found that direct payments could be considered a relatively stable income source, which might raise farmers' willingness to expand and gain credit. Because of this, more farmland would be utilized; consequently land prices were likely to increase. In a study on the effects of introducing CAP in the Czech Republic, Sahrbacher et al (2009) came to the conclusion that a significant proportion of income subsidies were capitalized into land rentals and the prices of other production factors.

Hecht et al (2016) modelled a policy scenario in which permanent grassland would gain more subsidy funds compared to the current situation. Under these conditions, a strong increase (80%) of utilized permanent grasslands was detected. As an undesirable side effect, however, the increase of the price of fodder and land rent prices of permanent grasslands was also detected.

In certain extreme examples, studies also showed an increase in land rent prices beyond the magnitude of direct subsidy amounts. Ciaian and Swinnen (2009) analysed the impact of subsidies on income by using an FADN based simulation model based on French 2003-2004 data and showed that land rents increased by more than the subsidy, causing that on aggregate farms lost from the subsidy, supposing that farms are homogenous.

Ciaian et al. (2018) analysed the impact of the decoupled payments on the capitalisation of land values and found that each euro of decoupled payment increased capitalisation by an additional 18 cents. However, while capitalisation in the New Member States decreased somewhat (from 83% to 79%) after 2015, it actually doubled (from 21% to 43%) in Old Member States. Their results are in line with a previous research of the authors (Ciaian et al., 2014) where they concluded that implementation details of the new SPS model, especially the reference period for entitlement allocation, regionalization, payment differentiation, and budgetary changes would largely determine the impact on land markets.

On the contrary, in a recent research conducted by Guastella et al. (2018), using Italian FADN data, results suggest that when selectivity, endogeneity and

unobserved individual heterogeneity are accounted for, no capitalisation of coupled payments and limited capitalisation of decoupled payments are observed in Italy.

The reviewed articles analyzing the effects of direct payments on the price of agricultural land are summarized in table 8.

Table 8 – Effects of direct payments on the price of agricultural land

Author	Topic	Country	Method	Result
Patton et al (2008)	Effects of direct payments on land rental prices	Northern Ireland	Generalized Method of Moments estimation with instrumental variables	The higher the input demand for land in a given sector, the greater the capitalization effect on land rent prices of direct payments.
O'Neill (2016)	Effects of direct payments on land rental prices	Ireland	Two-step Generalized Method of Moments	Coupled direct payments were heavily capitalized into land rent prices (67-90 cent per each euro of support).
Milczarek-Andrzejewska et al (2018)	Study of the market of agricultural land	Poland	Computable General Equilibrium model (POLTERM)	Strong increase of land prices after EU-accession, direct payments contributed to 77% of this rise.
Latruffe and Davidova (2007)	Distributional effects of direct subsidies	New Member States	Game theory	Land rent increased after EU-accession. Private landowners were likely to renegotiate the price of rented land with professional farms.
Klaiber et al (2017)	Effects of direct payments on land rental prices	Germany	Fixed-effects, reduced form regression estimation	Capitalization of direct support into land rent prices reached 53 cents per each support euro after 2013.
Kilian et al (2012)	The effect of the 2003 CAP reform on land	Germany	Graphical analytical model, regression	Decoupling increased the capitalization of direct payments into land rental

	rental prices		estimation	prices. One additional euro of direct payments increased land rental prices by 28-78 cents.
Brady et al (2009)	Impact of the 2003 CAP reform	Several Member States	Agent-based modelling scheme	Increased land rental prices will reduce the ability of the CAP to provide income security for farmers.
Britz et al (2012)	Impact of the 2003 CAP reform on income distribution	All Member States	CAPRI model	Income was redistributed away from traditional cultures to fodder production which was caused by the capitalisation of decoupled payments on previously unsubsidised land.
Bartolini and Viaggi (2013)	Determinants of changes in farm size in the EU	Several Member States	Comparison of survey data on farmer intentions between policy scenarios	The more direct link between support amounts and agricultural land, the higher the capitalization of support into land prices.
Latruffe et al (2010)	Introduction of CAP in Lithuania	Lithuania	Analysis of FADN data and survey on farmer intentions	Direct payments are a stable income source, which raises farmers' willingness to expand. Because of this, more farmland would be utilized; land prices were likely to increase.
Sahrbacher et al (2009)	Introducing CAP in the Czech Republic	Czech Republic	Agent-based model (AgriPoliS)	A significant proportion of income subsidies were capitalized into land rentals and the prices of other production factors
Hecht et al (2016)	Permanent grassland policy scenario analysis	Germany Wales Switzerland	Case study	If policy shifted toward grassland, the area of utilized pastures would increase, as well as the price of fodder and land rent prices.
Ciaian and Swinnen (2009)	Impact of direct subsidies on income	France	Simulation model based on FADN data	Land rents increased in 2003-2004 by more than the subsidy, causing that on aggregate farms lost

				income because of the policy intervention.
Ciaian et al. (2014, 2018)	Impact of decoupled payments on capitalisation	All Member States	Study of the implementation details of payment schemes	The level of capitalization depends on the implementation details of the payment system. Subsidies with more direct link to land get heavily capitalized into land prices.
Guastella et al. (2018)	Impact of direct support on land prices	Italy	Estimation accounting for selectivity, endogeneity and unobserved individual heterogeneity	Weak link between direct payments and land rent prices.

Source: own composition

Based on the reviewed articles, it can be stated that direct payments significantly increase land lease and sale prices. The support increases the expected returns of agricultural activities, therefore the demand for agricultural land raises. The closer the link between the given support measure and agricultural land, the higher the capitalization of subsidy amount into land prices. Also, the more a given sector uses land as a production input factor, the higher land prices climb as a result. Because of this, even animal husbandry support gets capitalized into land prices (in cases where pastureland is an important production factor). The level of capitalization detected by the studies varied from a minimum of 20-30% to extremely high levels (90-100%). Decoupling does not seem to alleviate the situation (decoupling broke the link between support and production but having agricultural land at the farmer's disposal is still a precondition for accessing decoupled payments). The capitalization effect is also reflected in the fact that land prices have been rising significantly in new Member States since their EU-accession. The effect of direct payments on land prices raises serious doubts concerning the efficiency of the support system. Better targeted policy is called for, where landowners cannot channel a significant part of the funds towards themselves.

3.5.2 The effect of direct payments on land use conditions

The majority of direct payments are linked to the use of agricultural land, because farmers are required to have land at their disposal in order to access support amounts. This is also true for decoupled payments, where agricultural production is not a requirement, but the minimum maintenance of agricultural land is. Consequently, direct payments influence land use conditions, although these effects do not always point in the appropriate direction or have the necessary magnitude. One example of this was explored by Nikodemus et al (2010), who examined the effects of certain CAP payments on land use conditions in Latvia. After the collapse of the Soviet centralised planned economy, the abandonment of agricultural land gained unprecedented momentum, a situation that was expected to be alleviated by CAP payments. Focusing on five, geographically diverse sample municipalities, the authors analyzed land use changes by comparing historic maps with modern land use data coming from CAP area-based claims, complemented by geographical information on land quality. It was found that support amounts coming from the single area payment scheme (SAPS) and the payment for less favoured areas (LFA) could somewhat limit land abandonment, but not to the expected extent. The majority of direct payments went to farmers with large parcels in good agricultural condition, and not to farms situated in most valuable or most vulnerable landscapes. To achieve complex land use goals, more targeted support would be called for.

3.5.2.1 The effect of decoupling on land use conditions

The scientific literature particularly concerns itself with the effects of decoupling on land use. Tranter et al (2007) studied the effects of the decoupling of support introduced by the 2003 Fischler reform of the CAP. Under the Single Farm Payment, the amount of support would no longer depend on the level of agricultural production, a fact that led to fears of land abandonment, decrease in production and massive amounts of labour leaving the agricultural sector. To see if these fears were well-founded, the authors conducted a postal survey of 4200 farmers from the United Kingdom, Germany and Portugal. The results show that there would be relatively little change in the status quo: the decrease of production would be smaller than

predicted by previous quantitative studies, especially in the cereal sector. Land abandonment is also of little concern, except for certain regions in Portugal.

Bougherara and Latruffe (2010) analysed the potential impacts of the 2003 CAP reform on land idling decisions of French landowners through a survey and found that landowners showed little interest regarding good agricultural and environmental conditions (GAEC), suggesting that no dramatic changes would occur in terms of land idling in France after the 2003 reform.

While generally it is true that decoupling did not lead to massive land abandonment, it might have triggered unfavourable changes in certain regions and sectors or caused unwanted changes to the structure of land use. Trubins et al (2013) studied the effects of decoupling on the changes of land use in Southern Sweden between 2002 and 2010. Based on the GIS data from the applications for area-based support, and data from the LPIS they examined the changes of land use between main utilization categories. It was found that decoupling causes agricultural production to concentrate on better quality land, while lower quality land is increasingly left fallow or converted from arable land to temporary grassland.

Ostenburg et al (2006) also reported problems concerning land use after the decoupling of payments. They studied the effects of the 2003 decoupling of the CAP in Brandenburg, an agriculturally less favoured region of Germany. A linear programming farm model was set up, which took into account different factors such as land quality, interactions with agri-environment and energy crop schemes, level of decoupling. It was found that decoupling would have small effect on production on high-quality land, but a significant abandonment of marginal land could occur. Sectors highly dependent on coupled aid (dairy and certain animal breeding sectors) could be negatively affected as well.

Reger et al (2009) also examined the effects of decoupling on land use, by focusing on habitat diversity in an agriculturally less favourable region (Dill catchment area in Hesse, Germany). Three scenarios were set up (coupled area payments, decoupled area payments, no direct payments), and the land use conditions were simulated in each case with the agro-economic land use model ProLand. Habitat diversity was then monitored by utilizing different indices for each scenario, and compared to a past baseline of 1995. The results showed that neither scenario was able to uphold

the baseline level of habitat diversity – to reach this aim, direct payments are simply not sufficient and probably more targeted Pillar II aid would be needed. The situation was worsening as the level of decoupling in the scenarios increased, leading to significant land abandoned or afforestation. On the other hand, coupled payments were most efficient in keeping some land under arable production in the agriculturally unfavourable study region, so this scenario contributed most to habitat diversity.

Roche et al (2004) analyzed the potential effects of the 2003 decoupling of direct payments on land allocation decisions of farmers. A mean-variance portfolio optimisation framework was utilized to check how decoupled payments (which are essentially free from the risks of production) alter the production decisions of (typically risk-averse) farmers, changing the amounts of land they allocate to different crops. The authors argue that theoretically - after the decoupling - farmers may leave some of their land idle, but the land that remains in production will be allocated to riskier products. This theory was then checked against data from 1990-2001 on British and Irish grain-producing farms. The result was in line with the theory, showing that the grain farms indeed moved towards riskier products during their land allocation decisions. An intensification of production could be foreseen on good quality land, while other areas could get marginalized.

3.5.2.2 The effect of CAP and greening on land use conditions

One of the main criticisms concerning the greening payment of the 2013 reform is that it failed to reach sufficient restructuring in agricultural production and land use. Louhichi et al (2018) explored this topic by using static positive programming methods on individual farm-level data to investigate the possible economic effects of greening all over the EU. The model utilized data of all individual farms from the FADN in every Member State, as well as data from the CAPRI database and Eurostat information. The IFM-CAP models the economic behaviour of each individual farms based on a set of presumptions (for example production issues, risk aversion, income stabilization goals). The main message of the study was that even though 86% of the agricultural area in the EU was subject to greening, its effects would not be substantial on production (0,9% decrease) or on income (1% decrease). Furthermore,

changes in land use would also be small (4,5% of the total area), which suggested that the environmental effects of greening would also not meet the expectations. Greening might have been a proper first step towards making the CAP more sustainable, but in the future it clearly needs certain adjustments.

In an article on the same subject, Louhichi et al (2017) examined the influence of the greening's crop diversification measure on farmers' production decisions. The IFM-CAP model was used to simulate individual farm decisions, based on data of all farms present in the EU-FADN. The results showed that the overall effects of diversification (which is a part of the requirements of the greening measure) were rather small. A 0.5% decrease was experienced in farm income and crop production. The reallocation of land due to diversification was less than 1% of the total utilized agricultural area in the EU-27. The strongest restraint of the requirement seemed to be the 75% limit on the area of the main crop of the farm, which primarily affected medium-sized farms (small farms were partially exempted, large farms had had diversified production even before greening was introduced). To be an effective policy in terms of environment protection and climate change mitigation, greening measures have to become more ambitious in their requirements on the one hand, and more targeted in their scope on the other hand.

Furthermore, Solazzo et al (2014) studied the 2013 reform of the CAP regarding the Italian tomato sector, with a focus on convergence of payments and the possible effects of greening on production decisions of farms. The study found that tomato farms would not change their land use conditions significantly as a result of the reform.

Cortignani and Dono (2019) analysed the impact of greening on Italian farms and environment by applying a Positive Mathematical Programming model on Italian FADN data. Results suggest that greening had a limited impact on the environment, reinforcing those already determined by the previous CAP reform. However, results found to differ across regions and were sometimes controversial. In an earlier article, Cortignani et al. (2017) even found that coupled payments were more effective in achieving environmental goals.

Gocht et al. (2017) analysed the economic and environmental impacts of CAP greening by using the CAPRI model and found relatively minor effects in terms of

land use, production, prices and income. Environmental impacts were also found to be quite small, although differences existed by region.

Bertaglia et al. (2016) investigated the possible impacts of greening on European agriculture and found that the simple fact that crop diversification and ecological focus areas were not applied for small holdings had significant consequences. More concretely, the authors found that the vast majority of agricultural land is exempt from greening in those regions where there was a major prevalence of specialist cereal farming systems.

Bertoni et al. (2018) analysed farmland use transitions due to greening in Italy by applying a Markov chains approach on 2011-2016 farm data. Results suggest that monoculture land uses have significantly decreased, especially for maize. The paper argues that despite various criticisms on the ambiguous effects of greening, ex-post estimations verified the effectiveness of this new policy instrument in Italy. Capitanio et al. (2016) analysed the impact of CAP on crop diversity decisions of Italian farms by using panel regression models and found a positive relationship between decoupled payments and diversity.

Diversification of crops is defined as a goal that the greening payment aims to achieve. In their paper, Peltonen-Sainio et al (2016) focused on crops that were cultivated only on a limited amount of agricultural area but had a potential for expanded production. Long term data on yields and production areas from crop experiments all over Finland were analyzed in the period 1970-2013. By comparing the situation before and during the application of CAP, the authors found that the policy strengthened the role of cereal monocultures (spring barley, oat, wheat), and reduced the role of minor crops (rapeseed, potato, pea, sugar beet) – both regarding production areas and realized yields. This suggests that the CAP in its present form does not contribute to diversification goals very efficiently.

Further studies also were focused on diversity of agricultural production. Volkov et al (2019b) looked into the socio-economic sustainability of small farms between 2004 and 2016 in Lithuania, in the context of CAP direct payments. To measure sustainability, a list of indicators was set up, which was then aggregated into a single composite index using the multi-criteria decision-making method. It was found that direct payments were not sufficient to contribute to the sustainability of small farms

until 2013 - they had a negative effect on the diversity of local production. From 2013, however, the system of direct payments was reformed, which resulted in an increasing trend in the values of the composite indicator on sustainability.

Resl et al (2006) analyzed the effects of the CAP on Czech cash crop growing, by modelling hypothetical farms in three production regions. The analysis included data from the FADN, statistical data on crop prices and yields, and data on the support payments made to farmers. The focus of the analysis was on comparing the profitability of certain cash crops before the 2004 accession to the EU, and directly after that period. It was found that the profits for 2004-2006 increased in case of winter wheat, summer barley and rapeseed (mainly because of the CAP direct payments). An even greater rise was detected in case of sugar beet (mainly because of a significant increase in prices). By raising the price of intensive cereal and other cash crops, CAP does not contribute to the diversification of production.

Bartolini et al. (2014) aimed at explaining the determinants of on-farm diversification in Tuscany and by applying a two-step simulation model, the authors suggested that high per hectare direct payments had a negative influence on diversification intensity.

The reviewed articles analyzing the effects of direct payments on land use are summarized in table 9.

Table 9 – Effects of direct payments on land use conditions

Author	Topic	Country	Method	Result
Nikodemus et al (2010)	Effects of certain CAP payments on land use conditions	Latvia	Comparison of historic spatial data with land use data coming from CAP area-based claims	The majority of direct payments went to farmers with large parcels in good agricultural condition, and not to farms situated in most valuable or vulnerable landscapes.
Tranter et al (2007)	Effects of decoupling on	United Kingdom	Comprehensive survey	Decoupling does not result in massive land

	land use	Germany Portugal		abandonment. Certain regions in Portugal are affected to a greater extent.
Bougherara and Latruffe (2010)	Farmer decisions on setting aside land	France	Comprehensive survey	No dramatic changes were expected to occur in terms of land idling in France after the 2003 reform.
Trubins et al (2013)	Effects of decoupling on changes of land use	Sweden	Analysis of GIS and LPIS data on land utilization categories	Decoupling causes agricultural production to concentrate on better quality land, while lower quality land is increasingly left fallow or converted.
Ostenburg et al (2006)	Effects of decoupling on land use	Germany	Linear programming farm model	Decoupling has small effect on production on high-quality land, but a significant abandonment of marginal land could occur.
Reger et al (2009)	Effects of decoupling on land use	Germany	Agro-economic land use model (ProLand)	Land use situation was worsening as the level of decoupling in the policy scenarios increased, leading to significant land abandoned or afforestation.
Roche et al (2004)	Effects of decoupling on land allocation decisions	United Kingdom Ireland	Mean-variance portfolio optimisation framework	Farms moved towards riskier products during their land allocation decisions. An intensification of production could be foreseen on good quality land, while other areas could get marginalized.
Louhichi et al (2018)	Effect of greening on land use	All Member States	Static positive programming methods on individual farm-level data (IFM-CAP)	Changes in land use are expected to be small (4.5% of the total area).
Louhichi et al (2017)	Effect of greening on crop	All Member States	IFM-CAP	The reallocation of land due to diversification was less than 1% of the total

	diversification			utilized agricultural area in the EU-27.
Solazzo et al (2014)	Effects of the 2013 reform on tomato farms	Italy	Positive Mathematical Programming model	Tomato farms would not change their land use conditions significantly as a result of the reform.
Cortignani and Dono (2019)	Impact of greening on Italian farms	Italy	Positive Mathematical Programming model	Greening has limited effect on farm activities.
Gocht et al. (2017)	Impact of greening	All Member States	CAPRI model	Relatively minor effects in terms of land use, production, prices and income.
Bertaglia et al. (2016)	Exemptions from greening obligations	All Member States	Policy analysis	A vast majority of agricultural land is exempt from greening by regulation. This limits the effects of the policy considerably in certain regions and sectors.
Bertoni et al. (2018)	Farmland use transitions due to greening	Italy	Markov chains approach	Despite criticisms on the ambiguous effects of greening, ex-post estimations verified the effectiveness of the policy.
Capitanio et al. (2016)	Impact of direct payments on land diversity decisions	Italy	Panel regression methods	There is a positive relationship between decoupled payments and diversity.
Peltonen-Sainio et al (2016)	Diversification of land use for producing different crops	Finland	Analysis of land use and production yield data	Direct payments strengthened the role of cereal monocultures (spring barley, oat, wheat), and reduced the role of minor crops (rapeseed, potato, pea, sugar beet).
Volkov et al (2019b)	Socio-economic sustainability of small farms	Lithuania	Multi-criteria decision-making method	Direct payments had a negative effect on the diversity of local production until 2013 From 2013 however, the situation has changed.

Resl et al (2006)	Comparison of the profitability of certain cash crops before and after EU-accession	Czech Republic	Modelling hypothetical farms based on FADN, spatial and crop yield data	Profits after the EU-accession increased in case of winter wheat, summer barley and rapeseed. By raising the price of intensive cereal and other cash crops, direct support does not contribute to the diversification of land use.
Bartolini et al. (2014)	Explaining the determinants of on-farm diversification	Italy	Two-step simulation model	High per hectare direct payments had a negative influence on diversification intensity.

Source: own composition

Based on the review of the scientific literature on land use effects of direct payments, it can be stated that the policy does not always influence land use conditions in the desired direction. Some studies suggest that the majority of payments are targeted at large, intensively cultivated parcels and not at the most valuable or vulnerable areas. Decoupling did not seem to have achieved major changes in the structure of land use. The fears of massive land abandonment associated with decoupling were not confirmed in practice, although decoupling did shift production to better quality land, while marginal land was abandoned or set-aside. This effect can even be called significant in certain regions and sectors. Decoupled direct support overall tends to strengthen the production of intensive cash crops, with little incentive to diversify land use and production. Surprisingly, the introduction of the greening payment did little to alleviate the situation in this regard. The majority of the reviewed articles (with the exception of Bertoni et al, 2018 and Capitanio et al, 2016) found evidence that greening can achieve only minor changes in land use decisions, therefore its impact on crop diversification is rather small.

3.6 4. Further economic effects of direct payments

3.6.1 The effect of direct payments on investment

Direct payments are by definition income subsidies; therefore they are not directly aimed at bolstering agricultural investments. However, it is interesting to see if – through indirect effects – they can influence the level of farm investments in any way.

Sckokai and Moro (2009) sought the answer to this question when they studied the effects of arable CAP payments on farm investment and output. They analyzed data from the Italian FADN on professional arable farms in the period 1994-2002. By utilizing a dynamic dual model of farm decision-making, they studied different policy scenarios concerning changes in the amount of intervention aid, coupled area payments and decoupled area payments. The results showed that an increase of the intervention price has a significant, positive effect on farm investment, mainly because it reduces price volatility. On the other hand, increasing the level of support that does not influence price volatility (for example, area payments) has no significant effect on investment decisions. Being risk-averse, farmers see price volatility as a hindrance of future investments. All in all, direct payments did not seem to be very efficient in promoting investment.

In an interesting study on production and investment decisions, Piot-Lepetit (2011) examined the effect of CAP support on the beef sector. A dynamic microeconomic model was used, which included factors like past and anticipated future prices of beef, size of the herd, investment rates, and level of slaughtering. It was found that coupled beef premiums generally had a positive effect on the size of the herd and the level of market supply on beef products; however this effect varied between types of cattle. In case of decoupled aid after 2013, production decisions merely depended on past and present prices in case of male cattle; regarding reproductive stock (cows and heifers), the expected future prices were also an important factor. All in all, direct support might have added to production levels, but they did not have a significant

influence on investment decisions, whereby farmers' expectations play the major role, due to the long-term nature of cattle production.

Certain articles analyzed the effect of direct payments on farm investment with a focus on the decoupling of support. Viaggi et al. (2010) investigated the effect of the decoupling of CAP direct payments on income and investment choices of a sample of farmers from 8 different Member States, in the period of 2006-2013 and 2014-2021. They ran two scenarios of farm household dynamic models using multi-objective integer programming: one before the decoupling took place in 2003, the other assuming full decoupling of direct payments. The results show that investments are not affected at all in the majority of cases. This diversity of farming systems has to be taken into account when evaluating policy programs.

In another article the authors (Viaggi et al, 2011a) looked into the same problem with different methods. They analyzed a sample of 248 farms from 8 countries, using non-parametric classification tree methods. The focus of their research was to identify the underlying factors of on-farm investment decisions as a reaction to decoupling. It was found that specialization, existence of a successor, the farmer's age, labour management, the amount of support per hectare are important determinants of investment decisions, along with the country the farm is located in (which even tends to substitute the some of the above-mentioned factors). Decoupling in itself generally cannot change farmers' investment choices, although it can contribute to the amount of investment if a farmer already has a positive attitude towards it. This was also established in a further study by the authors (Viaggi et al, 2011b), where a mixed-method approach was utilized (an analysis was performed using quantitative modelling methods as well as farm surveys and interviews).

In theory, if financial support no longer requires actual agricultural production, then loss-making activities could be expected to be discontinued, thereby resulting in disinvestment, loss of production and possible farm exit. Kazukauskas et al (2013) used FADN data from the EU-15 countries for the period 2001-2007 in order to model possible decreases in production and disinvestment as an outcome of decoupling. The authors used a difference-in-differences approach (exploiting the fact that total decoupling was introduced at a different time in Member States) to estimate these possible effects. It was found that the probability of disinvestment did

not increase (contrary to theoretical expectations) after policy decoupling. The certainty of decoupled direct payments and the increase of cash flow could be the cause of this effect. Land reduction was also not detectable as a consequence of decoupling, because the payment of decoupled support was only granted on condition of the presence of agricultural land at the farmer's disposal.

From the above-mentioned articles we can draw the conclusion that direct payments (either coupled or decoupled), are quite neutral in terms of farm investment. However, in certain countries or sectors, there can be exceptions to this general rule. One example would be the case of economies in transition. Latruffe et al (2010) analysed the potential credit constrains Lithuanian farmers were facing, and the effect of CAP direct payments on those constrains. First, they analysed the pre-accession situation using data on individual farmers in the FADN for the period 2000-2002, to identify whether their economic activities were limited due to a shortage of finance. A two-stage, accelerator investment model was used for this purpose. Secondly, a survey was conducted with the same group of farmers in 2005 to inquire about their plans for the future regarding farm investments, which was then supported by the presence of direct payments. Farms facing severe constrains for credit were often smaller in size, with lower levels of subsidies and little knowledge and experience about acquiring loans. The analysis uncovered that the introduction of CAP support brought about an overall increasing willingness towards farm investments, but farmers who were previously more constrained for credit proved especially eager to expand their businesses. This underlines the income effect of direct payments, which provide farmers with a relatively stable income element that can be directly invested or used to gain access to credit. This was also confirmed by Ciaian et al. (2012), who analysed the impact of direct payments on farm bank loans and by using a panel regression on FADN data for the period 1995-2007. They found that direct payments influenced farm loans, though long-term loans of large farms increased more than those of small farms, due to decoupled payments. Moreover, short-term loans for small farms were found to be only affected by decoupled subsidies.

In a study with similar focus, Tóth et al. (2017) studied the effects of the CAP on access to credit of Slovakian farms in the period following the country's EU accession. They found that direct payments significantly improve farms' access to

credit, because they seem to decrease the overall risk of farm activities. Because most direct payments are linked to size of agricultural area, larger crop farms tend to have a better position because they receive a high amount of direct payments. The main factor for banks when considering credit decisions is profitability, which is enhanced by direct payments.

Kallas et al (2012) also arrived at a different result than the majority of studies in the field of policy effects on investment. FADN data of the Spanish cereal, oilseed and protein (COP) sector for 2000-2004 was used in order to estimate a reduced form dual model of investment under uncertainty. It was found that area-based direct payments increased demand for variable inputs and through this, they generated agricultural production in the short term. Farm investment was also increased by direct support, and it was also influenced by input and output prices, level of risk and the utilization of insurance schemes, the age of the farmer and land use structures. Production decisions (in terms of which crop to grow), however, were only influenced by market prices for inputs and outputs.

The reviewed articles analyzing the effects of direct payments on investment are summarized in table 10.

Table 10 – Effects of direct payments on investment

Author	Topic	Country	Method	Result
Sckokai and Moro (2009)	Effects of arable CAP payments on farm investment and output	Italy	Dynamic dual model of farm decision-making	Increasing the level of support that does not influence price volatility (direct payments) has no significant effect on investment decisions.
Piot-Lepetit (2011)	Effect of CAP support on the beef sector	All Member States	Dynamic microeconomic model	Direct support might have added to production levels, but they did not have a significant influence on investment decisions, whereby farmers' price expectations play the major role.
Viaggi et al.	Effect of	Several	Farm household	Investments are not

(2010)	decoupling on farm investment	Member States	dynamic models using multi-objective integer programming	affected at all in the majority of decoupling policy scenarios.
Viaggi et al (2011a, 2011b)	Effect of decoupling on farm investment	Several Member States	Classification tree Mixed-method approach	Decoupling in itself generally cannot change farmers' investment choices, although it can contribute to the amount of investment if a farmer already has a positive attitude towards it.
Kazukauskas et al (2013)	Effect of decoupling on production, investment, farm exit	Old Member States (EU-15)	Difference of differences approach	The probability of disinvestment did not increase after policy decoupling. The certainty of decoupled direct payments and the increase of cash flow could be the cause of this effect.
Latruffe et al (2010)	Analysis of farm credit constrains	Lithuania	Two-stage, accelerator investment model	The introduction of CAP support eased credit constrains farmers were facing; consequently it brought about an overall increasing willingness towards farm investments.
Ciaian et al. (2012)	Impact of direct payments on farm bank loans	All Member States	Panel regression on FADN data	Direct payments influenced farm loans positively (mainly the long-term loans of large farms).
Tóth et al. (2017)	Effects of CAP on credit	Slovakia	Analysis of farm-level subsidy and financial data	Direct payments significantly improve farms' access to credit, because they decrease the risk of farm activities.
Kallas et al (2012)	Policy effects on investment	Spain	Reduced form dual model of investment	Farm investment was increased by direct support, and it was also influenced by input and output prices, level of risk and the utilization of insurance schemes, the age of the farmer and land use structures.

Source: own composition

In summary, most reviewed articles found that direct support does not have a significant farm investment effect. Price expectations, risk preferences, production and land use structures play a more important role in this regard. The decoupling of direct payments in itself was not able to change farm investment choices altogether,

although it may have increased the extent of farm investment that the farmer already decided to perform, regardless of decoupling.

There is one notable exception, however: in case of New Member States, certain groups of farms faced very severe credit constrains before the EU-accession. In these countries, direct payments (which represent a relatively stable income source) helped farmers gain access to credit and consequently bolstered investment. Also, the investment effect varies quite significantly between Member States and sectors; this also has to be taken into consideration during the policy effects on investment.

3.6.2 The effect of direct payments on farm employment conditions

3.6.2.1 Farm employment issues

The creation of jobs in rural areas is one of the major policy expectations towards the CAP. Petrick et al (2012) analyzed the effects of the CAP with a dynamic, fixed-effects labour demand equation. The data on support and other economic indices and indicators came from 69 East-German counties in the period 1994-2006. It was found that agricultural employment was decreasing steadily in the study period. The level of employment was responding very slowly to any economic changes (compared to other sectors of the economy), especially in the case of family farms. Direct payments and area-based rural development measures had no effect on employment in the model. The decoupling of direct payments further increased job cuts, because the extra labour was no longer needed to maintain the production requirements of former coupled payments. However, investment measures (typically financing buildings and machinery) could under certain conditions be used to create jobs. On the whole, CAP was not found to be particularly effective for increasing farm employment.

Another study by the authors on the same subject came to slightly different results. Petrick et al (2011) conducted an impact evaluation of the CAP on agricultural employment in German states Brandenburg, Saxony and Saxony-Anhalt. Instead of using a basic treatment-effect model, they applied a difference-in differences

approach on panel data aggregated at county level from 1995-2006. The utilization of panel data allows for the elimination of time-fixed latent effects from the analysis, as well as studying the delayed effects of policy treatment on employment. The results showed that investment measures and income transfers to least favoured areas have no effect on employment levels. The increase of direct payments led to a reduction of jobs, especially after decoupling support from production. Agri-environment measures, on the other hand, promoted labour-intensive agricultural operations and technologies, and could therefore contribute to maintaining the level of rural employment in the study regions.

Malá et al (2011) examined the economic effects of CAP payments on Czech agricultural businesses. Panel data of 109 plant production farms was used from the period 2004-2009 to construct production, cost and profit function models, as well as demand functions for land and labour. The models showed that a 1% increase in direct payments lower production by 0,185%. Other subsidy types had no statistically significant impact on production levels. On the other hand, direct payments increased the demand for land (a majority of support is based on the size of agricultural area), and farm profits. Demand for labour was a factor of agricultural output and the price of work (wages), but the level of subsidies did not influence it in any way.

Dupraz and Latruffe (2015) analysed trends in labour in French field crop farms by applying censored models on French FADN data for the period 1990-2007. The authors found that coupled and decoupled direct payments reduced labour use on farms.

Gohin and Latruffe (2006) analysed the effects of the 2003 CAP reform on, inter alia, farm labour and by using a CGE model, the authors found a significant decline in agricultural labour after 2003, while employment in food processing has hardly changed.

The above-mentioned studies seem to confirm that direct payments are generally unable to create agricultural jobs. Moreover, decoupled subsidies even tend to contribute to the reduction of agricultural employment. Not all research arrived at the same conclusion, however. Olper et al (2014) used FADN panel data of 150 European regions across the EU-15 (old Member States) from the period 1990-2009 to model labour migration from farms towards non-farming sectors. A static, fixed

effects model and a dynamic model a labour supply equation was set up, where factors included the level of Pillar I/Pillar II payments, relative wages in the farm/non-farm sectors, population density, unemployment etc. The model identified that CAP support played a role in maintaining the number of agricultural jobs, although the strength of the effect is small. Direct payments had a much stronger effect in this regard, compared to Pillar II support. Coupled direct payments were more helpful in keeping jobs than decoupled aid. Other significant factors that influenced out-farm migration were the differences between income and labour supply in farm and non-farm sectors and unemployment rate.

A similar conclusion was reached by Nordin (2014), who examined the effects of the 2013 CAP reform on agricultural employment in Swedish municipalities. A not very widely analyzed aspect of the reform was that permanent grasslands became eligible for basic income support under the reform, a fact that had a profound support redistributive effect because of the high share of grasslands in Sweden. Using a panel dataset on 261 municipalities from 2001 to 2009, as well as statistical data on employment and support payments, a fixed effect model was set up with instrumental variables. The results showed that employment increases with the share of grassland, about 11.000 euro of direct payments generate one job in agriculture. Therefore the support on grassland was at least partially effective in keeping the number of agricultural jobs stable. This effect was limited by the requirements of cross-compliance which the farmers have to observe in order to be eligible for support, which generated costs and thus weakened the income effect of subsidies.

3.6.2.2 Off-farm employment, part-time farming

Based on the above-mentioned articles, it can be stated that the effect of direct payments on farm employments is controversial at best. Concerning bolstering off-farm employment and the promotion of part-time farming, however, CAP seems to be more successful in meeting its goals. Rizov et al (2018) made a study into the effects of CAP payments on non-farm employment in the UK. The data from 2006 to 2014 on UK small and middle-sized enterprises came from a private business database (FAME); furthermore CAP payments data from the Paying Agency were also analyzed. The generalized method of moments (GMM) was used to estimate the

link between subsidies and employment. The study found a significant positive effect between CAP payments and non-farm employment, meaning that the CAP indeed can create jobs outside the farming sector, as a kind of spill-over effect. It is important to point out that this effect is stronger in the case of Pillar II. (rural development) subsidies as compared to Pillar I. (direct payments), per euro spent. The employment effect is twice as high in rural areas as in urban regions.

Further evidence also hints at a positive link between CAP subsidies and off-farm work. Benjamin (1994) analysed diversification activities of French farm households by using a neoclassical farm household model and showed that compensatory payments (direct payments) increased the probability of off-farm work participation, especially for educated wives. This may be related to the concentration effect of direct subsidies (Mizik, 2019), as a result of which farms either increase their size (if they are able to do so) or diversify their activities by looking for part-time opportunities.

Blomquist and Nordin (2017) analysed the impact of CAP subsidies on employment outside the agricultural sector by making estimations on Swedish municipality data between 2001 and 2009. Results suggest that direct payments create private jobs for about $26,000 per job.

Off-farm employment was also strengthened by the decoupling of payments. Hennessy and Rehmann (2008) analyzed the effect of the 2003 CAP reform on labour allocation decisions of Irish farmers. A dataset from the national agricultural survey was used in a household decision-making probit model to identify labour-related effects. It was found that decoupling causes a labour substitution effect (decoupling causes farm wages to drop, which incentivizes farmers to seek off-farm employment). The empirical analysis confirmed decoupling increases the probability of farmers seeking off-farm employment on the whole.

Part-time farming was also researched by Latruffe and Mann (2015), who investigated the level of subsidization of part-time farmers in France and Switzerland. They used a large sample of FADN farms from 2003, and applied a nonlinear economic regression analysis, which included control variables like farmland, labour, region, part-time character, age of farmer and labour intensity. The results showed that the relationship between the level of direct payments and the

part-time character of farms is not linear: farms with a low part-time character received less payment, but farms with a strong part-time character generally received more. This is contrary to the general belief that part-time farms are not subsidized in a sufficient manner. Part-time farms with less livestock and larger agricultural areas received especially high amounts of direct payments. Moreover, decoupling (which had not taken place in the study period) could further enhance part-time farmers' positions.

Furthermore, based on a survey carried out in 2009 among 295 French CAP beneficiaries, Latruffe et al (2013) considered farmers' reactions in case the CAP was abolished. Respondents of the survey had to describe their ten-year business strategy in a scenario where CAP was continued in an unchanged way, as well as a scenario where all support was removed from 2014. The survey results were then examined with cluster analysis. The results showed that most farmers would not change their farming activities in case CAP was discontinued. However, 19% of respondents would quit farming in a no-CAP scenario, and a further 13% was uncertain about their strategy. In the absence of the CAP, intensive crop farms would increase their off-farm activities, substituting household labour with contract work. Part-time farming would also gain popularity among farmers.

The reviewed articles analyzing the effects of direct payments on employment are summarized in table 11.

Table 11 – Effects of direct payments on employment

Author	Topic	Country	Method	Result
Petrick et al (2012)	The effect of subsidies on farm employment	Germany	Fixed-effects labour demand equation	Direct payments and area-based rural development measures had no effect on employment. Decoupling further increased job cuts (the extra labour was no longer needed to maintain the production requirements of former coupled payments).
Petrick et al (2011)	The effect of subsidies on farm	Germany	Difference-in differences	Investment measures and income transfers have no

	employment		approach on panel data	effect on employment levels. The increase of direct payments led to a reduction of jobs, especially after decoupling.
Malá et al (2011)	Economic effects of CAP subsidies	Czech Republic	Production, cost and profit function models, demand functions for land and labour.	Demand for labour was a factor of agricultural output and wages, but the level of subsidies did not influence it in any way.
Dupraz and Latruffe (2015)	Trends in labour in French arable farms	France	Censored models on French FADN data	Coupled and decoupled direct payments reduced labour use on farms.
Gohin and Latruffe (2006)	The effect of decoupling on farm labour use	Old Member States (EU-15)	Computable General Equilibrium model	There was a significant decline in agricultural labour after decoupling, while employment in food processing has hardly changed.
Olper et al (2014)	Effect of CAP support on farm employment	Old Member States (EU-15)	Static, fixed effects model and a dynamic model of labour supply equation	CAP support played a role in maintaining the number of agricultural jobs, although the strength of the effect is small. Direct payments had a much stronger effect in this regard, compared to Pillar II support. Coupled direct payments were more helpful in keeping jobs than decoupled aid.
Nordin (2014)	Effect of the 2013 CAP reform on agricultural employment	Sweden	Fixed-effects model with instrumental variables	Employment increases with the share of subsidized grassland, about 11.000 euro of direct payments generate one job in agriculture.
Rizov et al (2018)	Effects of CAP payments on non-farm employment	United Kingdom	Generalized method of moments	There is a significant positive effect between CAP payments and non-farm employment, meaning that the CAP indeed can create jobs outside the farming sector, as a kind of spill-over effect.
Benjamin (1994)	Diversification activities of French farm households	France	Neoclassical farm household model	Direct payments increased the probability of off-farm work participation.
Blomquist and Nordin (2017)	Impact of CAP subsidies on employment outside the agricultural sector	Sweden	Estimations on Swedish municipality data	Direct payments create private jobs for about $26,000 per job.
Hennessy and Rehmann (2008)	Effect of the 2003 CAP reform on labour allocation	Ireland	Household decision-making probit model	Decoupling increases the probability of farmers seeking off-farm

	decisions			employment.
Latruffe and Mann (2015)	subsidization of part-time farmers	France Switzerland	Nonlinear economic regression analysis with control variables	Farms with a low part-time character received less direct payments, but farms with a strong part-time character generally received more.
Latruffe et al (2013)	Policy scenario analysis	France	Analysis of survey results	Part-time farming could gain popularity under certain conditions.

Source: own composition

The effect of direct payments on farm employment as documented by the reviewed articles is controversial. Most articles find no significant relationship between direct support and farm employment, meaning that the policy fails to influence rural employment conditions in the desired manner. On the other hand, a few articles did find a positive link between direct support and farm labour use. However, the scientific literature seems to agree upon the finding that decoupling generally caused a loss of jobs in agriculture (because farmers no longer had to comply with the production criteria set forth in former coupled support schemes). On the subject of creating off-farm jobs and promoting part-time farming, the CAP seems to play a beneficial role. In any case, in connection with the above findings, it should be noted that further research is needed on the impact of the CAP on agricultural employment, in particular due to the role of technological development and the elimination of black and gray economies, which make scientific clarity difficult in this topic.

3.6.3 The effect of direct payments on external and internal markets

3.6.3.1 External markets

Public intervention usually comes with market-distortive side effects. This is also the case with the CAP, the effects of which was examined by Urban et al (2016), focusing on the impact of the 2013 decoupling of the CAP on international trade. The trade distorting effect of domestic subsidies is a thoroughly researched topic. This study analyzed how this distortion changed with the decoupling of CAP direct

payments. The authors applied the Global Trade Analysis Project model in different scenarios (with variable levels of decoupling). They found that the effect on international trade depend highly on the level of decoupling introduced into the CAP.

Rickard et al (2011) arrived at a similar conclusion. They used a simulation model to measure the impacts of CAP policy reforms in the fruit and vegetable sector. The policy between 1978 and 2000 included quotas, guaranteed minimum prices for tomato growers and support for processors. In the period 2001-2007, a fixed amount was paid per ton of tomatoes to growers. From 2008, the fruit and vegetable sector was gradually included in the decoupling of direct payments. The result of the calculation showed that EU producers and global consumers benefitted most from CAP subsidies (during all three periods), while non-EU producers and EU taxpayers would have benefitted most from the total elimination of CAP payments. Since the EU is an exporter of processed tomato products, theoretically this makes sense. It was also found that the policy reform of 2001 did not bring much change concerning the production decisions of farmers, but the 2008 decoupling did. The situation is the same in case of the level of taxpayer expenditures. All in all, the decoupling did bring about a less production-distortive policy and more benefits for EU growers.

Boysen-Urban et al. (2019) also confirmed this, when they measured the trade restrictiveness of decoupled direct payments by an own index (Mercantilist Trade Restrictiveness Index) and showed that trade restrictiveness of the CAP decreased by the introduction of direct payments. Moreover, the authors found that trade restrictiveness depended on the degree of decoupling.

3.6.3.2 Internal market

The functioning of the single market within the EU necessitates the uniform implementation of Community policies in different Member States. If public intervention differs in fundamental ways, market distortions on the highly integrated single market are quick to appear. While the CAP strives at uniformity across the EU, there are decisions and options that can be elected at Member State level. Researchers warn that such deviations have to be applied carefully, in order to avoid distortions on the single market. Ihle et al (2012) used weekly calf prices from four major producer countries after the 2003 CAP reform in order to identify policy

effects on commodity price. A price transmission analysis with unit root tests and the utilization of Vector Error Correction Model was performed. It was found that the markets in different European countries are highly integrated (common market). Decoupling decreased prices in all markets – the higher the level of decoupling, the lower the price. Differences in the level of decoupling (which was, to a certain, in the hands of Member State administrations) therefore led to significant import/export consequences (due to the high interconnectivity of European markets). The CAP decision to allow for deviations in certain policy questions has to be evaluated very carefully, because of the economic affects it may have on the common European market.

Contrary to the traditional top-down approach of the CAP, the 2014 reform of the agricultural policy sought to introduce flexibility for Member States in defining certain policy issues at a national level. Henke et al (2018) examined this increase in subsidiarity based on a structural survey filled out by experts of each Member State, as well as formal communications from the European Commission. The study examined policy elements like the speed of transition towards flat-rate payments in the Basic Payment Scheme; the restrictiveness of eligibility criteria imposed on farmers by Member State administrations; and the extent of redistribution among beneficiaries. The Member States were then grouped into clusters based on their choices. The first cluster consisted mainly of old continental Member States who moved quickly towards a uniform unit amount of payment, but took limited interest in further redistribution or restriction of payments. The second cluster was made up by old Mediterranean Member States, who exhibited a very cautious approach towards flat rate-payments, and defined a wide range of eligibility criteria to restrict direct payments to farmers of the previous period. The third cluster consisted of new Member States who chose to keep the previously introduced Single Area Payment Scheme, and also took a lot of effort into further redistribution of direct payments. The fourth cluster's members tried to uphold the status quo of former payments without any particular attempts at redistribution or selectivity of eligible farmers. The flexibility of the CAP can be a good tool to depart from the "one size fits all" approach and arrive at a better targeted and streamlined set of policy instruments. However, special note should be taken on the possible distortions of the common market in the case of deviating economic policies across the EU.

The reviewed articles analyzing the effects of direct payments on external trade and internal markets are summarized in table 12.

Table 12 – Effects of direct payments on external trade and internal markets

Author	Topic	Country	Method	Result
Urban et al (2016)	Impact of the 2013 decoupling of the CAP on international trade	All Member States	Global Trade Analysis Project	The effect on international trade depends highly on the level of decoupling introduced into the CAP.
Rickard et al (2011)	Impacts of CAP policy reforms in the fruit and vegetable sector	All Member States	simulation model on different policy choices	EU producers and global consumers benefitted most from CAP subsidies, while non-EU producers and EU taxpayers would benefit most from the elimination of CAP. Decoupling brought about a less production-distortive policy and more benefits for EU growers.
Boysen-Urban et al. (2019)	Trade restrictiveness of decoupled direct payments	All Member States	Mercantilist Trade Restrictiveness Index	Trade restrictiveness of the CAP decreased by the introduction of direct payments, and also by decoupling.
Ihle et al (2012)	Price transmission study on the beef market	Several Member States	Price transmission analysis with unit root tests and Vector Error Correction Model	Markets in different European countries are highly integrated. Deviations in certain policy choices in Member States may distort the common market.
Henke et al (2018)	National policy choices on the 2013 CAP reform	All Member States		The flexibility of the CAP can be a good policy tool, but special note should be taken on the possible distortions of the common market.

Source: own composition

A very common criticism concerning public economic intervention is its market-distorting properties. Concerning CAP impacts on external markets, the relevant studies mainly focus on decoupling, which was – to a significant extent – introduced

exactly because of world trade considerations. The reviewed articles showed that decoupling succeeded in reaching its intended goal in this regard, because the CAP became less market distortive after decoupling took place. Concerning internal markets, researchers warn us that the EU internal market is highly integrated; therefore differences in subsidizing between countries can have significant distortion effects. These differences arise from the fact that the agricultural policy across the EU on the one hand is common in terms of a shared legislative, planning, control and financial framework, but on the other hand it leaves an ever increasing room for Member States to deviate in a number of policy choices. The growing subsidiarity of the policy may be a cause for concern in this regard.

4. RESEARCH METHODS

The aim of this chapter is to present the research methods, from asking the research questions to presenting the hypotheses to the data collection and the description of the applied models.

4.1 Research questions

The main aim of my research is to show the effects of direct payments at the regional level in the Member States of the European Union. The most important socio-economic impacts are addressed, according to the literature review. My research questions are:

1. What are the regional effects of direct payments in the European Union?
2. How different are the effects in the old and in the new Member States?

4.2 Hypotheses

I seek the answer to the above research questions with the following hypotheses.

H1: Direct payments increase agricultural income at regional level in the European Union.

There is a vast range of literature on state intervention in agriculture and one of their central assumptions is that the intervention is needed to increase the traditionally low incomes from agriculture (Bojnec-Fertő, 2019). The variability and low level of income from agriculture are typical characteristics of the sector, which mainly are caused by weather conditions, volatile agricultural markets, and factors of production. At the same time, the effectiveness of government subsidies does not always produce the desired results. According to part of the literature, direct payments have increased farmers' incomes at the national level (Boysen et al. 2016,

Ciaian et al. 2015), while in other articles this effect is far from clear (Viaggi et al. 2010, Vosough Ahmadi et al. 2015).

I expect a positive relationship between the regional income and support payments data collected to test the hypothesis, i.e. I assume that direct support has an income-increasing effect.

H2: Direct payments increase regional agricultural productivity in the European Union.

One of the classic dilemmas of agricultural economics / agricultural policy is whether agricultural subsidies can increase productivity. According to some views, direct payments increase agricultural productivity (Cillero et al. 2018, Kazukauskas et al. 2010), while others arrived at the opposite result (Zhu et al. 2012, Mary 2013). The hypothesis is based on the assumption that direct payments have the potential to increase unit added value. Accepting the hypothesis also has a serious economic policy message.

To test the hypothesis, I plan to examine changes in land and labor productivity. This requires regional agricultural productivity data, which I interpret as the quotient of regional agricultural value added and land or labour. I expect a positive link, namely that direct payments will increase agricultural productivity.

To test the hypothesis, I formulated two sub-hypotheses:

H2.1 Direct payments increase the productivity of agricultural labour at regional level.

H2.2 Direct payments increase the productivity of agricultural land at regional level.

H3: Direct payments alleviate income inequality and regional poverty in the European Union.

Direct payments have not only economic but also social effects. Reducing rural poverty and reducing the agricultural / non-agricultural income gap can be seen as an indirect objective of the Common Agricultural Policy. This assumption is based on

the fact that agriculture in rural areas is still a serious job-creating factor and a kind of "shelter" (Bojnec-Fertő, 2019).

When examining regional impacts, the question arises as to whether direct payments alleviate poverty and income inequalities within regions. To test these questions, I formulated two sub-hypotheses:

H3.1 Direct payments alleviate income inequalities in the European Union.

H3.2 Direct payments alleviate regional poverty in the European Union.

In both cases, I assume a positive relationship, i.e. that direct aids have a favourable restructuring and social role.

H4: The regional effects of direct payments will level off in the European Union over time.

The above hypotheses basically examine the effects within regions and interpreted for each region, i.e. they look at how much the actual situation has changed in each region. At the same time, it is also interesting to examine, in relation to research questions, whether there has been any change between regions - are the regional effects of direct payments converging or diverging? Are the differences between the EU-15 and the new Member States and between regions increasing or decreasing?

I am aware that the hypotheses listed above do not cover all the potential economic impacts I have identified in the literature review. In this regard, I emphasize that in the literature review, I wanted to give a complete picture of all the areas that the scientific literature has identified and examined in the subject. Not all areas will be presented in this dissertation - due to the limits of scope and methodological reasons, or in light of available data.

4.3 Analytical framework

As can be seen from the literature review, a number of models have been developed in recent decades to examine the effects of direct subsidies. These models are mostly ex-ante in nature, i.e., they run simulations and scenarios and examine expected future impacts. Such specific industry models have been used by the following authors in the literature review, among others:

• CAPRI: Biró et al. (2017), Britz et al. (2012), Gocht et al. (2013), Hoppe et al. (2009), Kozar et al. (2012), Sahrbacher et al. (2009);

• AGMEMOD: Chantreuil et al. (2013), Erjavec et al. (2011), Erjavec and Salputra (2011), Hanrahan et al. (2012);

• AgriPoliS: Happe et al. (2009), Sahrbacher et al. (2009).

In addition, other quantified general equilibrium models (e.g., Boysen et al. 2016, Espinosa et al. 2014, Gelan and Schwarz 2008, Gohin and Latruffe 2006) and partial equilibrium models (Rednak et al. 2003, Rude 2008) have been used in several reviewed studies. The methods listed above are well suited for ex-ante modelling of the effects of possible agricultural policy changes. However, my research questions focus on the ex-post analysis of CAP effects, which is why the analytical tools listed above are of little relevance to the present research.

There are a number of other classical impact assessment methods available for analyzing different economic policy interventions. In the impact assessment of the CAP, for example, the method of estimating the probability of participation (propensity score matching) or the difference of differences approach is also relatively common. However, these methods cannot be effectively used to analyze direct payments, as they compare the results of the observed and the control group, but the latter cannot be created for direct payments. In fact, virtually all farmers in all Member States receive direct support, so the possibility to establish a control group is severely constrained.

At the same time, regional impact analysis of direct payments is a new area of CAP impact assessment, for which these models are not suitable due to lack of data, and which is an area of research not yet explored in the literature. Impact assessments to

date, as can be seen from the literature analysis, typically focus on countries, while regional impacts are not examined. For these reasons, I decided – in accordance with the international literature (Bojnec and Fertő 2019, Ciaian et al. 2015, Galluzzo 2018b, Kilian et al. 2012, Klaiber et al. 2017, Petrick and Zier 2011, Severini et al. 2017, Tangermann 1998, and others) – to carry out a classic ex-post impact analysis based on regional data at NUTS2 level from 2008 to 2018.

4.4 Research data

In order to test the research hypotheses, it was necessary to build a unique database in accordance with the analytical framework, which was based on the following databases:

- Data on the volume of direct payments are from the **Clearance Audit Trail System** (CATS) database. The database is operated by the European Commission and records all payments made under any CAP support on an annual basis and by beneficiary. The data are reported to the Commission by the Member States each year and form the basis for the financial accounting between the Commission and the Member States.
- I downloaded regional data from the **Annual Regional Database of the European Commission** (ARDECO). The database is operated by the Commission's Joint Research Center; it is mainly based on Eurostat data but also involves additional data sources. The database contains regional data on demographics, labour market, capital formation, and gross domestic product, broken down by sector.
- The source of data on poverty and income inequality was the **EU Statistics on Income and Living Conditions** (EU-SILC) database.
- I collected several control variables for the applied models from the **Eurostat database** (income, agricultural land, population density data).

The variables used for the research are shown in Table 13:

Table 13 – Description of the variables used for modelling

Variable name	Description of variable	Unit of measure	Data source
dp	Amount of direct payments	€	CATS
gdp	Gross domestic product (GDP), current prices	million PPS	ARDECO
gdpperhead	GDP/capita	PPS	ARDECO
aggva	Gross Value Added in the agricultural sector (GVA), current prices	million PPS	ARDECO
nonaggva	Gross Value Added in all sectors outside agriculture (GVA), current prices	million PPS	ARDECO
gvagrowth	Total GVA growth, compared to the previous year	%	Eurostat
gfcf	Gross Fixed Capital Formation (GFCF) in agriculture, current prices	million €	ARDECO
agempl	Agricultural employment	thousand persons	ARDECO
nonagempl	Non-agricultural employment	thousand persons	ARDECO
salaries	Salaries of persons working in agriculture	million PPS	ARDECO
riskofsocial	Rate of people at risk of poverty or social exclusion	%	EU-SILC
uaanew	Utilized agricultural area	hectares	Eurostat
popdens	Population density	persons/square kilometre	Eurostat
convergence	Regions eligible for financing from the European Regional Development Fund, or the European Social Fund (convergence regions)	0 – non-convergence region; 1 – convergence region	Implementing decision of the European Commission, 18 February 2014
entreincome	Income of agricultural holdings	million €	Eurostat
hhincome	Household income (non-agricultural)	million €	Eurostat
foldtermnew	Productivity of agricultural land: agricultural GVA divided by the utilized agricultural area	million PPS/hectare	derived statistic

munkatermnew	Productivity of agricultural labour: agricultural GVA divided by agricultural employment	million PPS/thousand persons	derived statistic
incomeratio	Rate of agricultural income compared to total household income	ratio (from 0 to 1)	derived statistic
oms	Old Member State (Member of EU before 2004)	0 – New Member State 1 – Old Member State	European Commission
nms	New Member State (Member of EU from 2004 or later)	0 – Old Member State 1 – New Member State	European Commission

Source: own composition

In most cases, I also used the logarithmized version of the variables listed above (in this case I inserted the abbreviation 'ln' in front of the variable name).

All the data for the variables in the table above are available per NUTS2 region. Data are also broken down by year, covering the period 2008-2018 (however, data for some variables are not available for each year).

The names and codes of the regions are included in the dissertation according to the NUTS 2016 nomenclature. Out of a total of 281 NUTS2 regions, 244 regions are included in the database. The other regions were excluded from the scope of the analysis due to lack of data, or due to the fact that the area of the given region changed during the analysis period (merged with several regions or split into several regions), so the data for them could not be used validly. The range of regions included in the analysis is given in Annex 1.

After a uniform alignment of the values of the variables from the different data sources, a strongly balanced panel database was developed.

The values of each variable can be characterized by the following descriptive statistics:

Table 14 – Main descriptive statistics of the model variables

Variable name	Unit of measure	Number of observation	Mean	Standard deviation	Minimum	Maximum
dp	€	2 684	149 million	169 million	0	1 610 million
nonagempl	thousand persons	2 684	790,36	722,88	16,63	6 431,32
nonaggva	million PPS	2 684	44 159,97	51495	810,67	594 959
hhincome	million €	2 466	33 882,35	38 116	699,00	383 637
gvagrowth	%	2 384	1	3	-16	44 007
entreincome	million €	1 971	298,71	541,80	-523,00	9 169
convergence	0 – non conv. region; 1 - conv. region	2 684	0,27	0,44	0	1
gdpperhead	PPS	2 684	26 013,04	9 743	6 783	80 134
gfcf	million €	2 440	268,47	246,78	0,00	170 751
gdp	million PPS	2 684	50 220,63	57 526	943,57	670 957
aggva	million PPS	2 684	813,51	872,75	2,26	10 613,78
salaries	million PPS	2 440	210,36	219,60	1,11	1 881,60
agempl	thousand persons	2 684	41,99	74,94	0,10	827,38
riskofsocial	%	1 043	25,50	11,76	7,10	59,50
lnnonagempl		2 684	6,34	0,86	2,81	8,77
lnnonaggva		2 684	10,28	0,93	6,70	13,30

lngdpperhead		2 684	10,10	0,38	8,82	11,29
lngfcf		2 439	5,18	1,04	0,80	7,77
lngdp		2 684	10,42	0,91	6,85	13,42
lnaggva		2 684	6,22	1,11	0,81	9,27
lnsalaries		2 440	4,87	1,08	0,10	7,54
lnagempl		2 684	2,97	1,26	-2,30	6,72
lndp		2 683	18,26	1,23	12,13	21,20
oms	0 – New Member State; 1 - Old Member State	2 684	0,80	0,40	0	1
nms	0 – Old Member State; 1 - New Member State	2 684	0,20	0,40	0	1
uaanew	hectare	2 684	646,58	659,12	7,01	4 643,46
lnuaanew		2 684	6,01	1,07	1,95	8,44
foldtermnew	million PPS/ hectare	2 684	1,64	1,72	0,02	21,32
munkatermnew	million PPS/ thousand persons	2 684	0,07	0,06	0,00	0,47
lnfoldtermnew		2 684	0,21	0,74	-3,79	3,06
lnmunkatermnew		2 684	-3,03	0,84	-9,07	-0,76

popdens	persons/ square kilometre	2 637	324,74	694,11	2,70	7 471,50
lnpopdens		2 637	5,02	1,13	0,99	8,92
incomeratio		1 891	0,02	0,03	-0,03	0,23
lnhhincome		2 466	9,97	1,00	6,55	12,86
lnentreincome		1 661	5,24	1,22	0,00	9,12

Source: own composition

4.5 Operationalization

To test each hypothesis, I used random effects panel regression models, described in the following table. Where applicable, I used a logarithmic version of the variables to show percentage effects. In each case, I ran the models for all Member States and then separately for the old and new Member States.

Table 15 – Regression models used in the research

Variable name	**H1: income**	**H2.1: labour productivity**	**H2.2: land productivity**	**H3.1: income inequality**	**H3.2: poverty**
lndp	explanatory variable	explanatory variable	explanatory variable	explanatory variable	explanatory variable
Expected sign of exp. variable	+	+	+	+	-
lnentreincome	dependent variable		control variable		
lnmunkaterm		dependent variable			
lnfoldterm			dependent variable		
incomeratio		control variable		dependent variable	
riskofsocial					dependent variable
lngdp	control variable		control variable	control variable	control variable
lngdpperhead			control variable	control variable	control

					variable
lnaggva	control variable	control variable		control variable	control variable
lnnonaggva		control variable	control variable	control variable	control variable
lnagempl			control variable	control variable	control variable
lnnonagempl				control variable	control variable
lnhhincome	control variable		control variable		
lnsalaries	control variable	control variable	control variable	control variable	control variable
lnpopdens		control variable	control variable		
lngfcf		control variable	control variable		
convergence		control variable	control variable	control variable	control variable

Source: own composition

To test my fourth hypothesis on the equalization of the regional effects of direct payments over time, I made use of convergence theories. There are several methods for testing convergence between countries and regions. In this study I used Kernel density plots and Markov transition probability matrix methods (as presented by the article of Csáki and Jámbor, 2018). These methods are well suited to determine how asymmetric the distribution of the sample is, as well as to show whether there are significant differences in income, productivity, or social differences over time. Based on Csáki and Jámbor (2018), the Kernel method is suitable for identifying the external convergence, while the Markov method is suitable for identifying the internal convergence. Similar methods have previously been used to analyze the impact of CAP convergence, by Hansen and Teuber (2011), Montresor et al (2011), and Cuerva (2011) for example.

I am also aware of the limitations of my research design. For example, it is clear from the structure of the Common Agricultural Policy that not only direct payments but also other forms of support (agri-environment, less-favoured areas, etc.) can have income, production factors or efficiency impacts. Also, there are other effects (e.g. farm structure, production structure) that I will not examine in the dissertation. Obviously, EU regional and rural development policies are also important in examining regional impacts, but this is a major issue that could be addressed in a separate dissertation. Furthermore, it is also quite clear that tests other than the ones

used in my dissertation may lead to different results. However, the chosen methodology was used by a high number of researchers in this subject. Moreover, the fact that direct payments accounted for more or less 75% of all CAP payments confirms that the research questions and hypotheses are worth analyzing. I took the above limitations into account during the research (for example, by using control variables in various models).

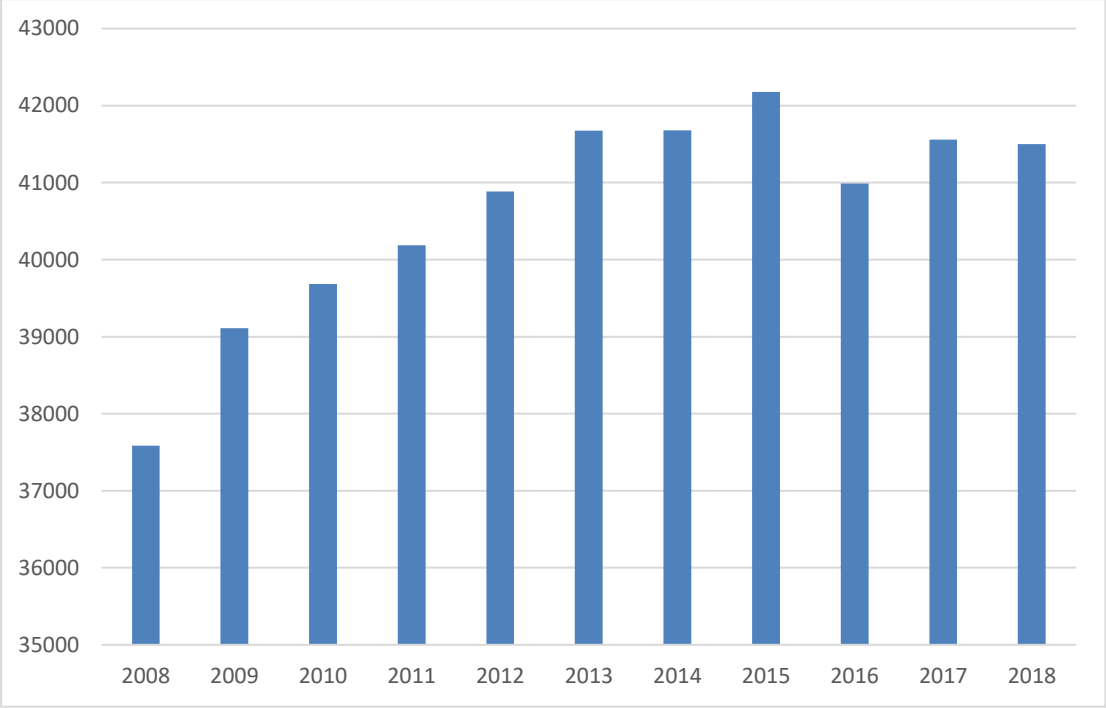
5. RESULTS

5.1 Development of the level of direct support in the research period

5.1.1 The total amount of direct payments

The total amount of direct payments across the EU is presented in Figure 10.

Figure 10 – Annual changes in the level of direct payments (million €)



Source: own composition

As shown in the figure above, the study period can be divided into two parts in terms of the evolution of the amount of direct payments. From 2008 to 2013, the level of direct payments showed an upward trend. This is due to the phasing-in mechanism

mentioned earlier, under which the Member States that joined the EU in 2004 received only 25% of the total amount at that time, which then gradually increased until 2013. In the period 2008-2013, the level of direct payments in these Member States in question increased by 10 percentage points each year.

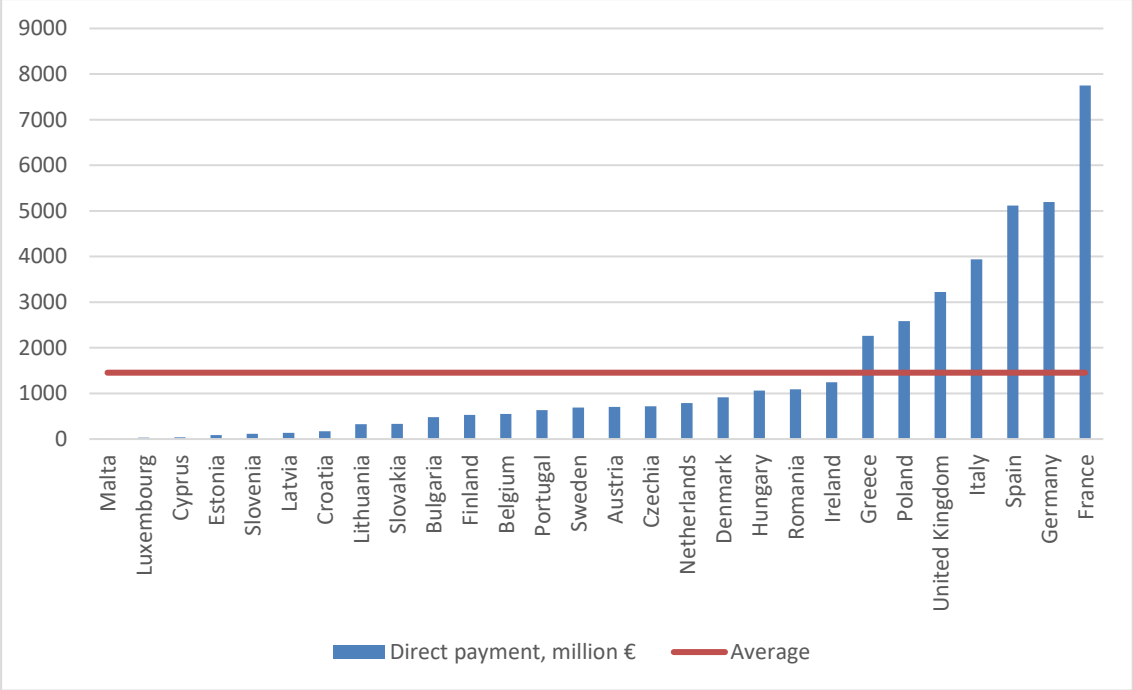
In the period 2014-2018, the level of direct subsidies stabilized, with smaller fluctuations in the range of 41-42 billion euros. I would like to draw attention to the fact that the 2014 reform of the CAP also fell into this period, in the course of which efforts were made to reduce the share of the CAP budget. Seeing the data, we can state that this was not successful in the case of direct payments, their amount showed relative stability in the examined period (however, there may have been a reduction in funding for Pillar II. rural development support).

5.1.2 The amount of direct payments by country

5.1.2.1 The level of direct payments in absolute terms

The annual average amount of direct payments disbursed in each Member State in 2008-2018 is as follows:

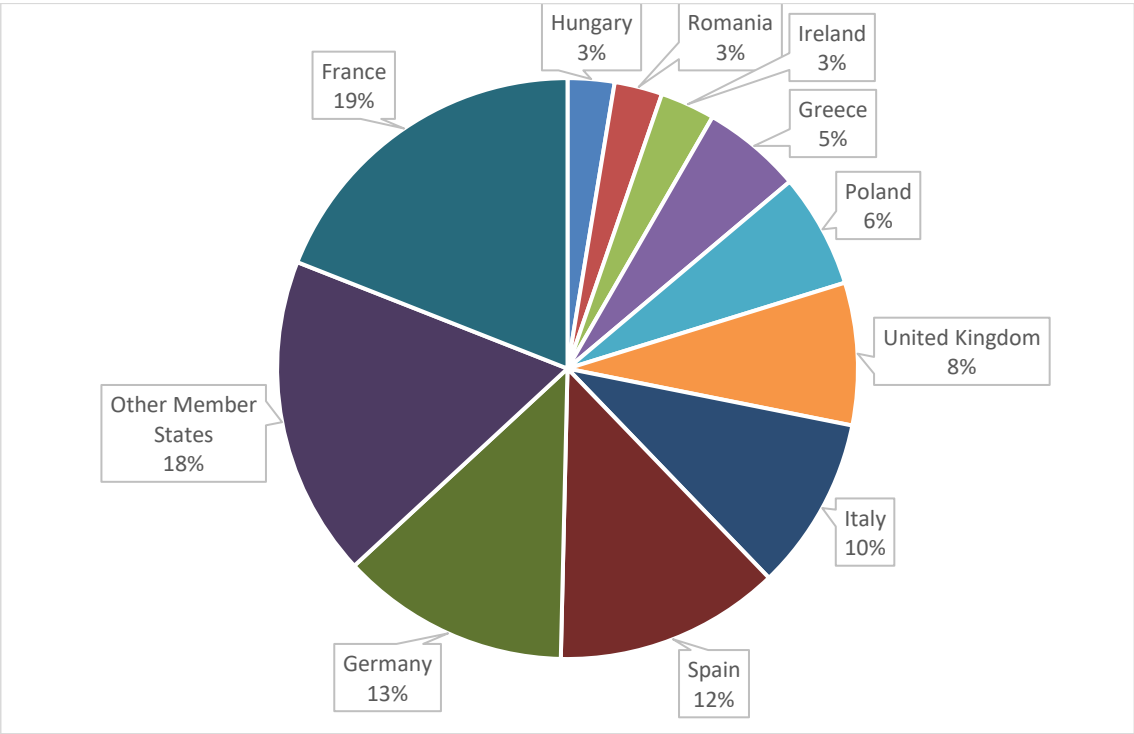
Figure 11 – Average annual amount of direct payments in Member States (million €)



Source: own composition

On the one hand, Figure 11 illustrates the different size and significance of the agricultural sector in each country; on the other hand, disparities between Member States in the level of direct payments. During the period under review, Greece, Poland, the United Kingdom, Italy, Spain, Germany and France were able to claim above-average amount of direct payments. Figure 12 illustrates the distribution of financial resources:

Figure 12 – Distribution of annual average direct payments between countries

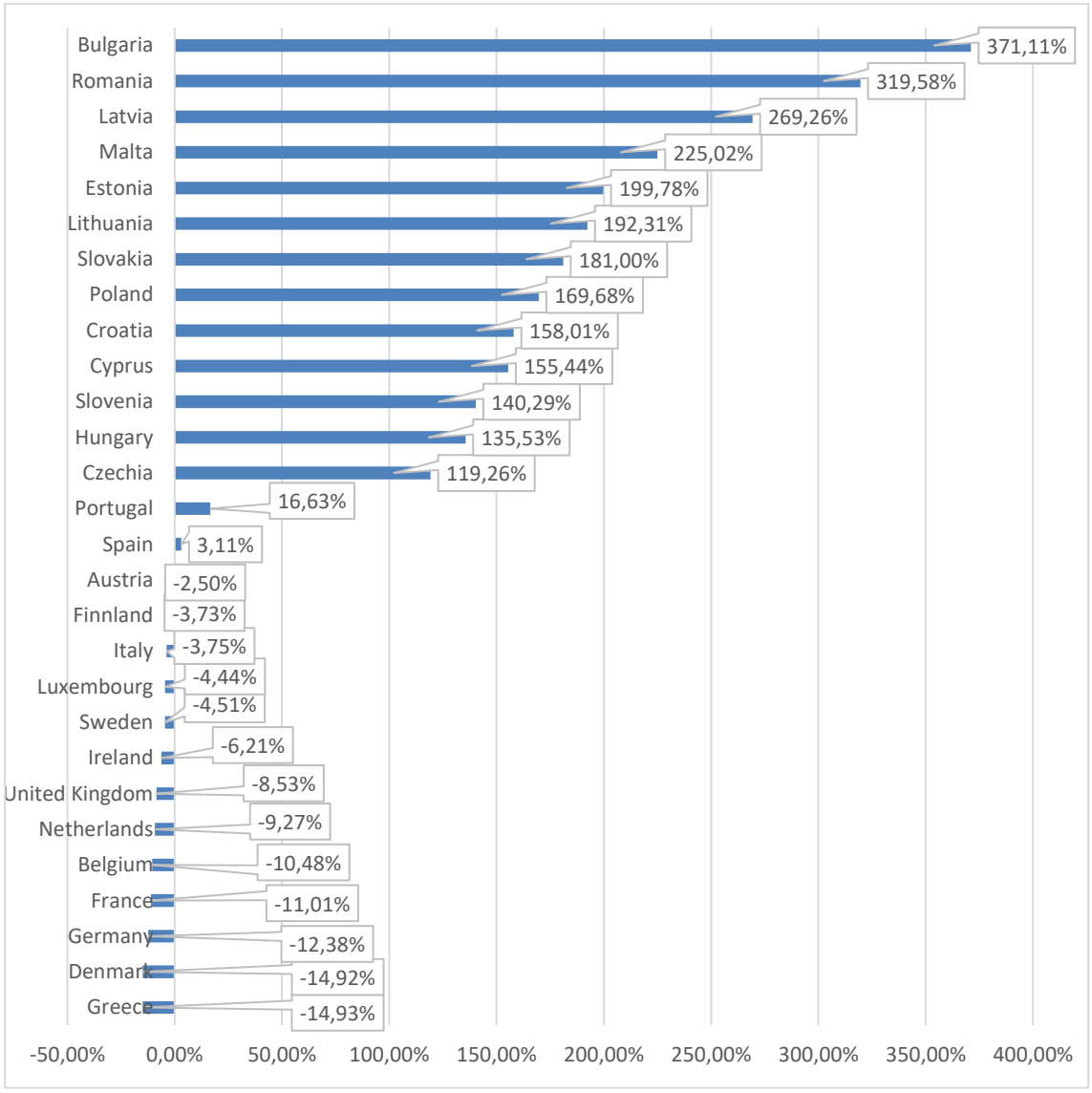


Source: own composition

Ten Member States received more than € 1 billion annually on average; these ten Member States accounted for around 82% of total direct payments. France had a much higher level of direct aid than any other country, receiving around € 7.7 billion in direct payments annually (19% of the average annual payment in the whole EU). This is followed by Germany, Spain and Italy (10-13%); followed by the United Kingdom, Poland and Greece (5-8%); and finally, Ireland, Romania and Hungary (3%). All other Member States had an average of over 18% of total payments during the period under review (slightly less than France).

It is also interesting to see how the level of direct support changed in each country in the study period:

Figure 13 – Change of annual direct payment amounts from 2008 to 2018



Source: own composition

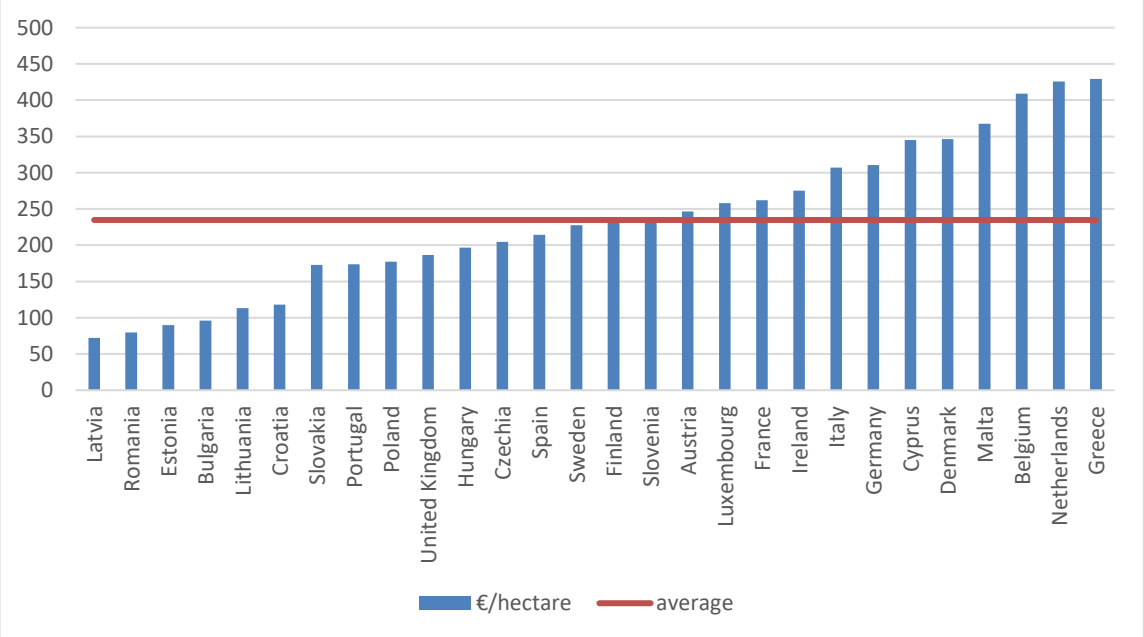
Figure 13 shows the percentage change in direct payments from 2008 to 2018 (except in Croatia, where I compared the level of payment in 2018 to the year of accession in 2014). The figure is in line with what was previously reported about the phasing-in mechanism. The phasing-in period in Romania and Bulgaria (2007-2016) almost completely overlaps with the study period, so it is not surprising that the level

of direct payments increased the most there. They are followed by the Member States that joined the EU in 2004, which also saw a significant increase. Of the old Member States, only Portugal and Spain were able to increase their direct payments during the study period, while the level of support in the other old Member States decreased (in most cases only to a lesser extent).

5.1.2.2 The amount of direct payments per hectare

In addition to examining the absolute value of direct payments, it is also worth analyzing how the distribution of direct payments per hectare developed in different Member States. Figure 14 shows the average amount of direct support per hectare, broken down by country.

Figure 14 – Average direct payment amount by country in 2008-2018, €/hectare

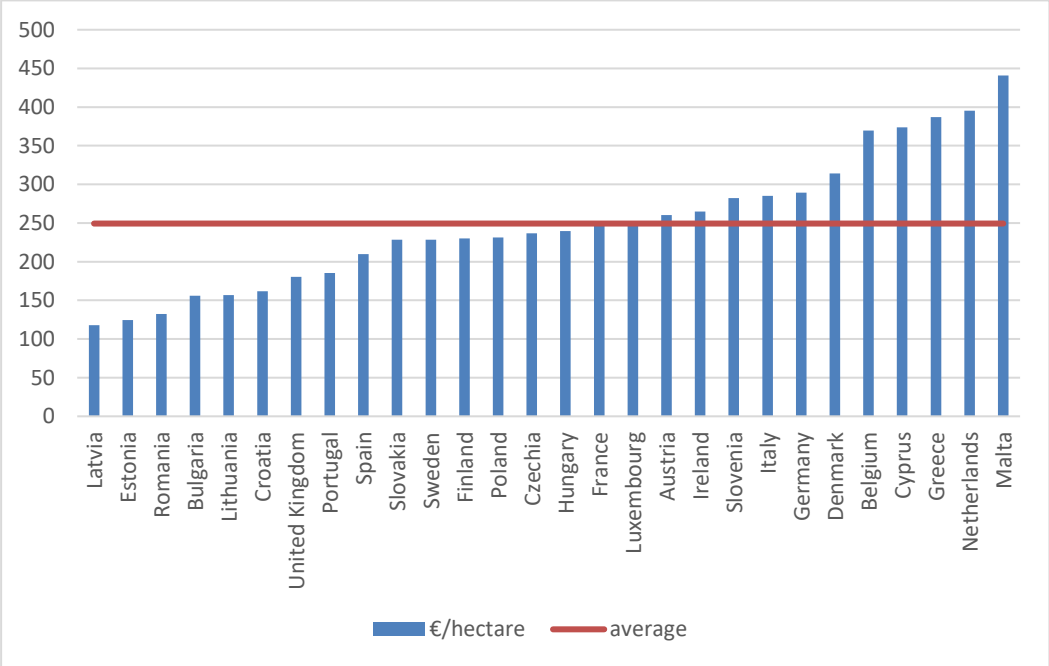


Source: own composition

Figure 14 illustrates the external convergence problems related to CAP direct support rather well. The level of direct payments per hectare varied widely between Member States in 2008-2018. Significantly lower than average aid intensities were found in new Member States (except for Cyprus and Malta), in particular the Baltic States, Romania and Bulgaria. In contrast, some old Member States (notably Belgium, the Netherlands and Greece) are still in a particularly good comparative position regarding direct payment intensity. I would like to draw the attention to the fact that for this figure, I divided the amount of direct subsidies by the utilized agricultural area; I did not take the size of eligible livestock into consideration, which would somewhat alter the picture. But as most direct payments are still paid on an area basis and not based on livestock numbers, the numbers are essentially valid.

In addition, I note that the data on aid intensities in the new Member States are affected by the phasing-in effect, so it is worth examining the differences in aid intensities between countries at the end of the phasing-in period of new Member States:

Figure 15 – Direct payment amount by country in 2018, €/hectare

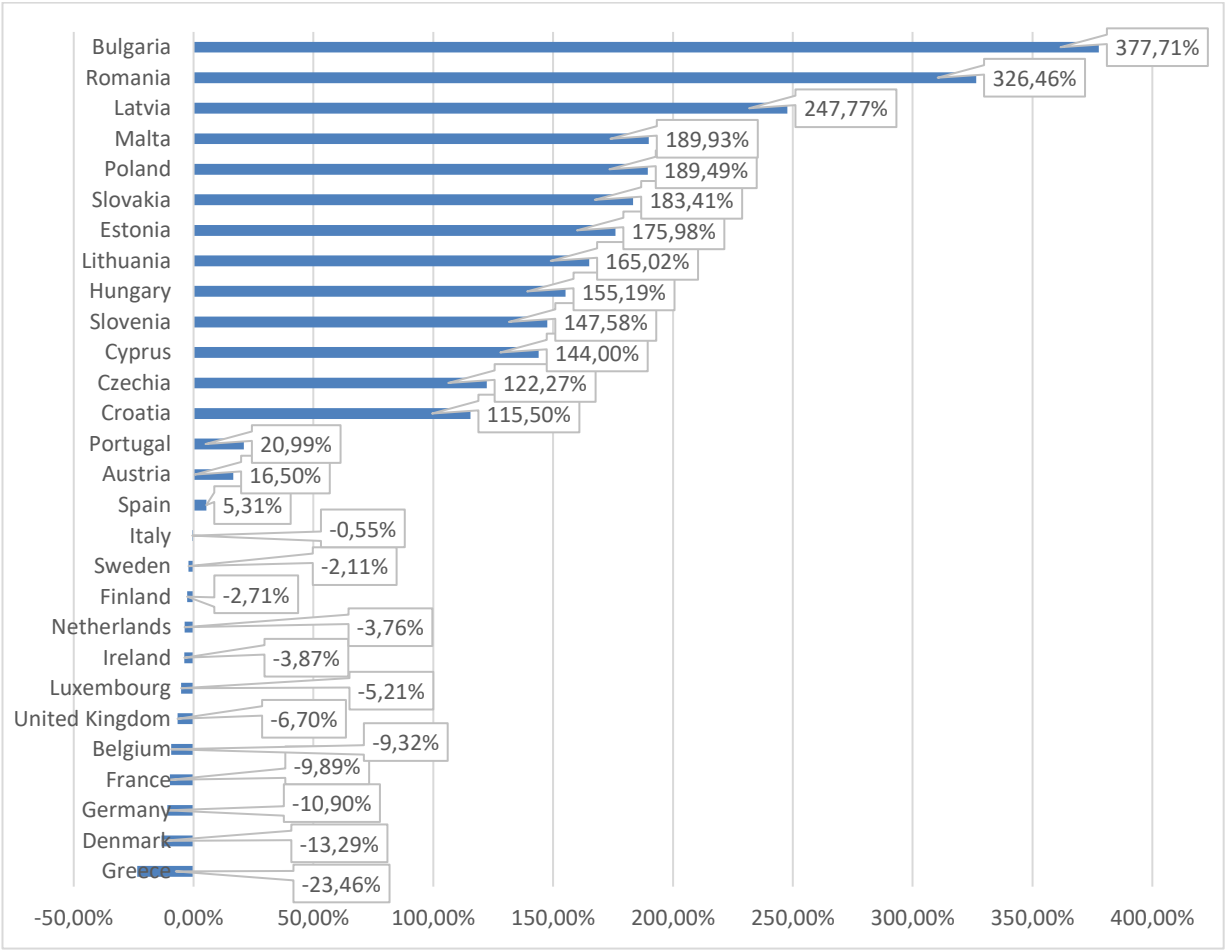


Source: own composition

Figure 15 does not show a significant difference from Figure 14. Although some Member States have swapped places, the main conclusions remain the same. Unfortunately, it cannot be said that (with the exception of Malta and Cyprus) the lower level of support in the new Member States is a temporary phenomenon due to phasing-in alone.

Figure 16 shows the change in the intensity of direct payments:

Figure 16 – Change of direct payment intensity, from 2008 to 2018



Source: own composition

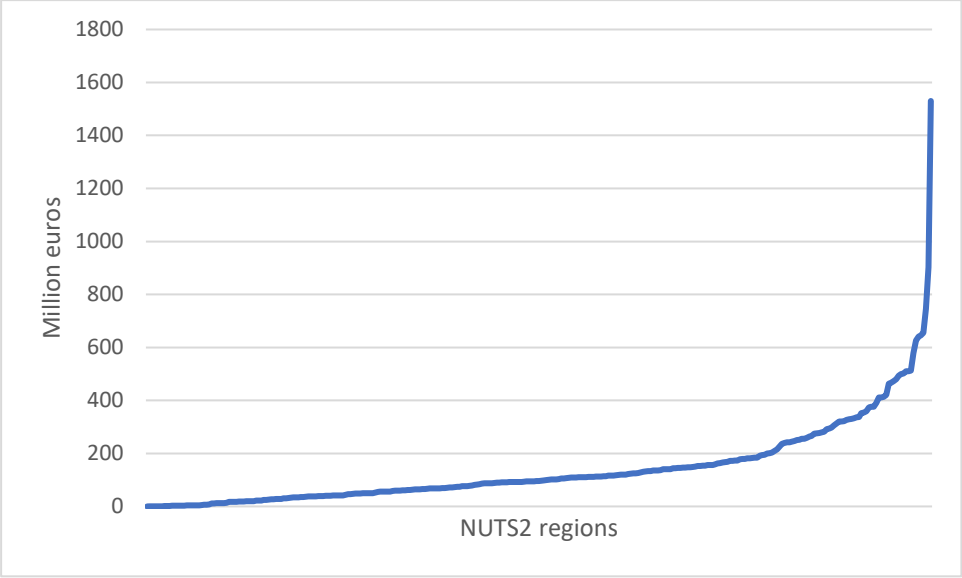
Roughly the same conclusion can be drawn from this figure as from Figure 13; the change in aid intensity was mainly determined by the phasing-in effect during the study period.

5.1.3 The amount of direct payments by region

5.1.3.1 The regional amount of direct payments in absolute terms

The distribution of the average regional amounts of direct payments is illustrated in Figure 17:

Figure 17 – Regional distribution of annual direct payments in 2008-2018 (million €)

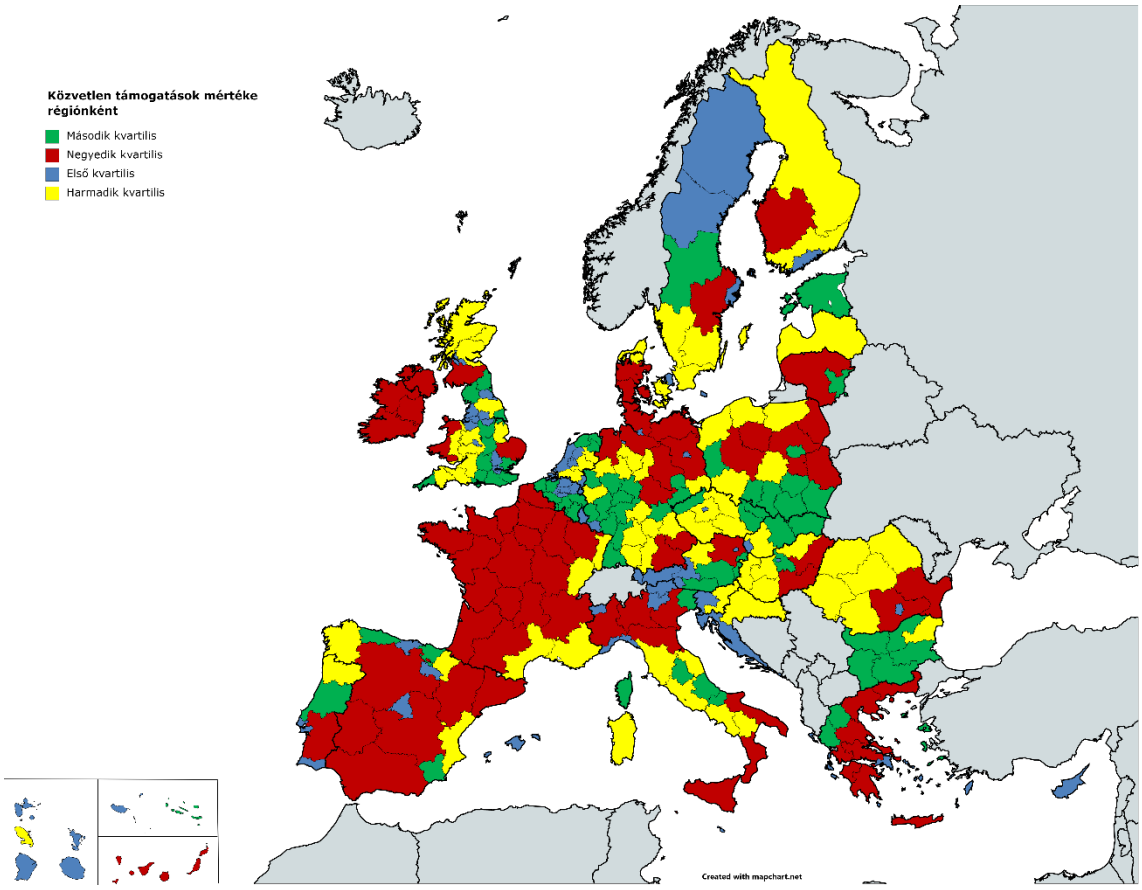


Source: own composition

As we can see, the distribution of direct payments between NUTS2 regions is far from uniform, strongly skewed to the right. The average amount of direct payments

paid regionally each year is € 143.7 million, while the median is € 96.3 million. These inequalities are partly due to the different size and agricultural significance of the regions. Naturally, the NUTS2 region of the Loire Valley receives many times more agricultural support than Inner London. On the map, the distribution can be illustrated as follows:

Figure 18 – Regional distribution of annual direct payments, per quartile



Source: own composition (with the mapchart.net tool)

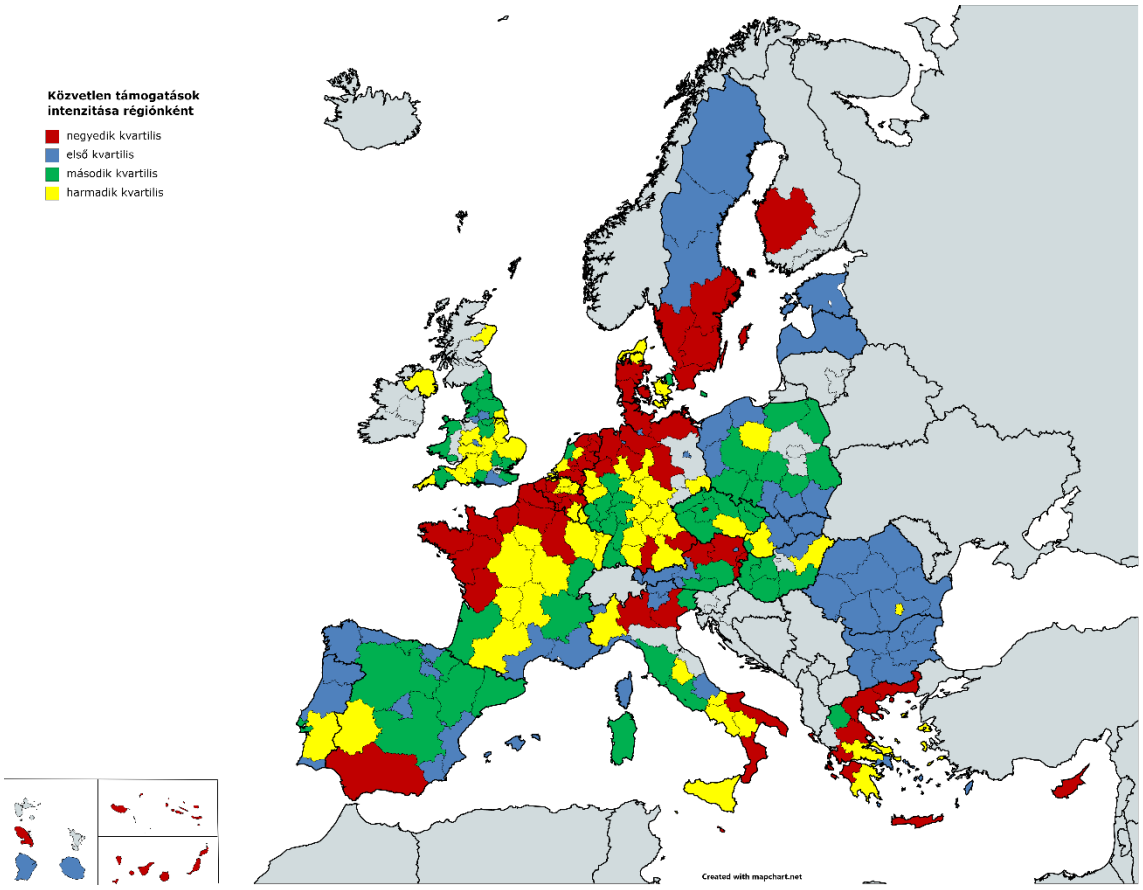
The map shows first quartile (lowest) direct payments in blue, second quartile in green, third quartile in yellow, fourth quartile (highest payments) in red. Most direct support is received by large-area, rural regions, while smaller, urban regions receive essentially less direct support. In addition, almost all regions of some old Member

States (France, Spain, Ireland, and Greece) were able to receive a much higher-than-average direct payment (in the fourth quartile) during the study period.

5.1.3.2 The regional amount of direct payments per hectare

But what can we say about the amount of direct payments per hectare in different regions? Figure 19 illustrates the distribution of direct support intensity regionally:

Figure 19 – Regional distribution of direct payment intensity (€/ha), per quartile



Source: own composition (with the mapchart.net tool)

The colour coding of Figure 19 as the same as that of Figure 18. The distribution of direct payments per hectare between regions is partially different from the distribution of the total amount of aid, but there are also many similarities. The main conclusions are:

- Most regions in Spain received a high level of support in absolute terms during the period under review, but their support intensity (with the exception of Andalusia) was rather below average. The map shows that most of them have large areas, so the incoming subsidies have to be spread over a large production area.
- The situation in the Benelux countries is just the opposite: because of the presence of smaller regions, the amount of direct aid coming to one region is not particularly high in absolute terms, but the aid intensity is.
- Aid intensities are above average in most regions in France, Greece, Denmark, Benelux, Northern and Eastern Germany, Northern Italy, Southern Sweden, Andalusia, and some regions in Austria.
- In contrast, the disadvantages of the new Member States in terms of direct aid per hectare are clear, with the value of the indicator being below average in almost all their regions (except in the case of Malta and Cyprus).

5.2 Results obtained from the examination of the hypotheses

In this chapter, I describe the result of the models detailed in Section 4.5. The regression models were run on version 12.0 of the Stata software package.

5.2.1 Impact of direct payments on agricultural incomes

My first hypothesis is that direct payments increase agricultural income at regional level in the European Union. The results of the models used to test the hypothesis are shown in the following table.

Table 16 – Impact of direct payments on agricultural incomes – model results

Dependent variable: agricultural income	all Member States	old Member States	new Member States
Amount of direct payments	0,325***	0,229***	0,460***
	(0,041)	(0,049)	(0,076)
GPD	-0,535***	-0,493***	-0,242
	(0,125)	(0,169)	(0,318)
Agricultural GVA	1,103***	1,040***	1,324***
	(0,051)	(0,059)	(0,132)
Non-agricultural income	0,513***	0,392**	0,128
	(0,109)	(0,164)	(0,300)
Agricultural salaries	-0,446***	-0,260***	-0,626***
	(0,054)	(0,070)	(0,098)
Constant term	-4,967***	-2,923***	-7,598***
	(0,743)	(0,878)	(1,620)
Number of observations	1578	1300	278
Number of regions	195	163	32
R squared	0,702	0,731	0,701

Source: own composition

The results of the model confirm our hypothesis that direct subsidies increase agricultural income. The demonstration of a positive relationship between direct payments and agricultural income is consistent with Boysen et al. (2016), Ciaian et

al. (2015), Nková et al. (2009), Kozar et al. (2006), Fragoso et al. (2011), Galluzzo (2016, 2018a) and the findings of others. In the model, the coefficient of agricultural value added is positive and the rate of agricultural wages has a negative sign. This is in line with our preliminary expectation: productive activity increases incomes, and wages paid appear as an expense, fundamentally reducing it. Interestingly, the models found a positive relationship between agricultural and non-agricultural incomes, suggesting that the two types of income did not appear as alternatives or substitutes for each other. On the contrary, they increased in parallel in the countries studied.

Studying the value of the coefficient, we can conclude that a one percent increase in the amount of direct payments results in a surplus of agricultural income of about 0.32%. The magnitude of this coefficient is influenced by two factors:

- on the one hand, the share of direct payments in agricultural income;
- on the other hand, the transfer efficiency of direct payments.

In connection with the latter, in line with the results of scientific research to date, we have reason to believe that a surplus of one euro of direct aid will increase the level of agricultural income by less than one euro. This effect can be attributed to the following factors (Thompson et al, 2009):

- In order to maximize support, farmers modify their production decisions, which increases the demand for certain factors of production, therefore the level of associated costs also rise. This effect partially offsets the income-increasing effect of direct payments. It should be noted that decoupled aid is not exempt from this effect either. On the one hand, because these are not completely production-neutral either (Katranidis and Kotakou, 2012). On the other hand, the demand for agricultural land is increased by decoupled direct payments of the CAP, as they are largely distributed on an area basis, i.e. their acquisition is conditional on the possession of land (Patton et al, 2008).
- Direct coupled payments influence farmers' decisions about what crops to produce, so they do not necessarily deal with the production of the most promising goods. This also reduces the income effect of direct payments.

Assuming that a surplus of one euro of direct payments generates one euro of additional agricultural income (i.e. the transfer efficiency of the system is 100%), then, based on a coefficient of 0.32 from the model, the share of direct payments should be 32% of the total income. But in the period under review, the median share of direct payments was 45%. Thus, we can say that the transfer efficiency of direct subsidies is 32/45 = 71%, i.e. a surplus of one euro of direct subsidies results in an average income surplus of 71 cents. The remainder is absorbed by the market-distorting effects of direct payments. Most direct support is leaked primarily in the form of increased land rents by landowners (Klaiber et al, 2017; Kilian et al, 2012; O'Neill 2016).

It is also interesting to note the differences between the old and new Member States. For both the old and the new Member States, a positive correlation was found between the level of agricultural income and direct payments, but the coefficient is higher in the new Member States (0.46 compared to the coefficient of 0.23 in the old Member States). That is, direct payments have a greater impact of 46% on the level of agricultural incomes in the new Member States than in the old ones (23%). This is mainly due to the higher share of direct payments in agricultural income in the new Member States, despite the fact that due to phasing-in, direct payments have not yet reached their maximum level in these Member States during the period under review. Due to the higher income share of direct payments, the functioning of the agricultural sector in the new Member States may be much more dependent on CAP payments than in the old ones. In the studies of Uthes et al. (2011), Lehtonen and Niemi (2018), Jitea et al. (2015), Hanrahan et al. (2012), Rezbova et al. (2012), Manos et al. (2010), we have seen earlier that the more a sector relies on direct payments, the more vulnerable it can become as a result. In such sectors, different ex-ante models have shown that the abolition of direct payments would have marked negative consequences. All in all, we can conclude that direct support increases incomes to a greater extent in the new Member States, but that their high income ratio makes the sector too dependent on aid.

5.2.2 Impact of direct payments on productivity

My second hypothesis is that direct payments increase regional agricultural productivity in the European Union. The results of the models for agricultural labour productivity are detailed in the following table.

Table 17 – Impact of direct payments on labour productivity – model results

Dependent variable: labour productivity	**all Member States**	**old Member States**	**new Member States**
Amount of direct payments	-0,016**	0,012	-0,663**
	(0,008)	(0,009)	(0,028)
Agricultural GVA	0,044***	0,008	0,208***
	(0,015)	(0,017)	(0,040)
Non-agricultural GVA	-0,244***	-0,180***	-0,441***
	(0,033)	(0,041)	(0,089)
Population density	0,379***	0,316***	0,060
	(0,045)	(0,049)	(0,156)
Agricultural GFCF	0,036***	0,049***	0,024
	(0,011)	(0,012)	(0,029)
Agricultural salaries	0,046***	0,110***	0,007
	(0,016)	(0,024)	(0,025)

Income ratio	-0,655***	-1,201***	-0,582
	(0,250)	(0,407)	(0,374)
Convergence region	-2,967***	0,488***	-0,660*
	(0,324)	(0,160)	(0,350)
Constant term	-2,967***	-3,992***	1,740
	(0,324)	(0,374)	(1,079)
Number of observations	1842	1539	303
Number of regions	214	182	32
R squared	0,211	0,232	0,061

Source: own composition

The results of the model contradict our hypothesis: direct subsidies have a negative effect on labour productivity in agriculture. With a 1% increase in direct payments, the labour productivity indicator will deteriorate by 0.016%, which means a lower agricultural value added (GVA) produced by a thousand people. The result is consistent with Zhu et al. (2010, 2012), Marzec and Pisulewski (2017), Mary (2013), Latruffe et al. (2017), which examined the technical efficiency of farms in general, and showed a negative relationship between productivity and the level of direct subsidies.

The negative effects of direct subsidies on efficiency are due to the following factors (Zhu et al, 2012):

- Direct subsidies are a stable source of income, increasing the income realized from agricultural activity, regardless of how technically efficient the production process is. In this way, farmers may become interested in sub-optimal production activities, thus reducing efficiency.

- Due to their stable nature, direct payments distort farmers' risk perceptions and preferences, which affect their production activities and often influence them in a less efficient way.
- Coupled support is particularly disadvantageous in terms of efficiency, as it can encourage farmers to produce goods that are not particularly efficient to produce under the given circumstances.

For all these reasons, direct payments do not encourage farmers to innovate, to develop new technologies, to invest or to restructure economic activities. This way, producers' efficiency efforts decline, and the phenomenon of wastage of factors of production, such as agricultural labour, emerges (Bakucs et al, 2010).

The coefficients of certain control variables were as follows:

- The use of gross fixed assets in agriculture (GFCF) has a positive effect on labour productivity. This is because in the model, the degree of fixed asset accumulation reflects productive investments (such as the purchase of agricultural machinery and equipment) that increase the efficiency of production.
- The level of agricultural wages also has a positive effect on labour productivity. Presumably because the amount of wages paid suggests not only the quantity but also the quality of the labour used, which increases efficiency.
- Convergence regions are less economically developed regions of the Union, so it is not surprising that the model for all regions has shown lower labour productivity.
- As the population density decreases, agricultural labour productivity also decreases. Presumably due to the shrinking labour supply in sparsely populated areas of the Union.

There is an interesting difference between the old and the new Member States. While the regression model run on data from the old Member States did not find a significant correlation between direct payments and labour productivity, a significant negative effect could be identified in the new Member States. Based on these, direct

payments do not seem to affect labour productivity in the old Member States, while they are negatively affected in the new ones.

The results of the model for agricultural land productivity are detailed in the following table.

Table 18 – Impact of direct payments on the productivity of land – model results

Dependent variable: land productivity	all Member States	old Member States	new Member States
Amount of direct payments	-0,081***	-0,069**	-0,040
	(0,018)	(0,028)	(0,037)
Agricultural employment	0,098***	0,081**	-0,012
	(0,029)	(0,034)	(0,069)
Agricultural income	0,114***	0,111***	0,099***
	(0,008)	(0,034)	(0,018)
GDP	3,296***	3,272***	4,033***
	(0,270)	(0,316)	(0,587)
GDP/capita	1,006***	0,977***	0,902***
	(0,073)	(0,087)	(0,233)
Agricultural GFCF	0,277***	0,346***	0,009
	(0,018)	(0,020)	(0,039)
Non-agricultural income	-0,326***	-0,344***	-0,153
	(0,057)	(0,069)	(0,123)

Non-agricultural GVA	-3,562***	-3,613***	-4,089***
	(0,274)	(0,322)	(0,512)
Population density	0,485***	0,537***	0,425***
	(0,040)	(0,043)	(0,126)
Agricultural salaries	0,174***	0,230***	0,103***
	(0,023)	(0,033)	(0,033)
Convergence region	-0,248***	-0,237*	-0,105
	(0,093)	(0,129)	(0,238)
Constant term	-8,528***	-8,297***	-9,507***
	(0,608)	(0,925)	(1,395)
Number of observations	1562	1284	278
Number of regions	193	161	32
R squared	0,535	0,559	0,558

Source: own composition

The results of the model run counter to our original expectation: direct payments have a negative impact on agricultural productivity of arable land. With a 1% increase in direct payments, the land productivity indicator will deteriorate by 0.08%, i.e. the agricultural value added (GVA) per hectare.

The negative link between the productivity of agricultural land and direct payments is because farmers receive payments mainly based on the size of the agricultural land used (although there are also livestock-based direct payments, most payments are calculated on an area basis). To maximize direct support amounts, farmers are

therefore interested in having as much agricultural land as possible for their own use. There are basically two ways to achieve this:

- more land is bought or leased, and market demand for agricultural land increases accordingly (Constantin et al, 2017);
- previously unused land is also brought into agricultural production. In doing so, farmers may also involve marginal, inferior land in production, merely to establish the entitlement to direct payment. The standard of agricultural production in these areas lags behind that of better-quality land, and consequently the productivity decreases.

In addition to the deterioration of the quality of the land, the decrease in productivity may also be exacerbated by the fact that direct subsidies, which can be considered as a more or less guaranteed income element, do not contribute to the efficiency and innovation of agricultural production technology (Zhu et al, 2012).

It is interesting to note that the increased demand for agricultural land may culminate in the phenomenon of "land grabbing" in extreme cases. In this context, investors embark on large-scale land acquisitions, which upset traditional land use conditions and lead to high levels of land concentration, resulting in possible social tensions and environmental problems. "Land grabbing" is a well-known phenomenon in many regions of the world, driven by several market factors. One such factor in Europe is CAP area-based direct support, which contribute to increasing pressures in the agricultural land market (Kay, 2016).

Regarding the coefficient of certain control variables, it can be emphasized that the use of gross fixed assets in agriculture has a positive effect on the productivity of agricultural land. This is consistent with the results of the labour productivity model; fixed asset investment generally aids in technological advancement and thus increases the efficiency of the use of factors of production. The variable representing convergence regions also had a negative coefficient in this model, in line with preliminary theoretical expectations. The impact on land productivity is negative in the old Member States, while not significantly different from zero in the new Member States. Interestingly, this is the opposite of what has been shown in terms of labour productivity. On the one hand, this may be due to the fact that the old Member States have higher levels of direct aid per hectare than the new Member States on

average. Thus, the there is more incentive for farmers to include less productive land in production because the higher amounts of direct support pay off for the possible losses. On the other hand, in the new Member States, there is a larger area of relatively productive land that can be involved in agricultural production (Constantin et al, 2017). Therefore, the inclusion of new land in the new Member States does not lead to the same reduction in productivity as in the old Member States.

At the same time, it is important to stress that, the phenomenon of "land grabbing" is much more prevalent in the new Member States overall than in the old ones because the price of agricultural land is much lower in them (Verhoog and Stoica, 2018). At the same time, the decline in land productivity related to CAP direct payments is still lower in the new Member States.

5.2.3 Impact of direct payments on income inequality and poverty

My third hypothesis is that direct subsidies alleviate regional income inequalities and poverty in the European Union as well.

First, I examined the issue of income inequalities. The issue of income equalization was examined through the share of agricultural income in total income. Income inequality is thus understood here as the difference in the level of agricultural and non-agricultural income (rather than the specifics of the income distribution relationship between individual beneficiaries or the convergence between regions). The results of the panel regression models are summarized in the following table.

Table 19 – Impact of direct payments on income inequality – model results

Dependent variable: income ratio	all Member States	old Member States	new Member States
Amount of direct payments	0,0016**	0,000	0,010**

	(0,0007)	(0,000)	(0,005)
Non-agricultural employment	-0,031***	-0,038***	-0,016
	(0,006)	(0,005)	(0,028)
Non.agricultural GVA	-0,198***	-0,126***	-0,227***
	(0,017)	(0,014)	(0,068)
GDP/capita	-0,015***	-0,023***	-0,006
	(0,005)	(0,004)	(0,023)
GDP	0,225***	0,156***	0,227***
	(0,017)	(0,013)	(0,077)
Agricultural GVA	0,011***	0,008***	0,021***
	(0,001)	(0,001)	(0,007)
Agricultural salaries	-0,015***	-0,004***	-0,026***
	(0,001)	(0,001)	(0,004)
Agricultural employment	0,005***	0,0003	0,012**
	(0,001)	(0,001)	(0,006)
Convergence region	0,014***	0,005	-0,014
	(0,003)	(0,004)	(0,024)
Constant term	0,010	0,125***	-0,053
	(0,035)	(0,031)	(0,130)
Number of observations	1858	1555	303
Number of regions	216	184	32

R squared	0,584	0,454	0,700

Source: own composition

The result is in line with our preliminary expectation that direct payments will help increase the share of agricultural income in total income. A one percent increase in direct payments increases the share of agricultural income within total income by 0.001653%. The average rate in question was 2% during the period considered. Direct payments increase agricultural income more than non-agricultural ones, but the effect is small.

It has long been a fact in the scientific literature that the profitability of the agricultural sector lags behind that of the whole economy. Incidentally, this is a phenomenon not only in the European Union, but in many regions of the world. Accordingly, public agricultural programs worldwide aim to “enable farmers to enjoy an equal standard of living with workers in other industries through increased agricultural income” (Winters, 1989). Despite some conceptual and methodological difficulties, European research also shows that agricultural income lags behind that of other sectors. In 2008, a European Commission study found that per capita farm entrepreneur's income was around 58% of the EU average wage (European Commission, 2010).

We have already seen in the testing of Hypothesis 1 and in the analysis of relevant scientific articles (e.g. in the studies of Boysen et al, 2016; Ciaian et al, 2015; Galluzzo, 2016) that direct subsidies increase agricultural income. In addition, direct subsidies can also have a positive spill-over effect on non-agricultural employment (Rizov et al, 2018), production and income. Partial leakage of subsidies also leads to an increase in non-agricultural incomes (Klaiber et al, 2017; Kilian et al, 2012; O’Neill 2016). The positive sign of the coefficient indicates that the agricultural effect is stronger than the non-agricultural one, so agricultural incomes are moving towards the average income level of the whole economy. However, the value of the coefficient is quite low, so the displacement is only small. Direct payments appear to be effective in moving the profitability of farms from a critically low level, but are not in themselves able to catch up with the average of other sectors.

It is worth noting that the values of the control variables are in line with expectations: an increase in agricultural employment and value added (production) improves the ratio, while an increase in non-agricultural employment and production worsens it. Interestingly, the coefficient of the GDP / capita variable is negative. This may be explained by the fact that regions with a high per capita GDP tend to have a lower share of agricultural income; other sectors are the real driving force of the economy, so the share of agricultural income is lower than other incomes.

A comparison between the old and new Member States shows that the coefficient for direct payments is positive in both models, but not significant for the old Member States. Accordingly, direct payments appear to be more effective in helping the income share of agriculture in new Member States. This can be explained by the fact that in these countries direct support accounts for a larger share of agricultural incomes (and total incomes), so their equalizing effect can be proportionally more pronounced. The finding is consistent with Kapronczai et al. (2014), which found that the income situation of Hungarian farmers improved significantly after EU accession, thanks to CAP subsidies. Similarly, European Commission research has found that the income gap between sectors is narrowing in the new Member States (European Commission, 2010).

In the second part of the third hypothesis, I assumed that direct subsidies alleviate regional poverty in the European Union. I modelled regional poverty as the rate of material and social deprivation from the EU-SILC database. The dependent variable represents the percentage of the population living in material and social deprivation, for which Eurostat has developed a detailed indicator system. In 2016, 16% of the EU population suffered from material and social deprivation (Eurostat, 2017). The result of the model is presented in Table 20:

Table 20 – Impact of direct payments on poverty – model results

Dependent variable: rate of material and social deprivation	**all Member States**	**old Member States**	**new Member States**

Amount of direct payments	-0,668***	-0,171	0,575
	(0,238)	(0,247)	(0,741)
Non-agricultural employment	-22,434***	-26,646***	-11,341**
	(2,396)	(3,124)	(4,623)
Non-agricultural GVA	-22,571***	-9,680	8,193
	(7,225)	(10,582)	(12,135)
GDP/capita	-30,045***	-28,079***	-20,370***
	(2,156)	(2,452)	(4,061)
GDP	48,716***	38,910***	-2,417
	(7,289)	(9,890)	(13,757)
Agricultural GVA	-0,695	-1,648**	2,350*
	(0,606)	(0,715)	(1,255)
Agricultural salaries	-1,468***	2,413***	-2,693***
	(0,483)	(0,798)	(0,662)
Agricultural employment	1,334*	-2,021**	5,132***
	(0,712)	(0,935)	(1,054)
Convergence region	1,723	13,103***	-20,969***
	(1,476)	(2,075)	(4,413)
Constant term	214,050***	176,436***	228,678***
	(14,548)	(18,000)	(23,512)
Number of observations	938	618	320
Number of regions	136	104	32

R squared	0,689	0,737	0,839

Source: own composition

The results of the model confirm our hypothesis: direct subsidies reduce the rate of material and social deprivation. This finding is consistent with a study by Poczta-Wajda (2015) who, using quantitative tools, found that agricultural support systems in different countries of the world are generally successful in alleviating poverty and social deprivation. Czyżewski et al. (2017), based on a comprehensive panel regression study covering all EU Member States, found that CAP subsidies reduce relative deprivation.

I could not analyze the differences between the old and new Member States because the coefficient of the variable is not significant in those separate models. In any case, the value of the coefficient is low in both models, which hints at a very small-magnitude effect.

5.2.4 Convergence of direct payments' impacts between regions

My fourth hypothesis is that regional effects of direct payments will level off in the European Union over time.

5.2.4.1 The convergence of direct payments

First, I examined the dynamics of the distribution of direct subsidies in the period 2008-2018.

Table 21 – Markov transition probability matrix for direct payments between regions, from 2008 to 2018

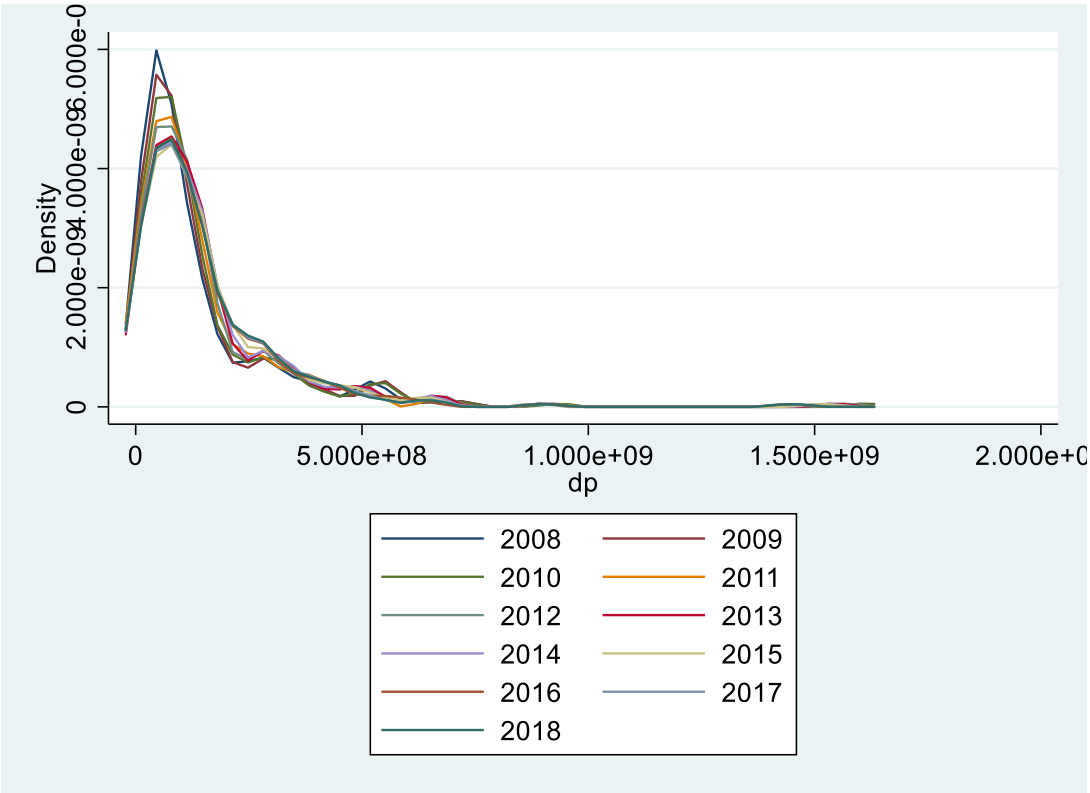
Initial distribution		<75 percent	76-124 percent	>125 percent
159	<75 percent	94%	49%	21%
34	76-124 percent	5%	42%	8%
51	>125 percent	1%	9%	71%

Source: own composition

The above Markov transition probability matrix shows the chances of the amount of direct support of the regions changing from the beginning to the end of the study period. We can see, for example, that 94% of the regions that received less than 75% of the average CAP direct payment at the end of the period (2018) received 75% or less at the beginning of the period (2008) as well. Overall, it cannot be said that the regional level of direct payments has been largely rearranged over the period under review, as there are relatively high probability values in the main diagonal of the matrix. This suggests that the status quo has been maintained. The only significant exception to this finding seems to be that 49% of the regions with an average aid rate of 76-124% in 2018 had access to support amounts below 75% on average. The reason for this is certainly the phasing-in phenomenon, the effect of which I have already illustrated with the help of Figures 13 and 16. The conclusions drawn there are consistent with the values of the transition probability matrix above. We can also state about the matrix that in the examined period it was very uncommon for the level of direct support of a region to decrease because the probability values below the main diagonal are relatively low.

The representation of the Kernel density function confirms that the equalization of the regional level of direct payments was very subdued during the study period.

Figure 20 – Kernel density plot on the regional amount of direct payments



Source: own composition

The shape of the functions showing the distribution of the level of direct payments does not show a significant change over time. In other words, there is at most a small degree of convergence in the level of direct support for European regions during the period under review. In addition, it is worth noting that the strongly asymmetric distribution of the curve is consistent with those previously illustrated in Figure 17. Accordingly, previous studies in the literature (Volkov et al, 2019a; Rumanovska, 2016; Ackrill, 2003) that urge further convergence of direct payments between countries appear to be well-founded.

5.2.4.2 The convergence of agricultural income

The calculations for the convergence of agricultural incomes yielded the following results.

Table 22 – Markov transition probability matrix for regional agricultural income

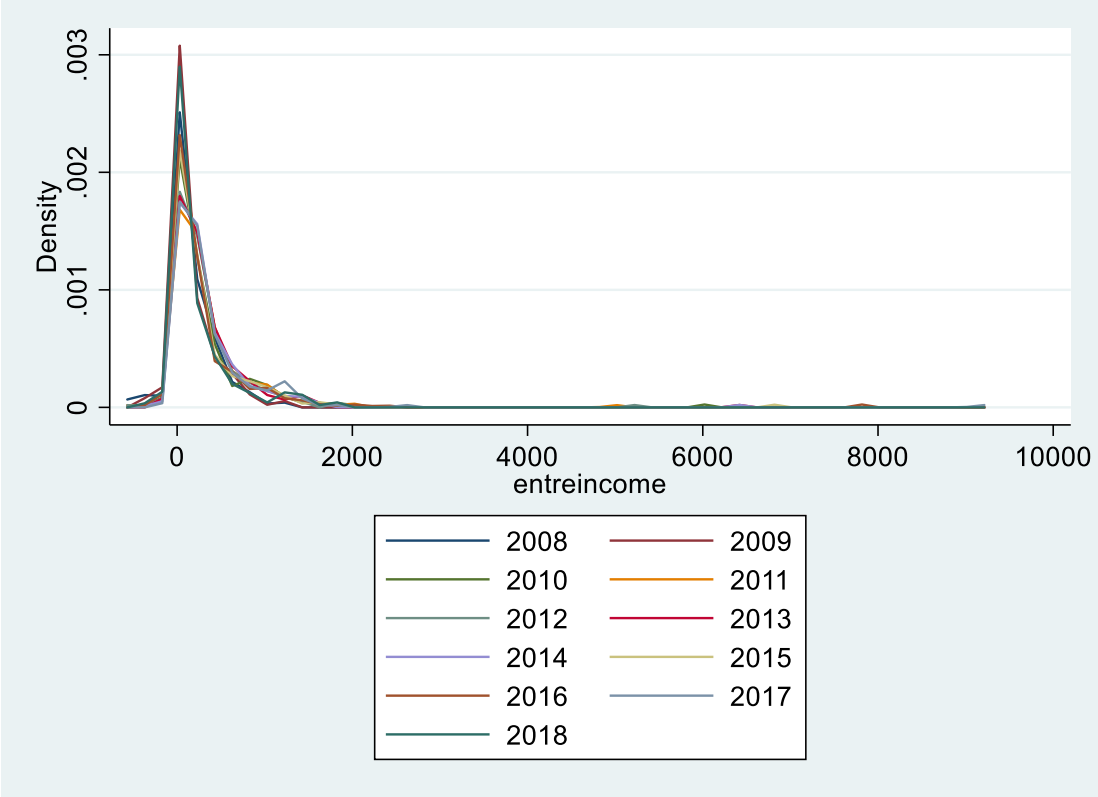
Initial distribution		<75 percent	76-124 percent	>125 percent
178	<75 percent	72%	88%	71%
11	76-124 percent	5%	0%	3%
55	>125 percent	23%	12%	26%

Source: own composition

Table 22 shows that the regions with below-average incomes at the end of the period were mainly those with below-average incomes at the beginning of the study. This is not a surprising finding in itself; it merely confirms the maintenance of the status quo. But the table also shows that at the end of the period, most of the regions with average or above-average incomes were regions that previously had lower agricultural incomes. This rearrangement is presumably due to the emerging regions of the new Member States, where the previously very unfavourable income position of farmers has been able to improve significantly after accession (Kapronczai et al, 2014). This is in line with the statement in section 5.2.1 that direct payments increase agricultural incomes to a greater extent in the new Member States than in the old ones. In this way, some regions could certainly exchange places between different points of the matrix.

But how did this affect the overall picture of the regional distribution of incomes? The representation of the kernel density function is as follows.

Figure 21 – Kernel density plot for regional agricultural income



Source: own composition

We can see that there was no significant change in the overall picture during the study period; the annual density curves are fairly similar. There may have been some rearrangement in terms of income relationships within the sample (relocation between categories for some regions), but the effect is not strong enough to change the distribution of income to a larger extent (Volkov et al, 2019a).

5.2.4.3 Convergence of agricultural employment

Regarding agricultural employment, the methods used do not show any convergence during the study period.

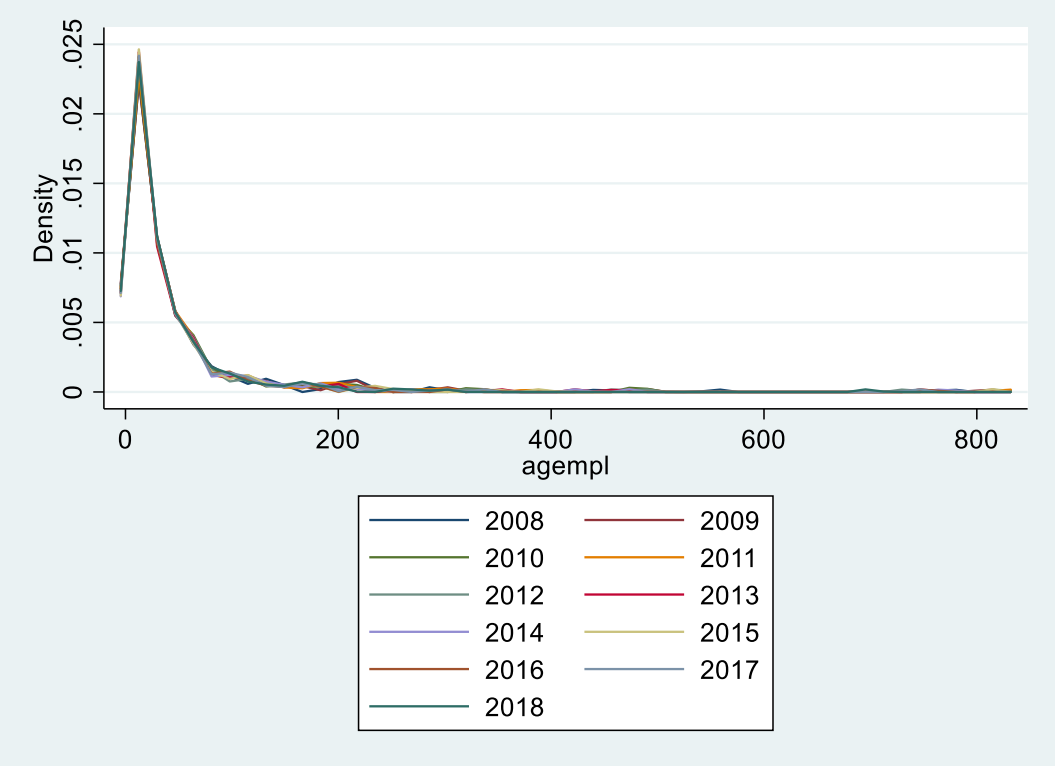
Table 23 – Markov transition probability matrix for regional agricultural employment

Initial distribution		<75 percent	76-124 percent	>125 percent
125	<75 percent	98%	19%	0%
35	76-124 percent	2%	74%	1%
84	>125 percent	0%	7%	99%

Source: own composition

There are extremely low probability values in the matrix outside the main diagonal, which indicates that the initial distribution of farm employment conditions between regions is unchanged.

Figure 22 – Kernel density plot for regional agricultural employment



Source: own composition

The functions overlap almost perfectly; here too we cannot detect a shift in the nature of the distribution of regional agricultural employment over time. This is consistent with Petrick et al. (2011, 2012), who found that direct subsidies do not affect the level of agricultural employment. After decoupling, the impact on the amount of utilized labour was further weakened. Malá et al. (2011) found that labour demand is determined by the level of agricultural production and wages; the level of direct payments cannot influence it.

5.2.4.3 Convergence of agricultural productivity

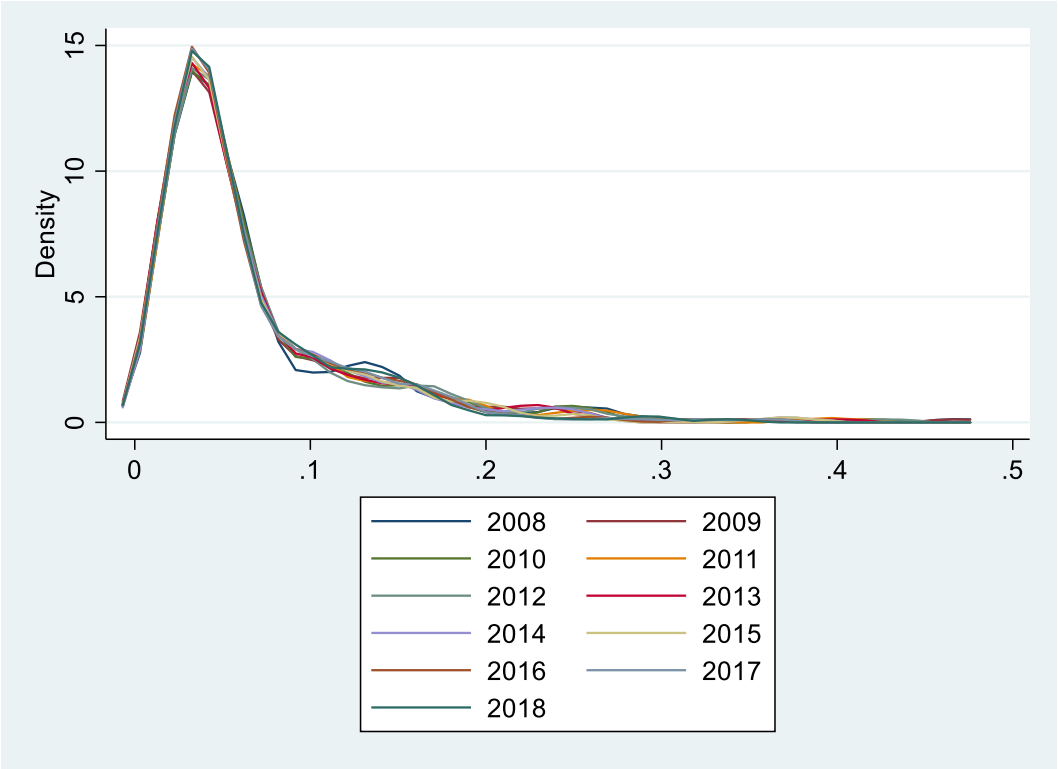
The situation is similar for agricultural labour productivity. The methods used do not indicate a levelling off of labour productivity between regions during the study period.

Table 24 – Markov transition probability matrix for regional agricultural labour productivity

Initial distribution		<75 percent	76-124 percent	>125 percent
110	<75 percent	94%	10%	1%
67	76-124 percent	5%	81%	12%
67	>125 percent	1%	9%	87%

Source: own composition

Figure 23 – Kernel density plot for regional labour productivity



Source: own composition

The above results show that neither of the two methods shows convergence of agricultural labour productivity between regions in the study period. This is in line with the previous finding of section 5.2.2 (direct payments do not have a strong impact on agricultural productivity). I note that Cuerva (2011) and Montresor et al. (2011) arrived at the same conclusion. Wicki (2012) examined the convergence between labour productivity indicators in the agricultural sectors of old and new Member States and also concluded that there was no conversion between these countries in the period 2007-2013. It was found that a major restructuring of farms would be needed to start the equalization of labour productivity.

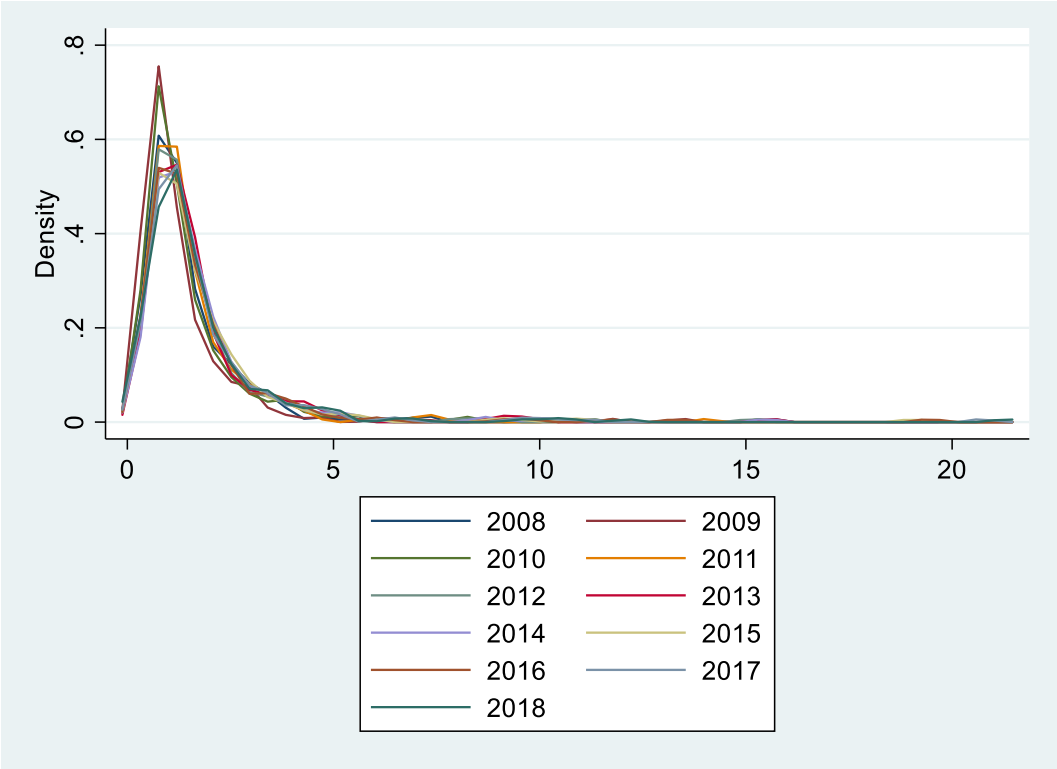
The situation is similar regarding the productivity of agricultural land.

Table 25 – Markov transition probability matrix for regional land productivity

Initial distribution		<75 percent	76-124 percent	>125 percent
134	<75 percent	87%	31%	0%
59	76-124 percent	12%	58%	10%
51	>125 percent	1%	11%	90%

Source: own composition

Figure 24 – Kernel density plot for regional land productivity



Source: own composition

We can state the same as for labour productivity: there is no trace of convergence in agricultural land productivity in the study period. Jitea and Pocol (2014), for example, also came to this conclusion.

5.2.4.4 Convergence of poverty conditions

The convergence of the indicator of material and social deprivation is reported in the Table 26 and Figure 25 below.

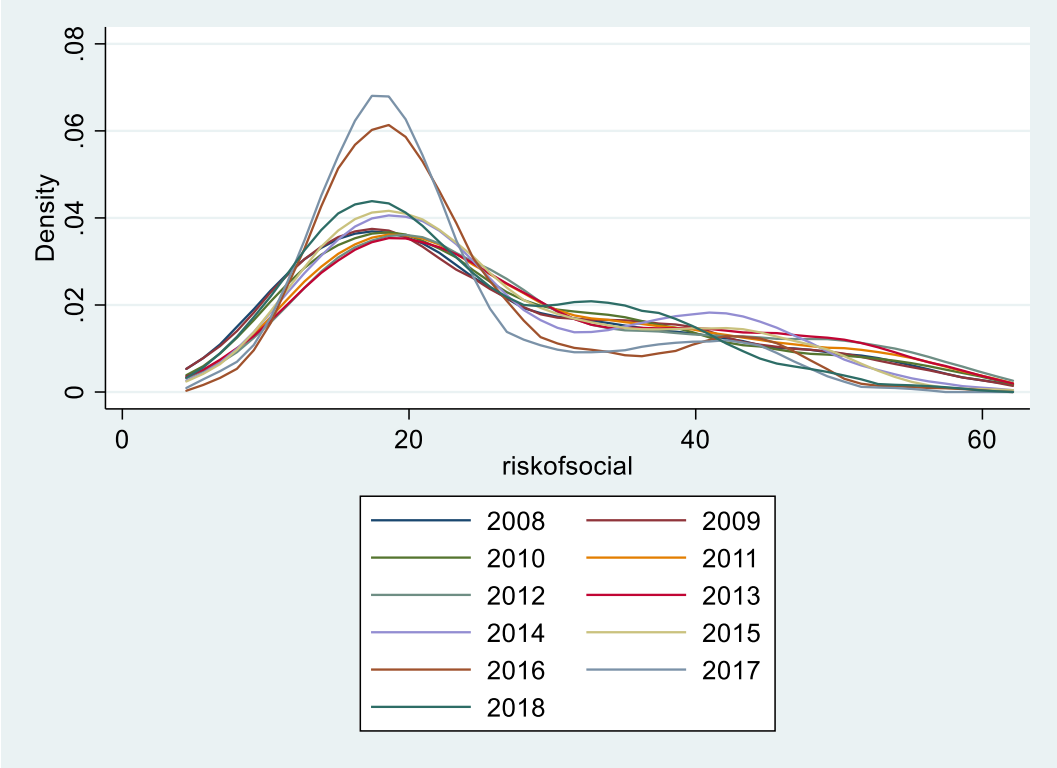
Table 26 – Markov transition probability matrix for regional poverty

Initial distribution		<75 percent	76-124 percent	>125 percent
163	<75 percent	99%	0%	24%
2	76-124 percent	0%	0%	2%
79	>125 percent	1%	100%	74%

Source: own composition

It can be seen from the matrix that there has been some rearrangement in terms of the poverty rate between regions during the period under review. Regions with a poverty rate around the average at the end of the period had an above-average poverty rate at the beginning of the period, i.e. the percentage of people at risk of material deprivation or social exclusion decreased. Irz et al. (2001) found in their theoretical approach a positive correlation between the strengthening of the agricultural sector and the reduction of poverty. Furthermore, as noted in Section 5.2.3, our own modelling also concluded that direct support has certain poverty-reducing role. This is consistent with the above findings on the dynamics of the rearrangement of poverty. However, it should be noted that in addition to CAP subsidies, the value of the poverty indicator is obviously shaped by several different factors as well.

Figure 25 – Kernel density plot for regional poverty



Source: own composition

We can see that the curves representing the distribution of the proportion of the population at risk of poverty become more and more flattened over the study period. This means that regional disparities in terms of poverty decreased, confirming the conclusions drawn from the previous transition probability matrix.

5.3 Summary of research results

In the light of the results obtained, my findings on the research hypotheses are summarized in Table 27.

Table 27 – Summary of research results

Hypothesis	**Hypothesized effect**	**Demonstrated effect**	**Conclusion**
H1 effect of direct payments on income	positive	positive	Accept H1
H2.1 effect of direct payments on labour productivity	positive	negative	Reject H2.1
H2.2 effect of direct payments on land productivity	positive	negative	Reject H2.2
H3.1 effect of direct payments on the ratio of agricultural income in total income	positive	positive	Accept H3.1
H3.2 effect of direct payments on poverty	negative	negative	Accept H3.2
H4 convergence of direct payment effects:			
- income	convergence	partial convergence	Partially accept H4 – income.
- employment	convergence	no convergence	Reject H4 – employment.
- labour productivity	convergence	no convergence	Reject H4 – labour productivity.
- land productivity	convergence	no convergence	Reject H4 – land productivity.
- poverty	convergence	convergence	Accept H4 – poverty,

Source: own composition

My results show that direct payments increase agricultural incomes, especially in new Member States, although the transfer efficiency of direct support is low. They also increase the share of agricultural income in total income, albeit only slightly. In addition, they can contribute to reducing regional poverty. At the same time, efficiency criticisms of direct payments seem justified: they do not promote the efficient use of land and labour, on the contrary, they worsen farm productivity. Direct payments make only a very limited contribution to the economic convergence of European regions. In the examined period, I found signs of equalization only in the field of poverty indicators and partly in relation to agricultural incomes. In terms

of agricultural employment and productivity indicators, there was no evidence of convergence between the regions studied.

6. SUMMARY

This dissertation aimed to analyze certain regional economic effects of CAP direct payments. The research has focused on the economic effects of direct payments in different regions of the European Union; how different the effects are in the old and new Member States; and how these effects are balanced over time between regions. The particularity of the research is that instead of analyzing the data at Member State level, I included the relevant data of the NUTS2 classified regions, which allowed for a more detailed analysis. During the research, I used quantitative, ex-post impact analysis methods, which were based on data of 244 European NUTS2 regions in the period 2008-2018.

I began my research by reviewing the relevant literature on the subject. Regarding the effects on agricultural income, research to date has found that direct payments increase the income levels of their beneficiaries. In the new Member States, direct payments have been particularly successful in improving agricultural income positions since accession. Direct payments have been able to increase the level of agricultural income even though a significant proportion of them have leaked in the form of land rents to landowners. However, the system has been widely criticized for the nature of the distribution of support amounts: 20% of farmers receive 80% of direct payments; the concentration of payments is very high in almost all Member States. Moreover, this disproportion is not limited to the level of support between farmers; there are also large differences in support intensities between some Member States (mainly to the disadvantage of new Member States). In addition, the studies have shown that, although direct payments are a relatively stable part of agricultural income, they have little effect on the development of other income elements; they have no anti-cyclic effect; therefore, their income stabilizing role is limited.

Regarding the effects on agricultural production, based on a review of the literature, CAP direct payments seem to have a production-boosting effect. However, some studies emphasize that the more a sector's production relies on direct payments, the more vulnerable it becomes. This is because direct aids do not play a role in

stimulating economic restructuring; on the contrary, they can preserve old production conditions, which can help stabilize markets in the short term but limit development and competitiveness in the long term. Consequently, direct subsidies can have a negative effect on the productivity and technical efficiency of farms. As a relatively stable source of income, direct payments do not encourage farmers to innovate, develop new technologies, restructure economic activities, or invest.

The literature analysis also identified several other economic effects of direct payments. Based on the studies reviewed, direct support had no effect (neither positive nor negative) on farm investments. Regarding the promotion of agricultural employment, the literature has produced quite ambivalent results. Other articles also drew attention to the trade-distorting effects of subsidies and the impact on traditional land use conditions.

Based on the lessons learned in the scientific literature, and considering the available data and methods, I set up the following research hypotheses:

- H1: Direct payments increase agricultural income at regional level in the European Union.
- H2.1: Direct payments increase the productivity of agricultural labour at regional level.
- H2.2: Direct payments increase the productivity of agricultural land at regional level.
- H3.1: Direct payments reduce income inequalities in the European Union.
- H3.2: Direct payments alleviate regional poverty in the European Union.
- H4: The regional effects of direct payments are balanced in time in the European Union.

I tested the hypotheses with panel regression models; and for the last hypothesis, I used Markov transition probability matrices and Kernel density functions to examine convergence between regions. The calculations were based on a balanced panel database containing data on 244 EU NUTS2 regions for the period 2008-2018 on the level of direct payments, the values of the hypotheses' dependent variables and the values of several control variables.

During the testing of the hypotheses, the effect of direct subsidies on increasing agricultural income was confirmed. A percentage increase in the level of direct payments, all other factors being unchanged, resulted in a surplus of around 0.32% in agricultural income in the study period. Considering the share of direct payments in total agricultural income, this means that the transfer efficiency of direct payments is 71%, i.e. a direct support surplus of one euro results in an average income surplus of 71 cents. The remainder is absorbed by the economic (side) effects of direct subsidies, such as rising input prices. Most direct payments are leaked in the form of increased land rents by landowners.

Contrary to our hypothesis about labour productivity, the results showed that direct subsidies have a negative effect on labour productivity in agriculture. The result is in line with the findings of previous research, which generally showed a negative relationship between productivity and the level of direct support. The effect is mainly due to the fact that direct payments are a stable source of income, increasing the income realized from agricultural activity, regardless of how technically efficient the production process is. Direct payments therefore do not encourage farmers to innovate and reorganize their economic activities, so factors of production, such as agricultural labour, may be used in an irrational, wasteful way.

Likewise, I identified a negative correlation between direct payments and agricultural land productivity. This is due to the fact that farmers receive payments primarily on the basis of the size of the agricultural land used, which increases the demand for land. Farmers buy or rent more land, or involve marginal, less productive land in production, leading to reduced efficiency.

Regarding the hypothesis of income inequality, I wondered whether direct subsidies increase the share of agricultural income in total income. The result, in line with Hypothesis 3.1, suggests that direct payments help to increase the share of agricultural income in total income, but the effect is small. Based on these, direct subsidies appear to be effective in moving the profitability of farms from a critically low level but are not in themselves able to catch up with the average of other sectors.

Poverty studies have confirmed my hypothesis that direct payments reduce the incidence of material deprivation and social exclusion. This finding is consistent with the results of previous research that found that agricultural support systems in different countries of the world are generally successful in alleviating poverty and social deprivation.

With regard to the comparison of the economic effects of CAP direct payments between old and new Member States, it can generally be stated that in the new Member States modelling has generally shown a stronger, more pronounced effect than in the old Member States (except for land productivity). For example, in terms of the impact on agricultural incomes, the coefficient for direct payments is much higher in new Member States (0.46 compared to 0.23 in the old Member States). This is mainly due to the higher share of direct payments in agricultural income in new Member States. The situation is similar when examining the share of agricultural income in total income or labour productivity. The more a sector relies on direct payments, the more vulnerable it can become as a result. All in all, we can conclude that direct payments increase incomes to a greater extent in the new Member States, but due to their high ratio in agricultural income, the sector may become too dependent on support payments.

In connection with Hypothesis 4, I came to the conclusion that there is some convergence in the distribution of agricultural incomes and poverty indicators over the study period among the regions included in the analysis. This rearrangement is presumably due to the emerging regions of the new Member States, where the previously very unfavourable income position of farmers has been able to improve significantly since accession. Consequently, poverty-related conditions in some regions could also improve. I did not find any signs of an equalization process in the extent of agricultural employment or in relation to land and labour productivity indicators in the study period. Accordingly, it can be stated that direct payments could not generate a significant realignment between the regions concerning these factors. Therefore, the cohesion objectives of the Common Agricultural Policy, according to which decision-makers seek to encourage regional economic and social convergence, is only partially achieved through direct payments.

In the light of the above findings, what recommendation could be made for the future of direct payments? I suggest that consideration be given to extending the use of insurance premium subsidies and income stabilization instruments. Both are present in the current CAP toolbox, but their use is not yet widespread, and their financial weight is relatively low compared to other support schemes. Under the former, part of the premium for (market or public) agricultural insurance is reimbursed to farmers, thus encouraging efforts to reduce the inherent risks of agricultural activity. The latter compensates for the decrease in farmers' income from agriculture, compared to the average of a fixed, past period of a few years. These measures could, in my view, provide an appropriate response to three important criticisms of the current system of direct payments.

On the one hand, they could improve the income stabilizing effect of the support system, which is one of the main declared objectives of the CAP. The income stabilizing effect of direct payments is severely limited. It is true that they are a relatively stable part of agricultural income, but they have only a limited ability to reduce its fluctuations. Due to their fixed nature, they are not able to react to the seasonal, cyclical effects, changes in supply and demand, and market shocks, which have a strong effect in agriculture. Moreover, they have little effect on the level of other income elements. To make agricultural incomes predictable and stable over time, more targeted economic intervention is needed, which could be achieved in the proposed way.

On the other hand, they could improve the transfer efficiency of the support system. It has been found by previous scientific research, as well as by this dissertation, that a significant share of direct support amounts ultimately goes to landowners, not farmers. The closer the link between a given support measure and the agricultural land, the greater the leakage of the aid amount in the form of land rents and prices. Most direct payments are paid on an area basis, the main condition for receiving them being the possession of agricultural land. However, the proposed insurance and income stabilization schemes are linked to agricultural land in a more indirect way, the level of support depends on a number of other factors of production and market conditions. Thus, there would presumably be less leakage of Community funds from farmers to non-agricultural actors.

Thirdly, they could respond to the criticisms of productivity and technological efficiency made against direct subsidies. Direct support is a fixed income supplement for the farmer, regardless of how efficiently they handle resources and production factors, and how much they encourage technological development and innovation. However, in the framework of income stabilization instruments, if the beneficiary was able to operate more efficiently and productively in the previous period, thereby increasing their agricultural income, the increased income reference would be the basis for support in the future. In this way, farmers could become more interested in efficient operation and increasing competitiveness.

In addition to the above arguments, insurance and income stabilization instruments are not directly linked to agricultural production, so their acceptance with world trading partners may be easier. Furthermore, they would presumably be better received by the EU public than the current system of direct payments.

A limitation of the present research was that it focused mainly on direct aids, other forms of CAP support and EU regional and cohesion policy grants did not fall within the scope of the research. The range of data collected was also a limiting factor; additional economic data could further complete the presented quantitative analysis. In addition, there are a number of other methodological approaches besides the one I have used, which would undoubtedly bring interesting results in terms of the economic effects of direct payments.

Due to the above, and also because of the importance of the Common Agricultural Policy, there is room for further research on this topic. It would be worthwhile to study in more detail the phenomenon of subsidy leakage and its extent with the help of data on land prices and land rents. Another interesting research question may be how the structure of farms and production influences the impact mechanism of direct subsidies. The current ex-post analysis could be complemented by the use of ex-ante models or qualitative research methods. In addition, future research could focus on modelling a modified direct support system that can respond to the main scientific criticisms of the current system.

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Appendix 1 – List of NUTS2 regions under analysis

NUTS2 code	Name of NUTS2 region
AT11	Burgenland (AT)
AT12	Niederösterreich
AT13	Wien
AT21	Kärnten
AT22	Steiermark
AT31	Oberösterreich
AT32	Salzburg
AT33	Tirol
AT34	Vorarlberg
BE10	Région de Bruxelles-Capitale / Brussels Hoofdstedelijk Gewest
BE21	Prov. Antwerpen
BE22	Prov. Limburg (BE)
BE23	Prov. Oost-Vlaanderen
BE24	Prov. Vlaams-Brabant
BE25	Prov. West-Vlaanderen
BE31	Prov. Brabant wallon
BE32	Prov. Hainaut
BE33	Prov. Liège
BE34	Prov. Luxembourg (BE)
BE35	Prov. Namur
BG31	Severozapaden
BG32	Severen tsentralen
BG33	Severoiztochen
BG34	Yugoiztochen
BG41	Yugozapaden
BG42	Yuzhen tsentralen
CY00	Kypros

CZ01	Praha
CZ02	Střední Cechy
CZ03	Jihozápad
CZ04	Severozápad
CZ05	Severovýchod
CZ06	Jihovýchod
CZ07	Střední Morava
CZ08	Moravskoslezsko
DE11	Stuttgart
DE12	Karlsruhe
DE13	Freiburg
DE14	Tübingen
DE21	Oberbayern
DE22	Niederbayern
DE23	Oberpfalz
DE24	Oberfranken
DE25	Mittelfranken
DE26	Unterfranken
DE27	Schwaben
DE30	Berlin
DE50	Bremen
DE60	Hamburg
DE71	Darmstadt
DE72	Gießen
DE73	Kassel
DE80	Mecklenburg-Vorpommern
DE91	Braunschweig
DE92	Hannover
DE93	Lüneburg
DE94	Weser-Ems
DEA1	Düsseldorf
DEA2	Köln
DEA3	Münster

DEA4	Detmold
DEA5	Arnsberg
DEB1	Koblenz
DEB2	Trier
DEB3	Rheinhessen-Pfalz
DEC0	Saarland
DED2	Dresden
DEE0	Sachsen-Anhalt
DEF0	Schleswig-Holstein
DEG0	Thüringen
DK01	Hovedstaden
DK02	Sjælland
DK03	Syddanmark
DK04	Midtjylland
DK05	Nordjylland
EE00	Eesti
EL30	Attiki
EL41	Voreio Aigaio
EL42	Notio Aigaio
EL43	Kriti
EL51	Anatoliki Makedonia, Thraki
EL52	Kentriki Makedonia
EL53	Dytiki Makedonia
EL61	Thessalia
EL62	Ionia Nisia
EL63	Dytiki Ellada
EL64	Sterea Ellada
EL65	Peloponnisos
ES11	Galicia
ES12	Principado de Asturias
ES13	Cantabria
ES21	País Vasco
ES22	Comunidad Foral de Navarra

ES23	La Rioja
ES24	Aragón
ES30	Comunidad de Madrid
ES41	Castilla y León
ES42	Castilla-la Mancha
ES43	Extremadura
ES51	Cataluña
ES52	Comunidad Valenciana
ES53	Illes Balears
ES61	Andalucía
ES62	Región de Murcia
ES70	Canarias (ES)
FI19	Länsi-Suomi
FI20	Åland
FR10	Île de France
FRB0	Centre - Val de Loire
FRC1	Bourgogne
FRC2	Franche-Comté
FRD1	Basse-Normandie
FRD2	Haute-Normandie
FRE1	Nord-Pas-de-Calais
FRE2	Picardie
FRF1	Alsace
FRF2	Champagne-Ardenne
FRF3	Lorraine
FRG0	Pays-de-la-Loire
FRH0	Bretagne
FRI1	Aquitaine
FRI2	Limousin
FRI3	Poitou-Charentes
FRJ1	Languedoc-Roussillon
FRJ2	Midi-Pyrénées
FRK1	Auvergne

FRK2	Rhône-Alpes
FRL0	Provence-Alpes-Côte d'Azur
FRM0	Corse
FRY2	Martinique
FRY3	Guyane
FRY4	La Réunion
HU21	Közép-Dunántúl
HU22	Nyugat-Dunántúl
HU23	Dél-Dunántúl
HU31	Észak-Magyarország
HU32	Észak-Alföld
HU33	Dél-Alföld
ITC1	Piemonte
ITC2	Valle d'Aosta/Vallée d'Aoste
ITC3	Liguria
ITC4	Lombardia
ITF1	Abruzzo
ITF2	Molise
ITF3	Campania
ITF4	Puglia
ITF5	Basilicata
ITF6	Calabria
ITG1	Sicilia
ITG2	Sardegna
ITH1	Provincia Autonoma di Bolzano/Bozen
ITH2	Provincia Autonoma di Trento
ITH3	Veneto
ITH4	Friuli-Venezia Giulia
ITI1	Toscana
ITI2	Umbria
ITI4	Lazio
LU00	Luxembourg
LV00	Latvija

MT00	Malta
NL11	Groningen
NL12	Friesland (NL)
NL13	Drenthe
NL21	Overijssel
NL22	Gelderland
NL23	Flevoland
NL31	Utrecht
NL32	Noord-Holland
NL33	Zuid-Holland
NL34	Zeeland
NL41	Noord-Brabant
NL42	Limburg (NL)
PL21	Malopolskie
PL22	Slaskie
PL41	Wielkopolskie
PL42	Zachodniopomorskie
PL43	Lubuskie
PL51	Dolnoslaskie
PL52	Opolskie
PL61	Kujawsko-Pomorskie
PL62	Warminsko-Mazurskie
PL63	Pomorskie
PL71	Lódzkie
PL72	Swietokrzyskie
PL81	Lubelskie
PL82	Podkarpackie
PL84	Podlaskie
PT11	Norte
PT15	Algarve
PT16	Centro (PT)
PT17	Área Metropolitana de Lisboa
PT18	Alentejo

PT20	Região Autónoma dos Açores (PT)
PT30	Região Autónoma da Madeira (PT)
RO11	Nord-Vest
RO12	Centru
RO21	Nord-Est
RO22	Sud-Est
RO31	Sud - Muntenia
RO32	Bucuresti - Ilfov
RO41	Sud-Vest Oltenia
RO42	Vest
SE11	Stockholm
SE12	Östra Mellansverige
SE21	Småland med öarna
SE22	Sydsverige
SE23	Västsverige
SE31	Norra Mellansverige
SE32	Mellersta Norrland
SE33	Övre Norrland
SK01	Bratislavský kraj
SK02	Západné Slovensko
SK03	Stredné Slovensko
SK04	Východné Slovensko
UKC1	Tees Valley and Durham
UKC2	Northumberland and Tyne and Wear
UKD1	Cumbria
UKD3	Greater Manchester
UKD4	Lancashire
UKE1	East Yorkshire and Northern Lincolnshire
UKE2	North Yorkshire
UKE3	South Yorkshire
UKE4	West Yorkshire
UKF1	Derbyshire and Nottinghamshire
UKF2	Leicestershire, Rutland and Northamptonshire

UKF3	Lincolnshire
UKG1	Herefordshire, Worcestershire and Warwickshire
UKG2	Shropshire and Staffordshire
UKG3	West Midlands
UKH1	East Anglia
UKH2	Bedfordshire and Hertfordshire
UKH3	Essex
UKJ1	Berkshire, Buckinghamshire and Oxfordshire
UKJ2	Surrey, East and West Sussex
UKJ3	Hampshire and Isle of Wight
UKJ4	Kent
UKK1	Gloucestershire, Wiltshire and Bristol/Bath area
UKK2	Dorset and Somerset
UKK3	Cornwall and Isles of Scilly
UKK4	Devon
UKL1	West Wales and The Valleys
UKL2	East Wales
UKM5	North Eastern Scotland
UKN0	Northern Ireland (UK)