EU-wide Distributional Effects of EU Direct Payments Harmonization analyzed with CAPRI

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Abstract

In this paper we analyse distributional effects of scenarios depicting different levels of harmonisation of CAP direct payments between farms and regions in the EU. We use the CAPRI-Farm type (FT) model, an extension of CAPRI by farm type models capturing farm heterogeneity across the EU. Its main advantage in the context of our analysis is that it allows to depict in high detail the current implementation of the Single Farm Payment. We analyze three flat-rate scenarios. The first assumes a per hectare payment at Nuts1 level, the second a flat-rate at MS and the third a flat-rate at EU level. The value of re-distributed payments vary strongly between the three flat-rate systems. The Nuts1 and MS flat-rate induce a substantial relocation of payments between farms and regions in EU-15 but have a minor effect in EU-10. More significant impact has the EU flat-rate. In the EU-15 almost all farms loose, whereas in EU-10 almost all farms gain from an EU wide flat-rate. In particular big gainers in EU-10 are mixed crops-livestock, general field cropping-mixed, cereals oilseeds as well as small farms. In EU-15 large farms and farms specialised in dairying, mixed crops-livestock, general field cropping-mixed and olives loose substantially in absolute and relative terms. Our conservative estimates indicate that the flat-rate payments could redistribute up to 8.2 billion €. The rental income effects, approximated by dual effects, reveal a reduction in landowners' returns for all flat-rate scenarios and across all sectors and farm sizes. The rent change varies between -11 €/ha and -358 €/ha (-5% and -40%), depending on farm type and scenario.

Key words: distributional effects, SPS, flat-rate payment, CAP reform, farm level model, CAPRI farm type layer

JEL: Q11, Q12, Q18

Introduction

One of the issues most intensively discussed in the current debate on the post-2013 CAP are the large differences of direct payments per ha between Member States (MS), reflecting past coupled supports and thus, to a larger extent, past productivity levels[1]. Especially farmers in more productive regions in EU15 receive much higher direct payments than their counterparts from Eastern European New MS, but also compared to more extensive regions in the EU15. Additionally, the New MS received only a part of the full value of eligible payments in the first ten years after the accession. For example, according to the Farm Accountancy Data Network (FADN) for 2008, the decoupled payments vary for most New MS between 40 and 150 EUR/ha, whereas farmers in most Old MS get much higher payments between 150 and 400 EUR/ha. Even once the premiums are fully implemented, larger discrepancies will remain. According to the EU, the rationale behind the SPS is to "allow farmers freedom to produce to market demand; promote environmentally and economically sustainable farming; simplify CAP application for farmers and administrators; and to strengthen the EU's position in WTO agricultural trade negotiations" (EUROPEAN COMMISSION 2010a). It is questionable if the

[1] The authors are solely responsible for the content of the paper. The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

current regional and farm type differences in payment rates can be motivated from these aims. Thus, not surprisingly, a strong demand for a more equitable allocation of the CAP support comes from the New MS. According to lobby groups, farmers in the New MS relative to farmers in the Old MS are disadvantaged for two reasons: because of lower productivity levels and the lower support which further reduces their competitiveness. In fact, the most recent European Commission communication on the future CAP, "The CAP towards 2020", proposes to introduce more equity in the distribution of direct payments between Member States and a substantial change in their design (EUROPEAN COMMISSION 2010b). To what extent SFP premium rates will be harmonized is not known yet and still subject to negotiations between MS. The objective of this study is to simulate potential re-distributional impacts of more equitable direct payment schemes. We consider three scenarios: flat-rate payment per hectare at Nuts1 level, at MS and at EU level (Table 1). The first scenario represents a relatively low equalization of payments between EU regions, but removes differentiation between farm types where the historical model is implemented. On the other hand, the third scenario represents an upper bound for the distributional effects because it considers the same per hectare payment to all farms in whole EU.

We apply the CAPRI-FT model, an extension of CAPRI (GOCHT & BRITZ 2011) which dis-aggregates the standard Nuts2 regional resolution of the supply models in CAPRI further to farm type models, capturing farm heterogeneity in terms of farm specialization and farm size across all EU regions and MS. The advantage of the CAPRI-FT model compared to other similar models (e.g. AROPAj system, BARANGER et al. 2008; FARMIS, OFFERMANN et al. 2005; LUAM, JONES et al. 1995) is that it represents comprehensively all major farm types in the EU and links farm level behaviour with output and input market price responses. This unique feature of endogenous prices at the farm level in the CAPRI-FT allows to capture not only pure re-distributional effects of direct payments (such as in VELAZQUEZ 2008) but it can also capture market impacts of the flat-rate system. The application of the farm model is also motivated by the fact that EU direct payments are farm specific support. Compared to models implemented at regional level, the CAPRI-FT captures distributional effects regarding income and payments between farms, regions and MS. The CAPRI-FT considerably reduces the aggregation bias in this respect and improves the reliability of results. The next sections focus on the model and its extension for modelling EU-wide farm type supply response, describes the scenario and then discusses the results. The paper concludes in the last section.

The model

CAPRI is a comparative static partial equilibrium model for the agricultural sector developed for policy impact assessment of the CAP and trade policies from global to regional scale (BRITZ & WITZKE 2008). It is solved by iteratively linking its supply and market modules. The market module is a global spatial Multi-Commodity Model using 28 trade blocs and 60 countries. Based on the Armington approach (ARMINGTON, 1969) products are differentiated by origin, enabling bilateral trade flows and the explicit implementation of bilateral as well as multilateral trade instruments, including tariff-rate quotas. The supply module is composed of separate, regional, non-linear programming models. The regional programming models are based on a model template assuming profit-maximizing behaviour under technological constraints, most importantly in animal feeding and fertilization, but also constraints on inputs and outputs such as young animal, land balances and set-aside. In addition, the models contain econometrically estimated behavioural functions (JANSSON & HECKELEI, 2011). The supply module currently covers all individual MS within EU27, Norway, Turkey and the Western

Balkans broken down to about 280 administrative regions (Nomenclature of Territorial Units for Statistics (NUTS) 2 level) and more than 50 agricultural products.

The shift from market to direct payment support with the 1992 reform and the introduction of farm specific premium schemes (e.g. stocking densities, decoupled payments) motivated the development of a tools more disaggregated at farm level. Hence, a farm type module was developed in the CAPRI model. For EU Member States, with the exemption of Bulgaria and Romania due to missing data, the regions are further disaggregated to 1,823 farm-type regional models, each representing the aggregate of a particular type and size of farming enterprise in a NUTS II region (GOCHT & BRITZ, 2011; GOCHT, 2010). The farm-type layer enables modelling the implementations of the SFP as implemented in different MS in a very detailed and explicit manner. It is sourced mainly from the Farm Structure Survey (FSS) data, complemented by FADN. Differently from competing approaches such as AROPAJ which are based solely on the FADN data. The CAPRI-FT defines the production programs of the farm type models based on the FSS, which mainly reports data on production activities by region and farm type. Most importantly is the fact that the FSS is a full survey and to a large extent harmonized with regional agricultural statistics, whereas FADN provides only a representative sample for the most important farm types. The FADN provides mostly complementary information about yields and inputs.

Farm Types in the CAPRI-FT

The farm type supply module in CAPRI consists of independent non-linear programming models for each farm type aggregated over all activities belonging to the farm in a specific Nuts2 region. The farm models, similar to the regional ones, capture the premiums paid under the CAP in high detail; include NPK balances and a module with feeding activities covering nutrient requirements of animals. Prices are endogenously determined by the market module in an iterative process solved between the supply and market modules until convergence is reached (BRITZ 2008). Grass, silage and manure are assumed to be non-tradable and receive internal prices based on their substitution value and opportunity costs. The CAPRI-FT module represents total regional production as well as input and primary factor use. Each single farm type is characterized along two dimensions given: by production specialization and the “economic size class” represented in terms of “European size units” (ESU) (Table 3). We consider 13 production specializations and 3 farm sizes. The choice of farm specializations and farm size classes is a compromise between model complexity, robustness of the result, reporting limitations and data constraints. In particular, the data confidentiality issues and reduced average weights, when using more disaggregated types on regional aggregates, motivated our choice of the classification. Additionally, a higher farm disaggregation, would increase complexity of the results without adding value in terms robustness of the modelling results. Similar arguments hold for our choice of the three economic farm size classes (ESC), defined as ESC 1 with less than 16 ESU, ESC 2 with ESU between 16 and 100, and ESC 3 with more than 100 ESU. In total, this leads to 39 farm types (=13*3) defined by production specialization and farm size. All possible farm types are listed in Table 3. From these possible set of 39 farm types, maximum 9 most important farms are selected in each Nuts2 region. The farm selection is based on two criteria: Livestock Units (LU) and Utilised Agricultural Area (UAA). Both criteria were given equal priority (equal weights) in determining the importance of farm types. The restriction to maximal ten farm groups (the 9 most important ones plus the residual farm) per region is based on storage and computing time considerations, but also by the aim to keep database and model outputs at a manageable size for quality control and result analysis.

An important factor determining the income distributional effects of an area based flat-rate payment is how land use is modelled. Recently, CAPRI has been extended with land supply- and transformation functions allowing for endogenous supply of arable land and grass land in response to changed marginal land rents. The behavioural functions (publication in preparation) were parameterized based on the results of VAN MEIJL et al. (2006) and GOLUB et al. (2006), but adapted to the regional resolution of CAPRI based on GIS analysis and simulation experiments with the Dyna-CLUE model (VERBURG et al., 2010). But still, CAPRI does not model land markets in the sense that actual rent prices for agricultural land are modelled. However, dual values from land use per farm type can be used as an approximation of such effects.

The Baseline

The baseline is used as counterfactual situation for the scenario analysis. For the current study the baseline is calibrated for the year 2020 based on trend estimation, ex-post data and expert ex-ante projections. The Base year for which the official statistics is available is 2005. Here we provide a short description on how the baseline is constructed. For a detailed description we refer to BRITZ and WITZKE (2008). The CAPRI baseline construction relies on the combination of three information sources: the AGLINK baseline, analysis of historical trends and expert information (BLANCO FONSECA et al 2010). The most relevant information is a preliminary AGLINK baseline prepared for this project at the IPTS in October 2009. It includes recent assumptions on macroeconomic drivers such as GDP, population, oil price and the evolution of the CAP.

Because the regional resolution of the AGLINK is limited to EU aggregates, the baseline includes also national expert information. Furthermore, the baseline includes specific expert information from the PRIMES energy model for the bio-fuel sector and expert projections from the seed manufacturer KWS on the sugar sector. Trends and expert information combined might be inconsistent in some aspect and might violate basic technical constraints such as crop area and/or young animal balances. As a consequence all expert information is usually provided in the form of target values. For consistency reasons (such as production quantity equalization with activity levels and yields), deviations from target values are allowed but to avoid large deviations they are penalized during the model estimation process. Another important input into the baseline constructions is detailed information on policy measures. The policy assumptions complete the definition of the CAPRI baseline and together with other data form the basis for parameter calibration.

In the baseline for the farm types, it would be desirable to distinguish two different developments in the baseline projections for farm types: the *production development* (crops rotation and animal densities) and the *number of farms* for each farm type. This is not possible with the current version, whereas the development of a structural change module, which will allow addressing these shortcomings, is foreseen within the medium-term development of the system. The main constraint for this development are missing time series data for the evaluation of farm groups and their production structures to build trend forecasts and expectations for baseline routines. For this reason, a different approach has been chosen in the current version. The target values are obtained by multiplying the base period value of a farm type variable of interest (e.g. hectares for the crop, herd sizes, input-output coefficients) by the ratio between the projected value at Nuts2 level and the Nuts2 base year value of the variable. Table 4 shows the number of farms, UAA and livestock units for all farm types included in the CAPRI-FT (distinguished by *production specialization* and *economic size class*) for EU25, EU15 and EU10 in the baseline 2020. For example, the table shows that farms *specialized cereals, oilseeds & protein crops* are represented in EU25 by 245 supply models across EU25, together representing 32.2 million hectares of UAA, 2.1 million LU. Note the number of farms presented in the tables belong to the base year 2005..

The Scenarios

In this paper we simulate three scenarios, implemented in 2020 and using the current baseline, i.e. Health check implementation in 2020 including dairy quota abolishment and full introduction of the SFP in the new Member States as the reference point. The first scenario is a regional flat-rate introduced at Nuts1 level. The payment rate is defined by keeping the total value of decoupled payments which farm types inside each Nuts 1 received unchanged in the baseline. In a similar way, the second and the third scenarios simulate a flat-rate payment at MS and EU level, respectively, while maintaining the total value of decoupled payments fixed (Table 1).

We consider the Single Payment Scheme (SPS) and Single Area Payment Scheme (SAPS), remaining decoupled payment and some important elements of pillar II (agri-env schemes, LFA, Natura 2000 payments to farm lands). The SPS is implemented in all Old MS as well as in Slovenia and Malta. It was introduced by the 2003 CAP reform starting from 2005. The EU Member States (MS) could choose between three SPS implementation models: *the historical model, the regional model*, and *the hybrid model* (see Table 2). Under the historical model, the SPS payment is farm-specific and maps basically the coupled support the farm has received in the "reference" period into a per ha payment. Under the regional model, an equal per hectare payment is granted to all farms in the region, i.e. it is a flat-rate payment which can be differentiated by arable and grass lands. The hybrid model is a combination of the historical and regional models, it has two versions: a static and a dynamic one.[2] The SAPS is open only to New MS, offers a flat rate premium on per hectare at MS level.

Moving from the existing system to flat rates will cause a re-distribution of payments and thus income distributional effects between farms and regions. As allocative effects of changing decoupled payment rates are low, both suggested by literature (cf. BHASKAR and BEGHIN 2009) and from our simulation results, we concentrate in the paper on distributional effects. In countries with a historical or hybrid SPS, farm types have different values for their premium rights, depending on the production structure and the value of coupled payments in the reference period. This implies that all three scenarios will induce redistribution of payments for historical and hybrid models. The SAPS is a standard area based subsidy of equal hectare payments given to all farms within the MS. This implies that the redistribution of payments will not occur in the Nuts1 and the MS flat-rate scenarios. Whereas the EU flat-rate scenario with an uniform payment across EU-27 can induce redistribution. Beside payments

[2] If a Member State implements the dynamic hybrid model, then there is a gradual move to a fully regional model. For example, Finland and Germany implemented the dynamic hybrid model which will be gradually replaced by the regional model. On the other hand, if a MS implements the static hybrid model, then the regional and the historical shares do not change over time (e.g. Denmark, Luxemburg, and Sweden).

redistribution, implementing the SPS differently might also impact market prices due to allocative responses when agricultural land use shrinks. Due to the feedback with the CAPRI market model, the distributional effects include changes in market prices. Further on, based on assumptions regarding the capitalization of the SFP into land rents, we try to hint also at eventual impacts on rent payments.

In all three scenarios we assume application of the SPS in all MS including those which implement the SAPS in the baseline. Under the SPS, farm's payments depend on the number of entitlements and eligible hectares (s)he possesses. More precisely, the entitlement is an asset owned by farmers. The entitlements can be activated if they are accompanied by an equal number of hectares.[3] We assume non-tradable entitlements in the CAPRI model. Generally, the SFP entitlements are tradable. However, due to regulatory constraints and market imperfections (e.g. policy risk, credit market imperfections, lease restrictions, and taxes), the tradability of entitlements may be constrained in reality. The preliminary evidence partially supports this assumption.

According to Ciaian, Kancs and Swinnen (2010) the price of entitlements is underpriced likely due to the market imperfections and regulations.[4] The entitlement endowment importantly affects land markets, particularly land rents. The land market effects crucially depend on the ratio of entitlements to UAA. The SPS affects land marginal profitability if farm's UAA is smaller than the number of entitlements. In this case the SPS will stimulate land markets and will push the land rents up. However, if the UAA overshoots the number of entitlements (which could be due to the higher flat-rate payment) then the marginal hectare will not receive the flat rate premium, implying that the SPS will not affect land markets.[5]

The implementation of the three scenarios in CAPRI-FT is based on the data collected from legal documents. Total value of decoupled payments (SPS, SAPS) in a given region/MS or at the EU level determines the payment ceiling available for the flat-rate system. The total SPS value is divided by the number of entitlements to obtain a per hectare Nuts1, MS or EU level flat-rate payment. For each farm type entitlement number is determined by the reference land use in the case of MS-15 and Slovenia and Malta and from the baseline land use in 2020 in the case of New MS which implement the SAPS (Table 2).

Results: Rental effects and redistribution of payments between farms and regions

Table 5 presents the re-distribution of decoupled payments between different EU regions. The first column shows the total value of decoupled payments in the baseline, followed by the total value of payments received in the three considered scenarios. The absolute and the percentage change of payments relative to the baseline are presented in the remaining

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[3] According to EU regulations, the eligible area for activation of payment entitlements includes arable land and permanent pasture except areas under permanent crops, forests or areas used for nonagricultural activities. In the CAPRI-FT we assume that all agricultural area is eligible for the SPS.

[4] CIAIAN, KANCS and SWINNEN (2010) report entailment sale prices between 1.0 and 3.0 times the entitlement face value which is significantly less than the theoretically predicted price between 4.4 and 20 depending on the interest rate and the duration of the SPS.

[5] See KILIAN and SALHOFER (2008), COURLEUX, et al. (2008) and CIAIAN and SWINNEN (2006) for more details on the theoretical issues related to modelling the SPS.

columns. In the baseline total value of payments is 42.8 billion € in EU-27. As expected, the value of redistributed payments for all three scenarios does not change significantly at EU-27 level (-0.7 % for Nuts1, -0.6% for MS and -1% for MS flat-rate scenarios). These changes are caused by shrinking agricultural land cover in farm types and regions where per hectare support drops, whereas an expansion is bounded by existing entitlements. For the **Nuts1** and **MS flat-rate** scenarios, the changes at EU-15, EU-10 and BuR are also relatively small, reflecting the fact that the SPS implementation in the baseline already had in many regions flattened out the hectare payment rates. For the **EU flat-rate** scenario around 3.15 billion € are re-distributed between EU-15, EU-10 and BuR. The simulations reveal that EU-15 will lose -3.4 billion €, whereas EU-10 and BuR gain around 1 billion € and 1.94 billion €, respectively.

These relatively small changes at the rather aggregate regional level hide however far larger changes at the level of individual farm types. Table 6 summarises the re-distributional effects for farm types in the EU-25.[6] The absolute level of re-distributed payments grows with the increase of the regional scope of the implementation (Nuts1-MS-EU). In relative terms, the biggest gainers are s*heep, goat & other grazing livestock*, *vineyards* and *residual* farm types. Both types receive in average low level of initial support per ha. On the other hand, the biggest losers are *olives* and *permanent crops mixed* because of high level of initial support. Other farms that loose are farms specialised in *cereals*, *oilseeds & protein crop*, *general field cropping*, *dairy farms* and *mixed crops & livestock* as well as big farms. Small farms (*less than 16 ESU)* are little affected by the flat-rate, whereas big farm loose.

Table 7 further disaggregates the results for EU-15 and EU-10. For the **Nuts1** and **MS** flat-rate scenarios the value of redistributed payments is almost zero in the EU-10 because of the SAPS which is also based on a flat-rate payment system. The exception is Slovenia and Malta who implement the historical SPS, hence small effects are observed in the EU-10. In EU-15 the redistributional effects are significant because under the SPS payments vary strongly between farms. The re-distribution effects for EU-15 are similar to the figures reported in Table 6.

Important regional redistributive effects occur in the **EU** flat-rate scenario. In EU-15 almost all farms loose (except for s*heep, goat & other grazing livestock*, *vineyards* and *fruit and citrus fruit*), whereas in EU-10 almost all farms gain (except for *permanent crops mixed*). In Table 5 we have reported that around 1 billion € were channelled to EU-10. In particular big gainers in EU-10 are *mixed crops & livestock* (200 million €), *general field & mixed cropping* (180 million €), *cereals oilseeds* (+ 155 million €) and *dairy farms* (+ 56 million €). Overall farm types with size class *less than 16 ESU* benefit with 610 million € in EU-10. In EU-15 large farms and farms specialised in *dairying*, *mixed crops & livestock*, *general field & mixed cropping*, *olives* and *cereals oilseeds* loose substantially in absolute and relative terms.

Table 6 and Table 7 have presented the net re-distributional effects across farm types. However, these aggregate changes might hide sizable re-distribution effects insides the farm type groups. To gain more insights, Figure 1 reports re-distribution of decoupled payments for

[6] Bulgaria and Romania have no farm types in the CAPRI-FT hence are not included in tables where results for farm types are presented.

all 1824 farms (normalized to percentage terms, 1=100%) available in the CAPRI-FT, i.e. excluding Romania and Bulgaria. The figure shows the change in decoupled payments relative to the baseline in million € (left panel) and in € per hectare (right panel) for EU-25. The left panel is calculated by sorting ascending all farms according to the size of re-distributed amount and cumulating the amount until all farms (100%) are reported. For the last farm the cumulated value represents the value of redistributed payments for all farms as reported in Table 5 for the corresponding scenario. The right panel shows the changes in hectare value relative to the baseline, which as before is sorted in ascending order.

The Figure 1 shows that in the **Nuts1** scenario almost 30% of all farm types lose payments, around 30 % are not affected (mainly new MS and Germany, which already implement a flat-rate scheme in the baseline) and the remaining 30 % gain payments. Overall (the end point of the curve in Figure 1), farms lose 320 million € (which corresponds to the figure reported in Table 5 for EU-25) in this scenario. It can also be observed that for the other two sub-scenarios (**MS** and **EU** flat-rate), *first* the net re-distribution loss is higher (end points) and *second* more farms are affected by the re-distribution of decoupled payments (the horizontal part of the curve is smaller, for EU flat-rate it almost disappears). Particularly, the EU flat-rate sub-scenario reveals that almost 40% of the farm types lose, whereas 60% gain payments.

The right panel complements the left panel by presenting the distribution on hectare basis. The area between the *x*-axis and the distribution function shows the total amount of re-distributed payments. When the line is below zero it represent a loss and when it is above zero it represents a gain in payments.

Table 8 shows re-distributional effects between MS. By definition the re-distributional effects between the MS for the **Nuts1** and **MS flat-rate** scenarios does not occur in EU-10, with exception of Slovenia and Malta due to the historical SPS in these two countries. For MS in EU-15 the effects are non-zero. This is mainly driven by the endogenous land use adjustment caused by the equalization of payments at regional and MS level in the Nuts1 and MS flat-rate scenarios, respectively.

The **EU flat-rate scenario** has considerable impact on the re-distribution of payments particularly between the Old and New MS. In percentage terms, the Netherland (-48%), Belgium (-45%) and Greece (-44%) experience the highest relative losses, whereas highest gains are observed in new MS which large land endowments – Latvia (+149 %), Romania (+92%), Estonia (+82%), Bulgaria (+55%) and Lithuania (+54). However, also Portugal (+43%) and Spain (+35%) gain considerable amount of additional payments through a EU wide flat-rate scheme because of low initial support level.

Germany loses in absolute terms 1.35 billion € (-26%). France contributes with 0.984 (-12.8%) billion € to the EU re-distribution amount followed by Italy with 0.964 billion € (-23%) and Greece with 0.957 billion € (-44%). Whereas Spain with 1.760 billion € (+35%), Poland with 0.585 billion € (+19.2%), Portugal with 0.257 billion € (+43%), Latvia with 0.218 billion € (+148%) and Lithuania with 0.204 billion € (+54%) gain from the re-distribution of payments in the EU flat-rate scenario. To summarize the total effects, Table 9 presents the net re-distributed payments at different regional levels.[7] The amount of re-distributed payments increases from scenario **Nuts1** to scenario **EU flat-rate** and it decreases from farm level to the MS level. The payments reallocated between farms increase from 9% of the total budget (3.7 billion €) in the **Nuts1** scenario to 19% (8.2 billion €) in the **EU flat-rate** scenario. Similar figures for payments reallocated between MS increase from 1% (0.3 billion €) in the **Nuts1** scenario to 13% (5.5 billion €) in the **EU flat-rate** scenario.

Table 10 summarises the approximated rental effects for farm types in the EU-25. Similar to previous tables, the first column shows the value of land rent (€/ha) in the baseline, followed by the value of land rent in the three considered scenarios. The absolute and the percentage change of rents relative to the baseline are presented in the remaining columns. All flat-rate scenarios induce a reduction in rental rates across all sectors and farm sizes and as expected the rent reduction is positively correlated with the payment change. The absolute level of rental rate reduction tends to increase with the increase of the regional scope of the implementation (Nuts1-MS-EU). The rent change varies between -11 €/ha and -325 €/ha (-5% and -31%) for the Nuts1, -14 €/ha and -358 €/ha (-6% and -40%) for the MS and between -21 €/ha and -305 €/ha (-10% and -38%) for the EU scenario. In relative terms, the biggest reduction in the land rent experience *olives*, *permanent crops mixed*, and *horticulture* farm types. The smallest reduction is observed for *mixed livestock holdings*, s*heep, goat & other grazing livestock,* and *cereals, oilseed & protein crops*. All farm sizes are affected almost equally by all three flat-rate schemes and the variation in rent change across farm sizes and scenarios is smaller than the variation between sectors. The rent change varies between -28 €/ha and -60 €/ha (-10% and -21%).

Conclusions

The CAPRI-FT model is able to capture in high detail the different payment schemes of the CAP including different implementation of decoupled payments, while capturing price feedback based on the linkage to the CAPRI market module. The introduction of a flat-rate system of payments changes the level of decoupled payment per hectare, affects land rents and thus induces land use changes which in turn impact agricultural output and input markets.

Given that the SPS and SAPS payments are based on the reference period support level paid under the Agenda 2000, the value of payment reflect to a larger extent the productivity of the regions and their specialization. Regions and farms with high historical yields and larger animal stocking densities show also higher payments rates. This is particularly the case for the historical and hybrid SPS models. Implementation of a uniform flat-rate at Nuts1/MS level but in particular the EU wide flat-rate tend to decrease the support in more productive regions and increase it in marginal regions. The scenario analysis has also show that there are strong heterogeneous impacts of the introduction of the flat-rate among farm types. In particular strongly affected are big farms and *dairying*, *mixed crops & livestock*, *general field & mixed cropping*, *olives, cereals oilseeds,* and *permanent crops.* Small farms tend to be little affected by the introduction of the flat-rate both in the Old and the New MS.

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[7] Note that the value of re-distributed payments reported in Table 9 is a conservative estimate because the CAPRI-FT model aggregates farms by Nuts2 region by keeping maximum 10 aggregated farms per one region.

All flat-rate scenarios induce a reduction in rental rates across all sectors and farm sizes and the reduction is positively correlated with the payment change. In relative terms, the biggest reduction in the land rent experience farms specialised in *olives*, *permanent crops mixed*, and *horticulture*. The smallest rental reduction is observed *for mixed livestock holdings*, *sheep, goat & other grazing livestock,* and *cereals, oilseed & protein crops*. All farm sizes are affected almost equally by all three flat-rate schemes and the variation in rent change across farm sizes and scenarios is smaller than the variation between sectors.

The results in this paper must be analysed in the context of modelling assumption within the CAPRI-FT. The use of template models which are identical in the mathematical structure and express differences between farm type and regions solely by different parameters alone might fall short of capturing the full diversity of farming systems in Europe. In particular, this is the case for the evaluation of policy measures which impact on farm management decisions, such as manure handling, feeding practices and farm demand behaviour, but eventually less important for the SFP as a flat rate scheme. The relatively simple representation of agricultural technology in the CAPRI compared to approaches parameterised based on biophysical models understates the farm response to natural and local constraints. However, the current structure of the approach gives a good balance between increased detail of represented farm types and robustness of the model results.

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Tables and Figures

Table 1: Overview sub-scenarios for the direct payment scenario

Scenario	Description	Assumptions
Nuts1 flat-rate	regional SPS at Nuts 1 region	Countries with no Nuts1 region, regional flat is applied to Nuts 2
MS flat-rate	regional SPS across the country	
EU flat-rate	227 € per hectare across EU-27	

The EU flat-rate amount (227 €/ha) is calculated by dividing the total EU-27 SPS payments by UAA in the baseline

Table 2: Single Payment Scheme implementation (baseline & scenarios)

	CAPRI Baseline 2020			Direct payment Scenario
Countries	regional SPS	historic SPS	Hybrid premium farm	flat-rate SPS
EU-15				
Belgium		x		x
Denmark	x	x	x	x
Germany	x			x
Austria		x		x
Netherlands		x		x
France		x		x
Portugal		x		x
Spain		x		x
Greece		x		x
Italy		x		x
Ireland		x		x
Finland	x	x	x	x
Sweden	x	x	x	x
United Kingdom	x	x	x	x

	CAPRI Baseline 2020		Direct payment Scenario	
Countries	SAPS	regional SPS	SAPS	regional SPS
EU-10				
Czech Republic	x		x	
Estonia	x		x	
Hungary	x		x	
Lithuania	x		x	
Latvia	x		x	
Poland	x		x	
Slovenia		x		x
Slovak Republic	x		x	
Cyprus	x		x	
Malta		x		x

Table 3: Type of farming and economic size classes for the farm types

Type of farming	abbr.	Economic size class	abbr.
Specialist cereals, oilseed and protein crops	13	< 16 ESU	ESC 1
General field cropping + Mixed cropping	14_60	≥ 16 ≤ 100 ESU	ESC 2
Specialist horticulture	20	> 100 ESU	ESC 3
Specialist vineyards	31		
Specialist fruit and citrus fruit	32		
Specialist olives	33		
Various permanent crops combined	34		
Specialist dairying	41		
Specialist cattle + dairying rearing, fattening	42_43		
Sheep, goats and other grazing livestock	44		
Specialist granivores	50		
Mixed livestock holdings	70		
Mixed crops-livestock	80		

Table 4: Indicators for farm types in CAPRI-FT for baseline 2005

	EU-27				EU-15				EU-10			
	No. of Farm Supply Models	Used Agricultural Area	No. of Holdings	Livestock Units	No. of Farm Supply Models	Used Agricultural Area	No. of Holdings	Livestock Units	No. of Farm Supply Models	Used Agricultural Area	No. of Holdings	Livestock Units
Type of Farming	No.		Million		No.		Million		No.		Million	
Cereals, oilseed & protein crops	245	32,2	1,	2,1	173	25,6	,7	1,9	72	6,6	,3	,2
General field & mixed cropping	251	20,	1,8	3,7	201	14,9	,9	3,	50	5,1	,9	,7
Dairying	235	16,9	,5	19,4	205	15,3	,4	18,5	30	1,7	,2	,9
Cattle- Dairying -rearing & fattening	149	11,7	,4	12,	133	10,9	,3	11,6	16	,8	,1	,4
Sheep, goats and other grazing livestock	172	15,5	,5	6,9	159	15,1	,4	6,8	13	,4	,	,1
Granivores	118	2,7	,2	10,2	76	1,6	,	8,8	42	1,	,2	1,4
Mixed livestock holdings	85	5,1	,5	5,1	53	1,8	,1	3,	32	3,3	,4	2,1
Mixed crops-livestock	276	19,8	,9	13,	214	12,7	,3	11,	62	7,1	,7	2,
Vineyards	22	1,4	,2	,1	21	1,4	,2	,1	1	,	,	,
Fruit and citrus fruit	13	,6	,2	,1	13	,6	,2	,1		,	,	,
Olives	25	3,6	,8	,2	25	3,6	,8	,2		,	,	,
Permanent crops mixed	16	,5	,2	,1	15	,5	,2	,1	1	,	,	,
Horticulture	5	,1	,	,	5	,1	,	,		,	,	,
Economic Size Class												
<=16 ESU	486	36,6	6,	11,9	342	22,4	3,2	7,5	144	14,2	2,7	4,4
>16 and <=100 ESU	673	56,8	1,	36,2	602	52,8	1,	34,7	71	3,9	,1	1,5
>100 ESU	453	36,6	,2	24,8	349	28,8	,2	22,8	104	7,8	,	2,
Residual	211	39,5	3,1	16,6	170	32,7	2,3	15,	41	6,8	,8	1,5
Total	1.823	169,4	10,2	89,4	1.463	136,7	6,6	80,	360	32,8	3,6	9,4

Table 5: Re-distribution of decoupled payments at diff. EU aggregates

	EU-Aggregates and MS									
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU	Nuts1	MS	EU
EU-Aggregate		Million €				change to Baseline			% to Baseline	
EU-27	42,834	42,514	42,590	42,404	-320	-244	-430.	-.7	-.6	-1.
EU-25	40,419	40,099	40,175	38,047	-320	-244	-2,371.6	-.8	-.6	-5.9
EU-15	33,953	33,635	33,710	30,587	-318	-243	-3,365.5	-.9	-.7	-9.9
EU-10	6,466	6,464	6,464	7,460	-1	-1	994.	.	.	15.4
Bulgaria	755	755	755	1,170	0	0	415.1	.	.	55.
Romania	1,660	1,661	1,661	3,187	0	0	1,526.4	.	.	91.9

Table 6: Re-distribution of dec. payments for EU-25 aggregate farm types

	EU-25						
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU
Type of Farming	Million €		change to Baseline			% to Baseline	
Cereals, oilseed & protein crops	7,729	-403	-615	-502.9	-5.2	-8.	-6.5
General field & mixed cropping	5,423	-415	-580	-963.	-7.7	-10.7	-17.8
Dairying	4,912	-471	-588	-1,133.1	-9.6	-12.	-23.1
Cattle- Dairying -rearing & fattening	2,898	124	339	-255.2	4.3	11.7	-8.8
Sheep, goats and other grazing livestock	2,539	560	1,168	971.2	22.1	46.	38.3
Granivores	640	-37	-37	-41.7	-5.7	-5.7	-6.5
Mixed livestock holdings	1,131	-34	-38	19.4	-3.	-3.4	1.7
Mixed crops-livestock	5,141	-296	-362	-718.9	-5.8	-7.	-14.
Vineyards	196	111	186	112.5	56.6	95.	57.5
Fruit and citrus fruit	106	9	-20	15.9	8.9	-18.6	15.
Olives	1,650	-592	-833	-871.7	-35.9	-50.5	-52.8
Permanent crops mixed	203	-51	-58	-86.9	-25.1	-28.8	-42.9
Horticulture	12	4	1	-.6	29.7	4.3	-5.
Economic Size Class							
<=16 ESU	8,041	-133	101	198.2	-1.7	1.3	2.5
>16 and <=100 ESU	14,471	-803	-582	-1,769.1	-5.6	-4.	-12.2
>100 ESU	10,068	-555	-956	-1,884.1	-5.5	-9.5	-18.7
Residual	7,839	1,171	1,193	1,083.4	14.9	15.2	13.8

Table 7: Re-distribution of dec. payments EU-15/10 aggregated farm types

				EU-15			
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU
Type of Farming	Million €	change to Baseline			% to Baseline		
Cereals, oilseed & protein crops	6,375	-403	-615	-657.8	-6.3	-9.6	-10.3
General field & mixed cropping	4,450	-421	-586	-1,143.	-9.5	-13.2	-25.7
Dairying	4,590	-446	-564	-1,189.4	-9.7	-12.3	-25.9
Cattle- Dairying -rearing & fattening	2,724	124	340	-261.7	4.6	12.5	-9.6
Sheep, goats and other grazing livestock	2,478	556	1,163	951.	22.4	47.	38.4
Granivores	431	-33	-33	-62.1	-7.6	-7.6	-14.4
Mixed livestock holdings	501	-36	-40	-110.9	-7.2	-8.1	-22.1
Mixed crops-livestock	3,728	-300	-366	-919.4	-8.	-9.8	-24.7
Vineyards	195	111	186	112.4	56.7	95.3	57.6
Fruit and citrus fruit	106	9	-20	15.9	8.9	-18.6	15.
Olives	1,650	-592	-833	-871.7	-35.9	-50.5	-52.8
Permanent crops mixed	198	-51	-58	-85.4	-25.7	-29.5	-43.1
Horticulture	12	4	1	-.6	29.7	4.3	-5.
Economic Size Class							
<=16 ESU	5,420	-136	99	-411.5	-2.5	1.8	-7.6
>16 and <=100 ESU	13,674	-793	-571	-1,870.8	-5.8	-4.2	-13.7
>100 ESU	8,343	-551	-953	-1,940.4	-6.6	-11.4	-23.3
Residual	6,516	1,161	1,182	857.1	17.8	18.1	13.2
				EU-10			
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU
Type of Farming	Million €	change to Baseline			% to Baseline		
Cereals, oilseed & protein crops	1,355	0	0	154.9	.	.	11.4
General field & mixed cropping	973	6	6	180.	.6	.6	18.5
Dairying	322	-24	-24	56.4	-7.5	-7.5	17.5
Cattle- Dairying -rearing & fattening	173	0	0	6.5	-.1	-.1	3.8
Sheep, goats and other grazing livestock	61	4	4	20.1	7.2	7.2	32.8
Granivores	210	-4	-4	20.5	-1.8	-1.8	9.8
Mixed livestock holdings	630	2	2	130.3	.3	.3	20.7
Mixed crops-livestock	1,413	4	4	200.5	.3	.3	14.2
Vineyards	1	0	0	.1	.	.	16.3
Permanent crops mixed	5	0	0	-1.5	.	.	-34.
Economic Size Class							
<=16 ESU	2,621	3	3	609.7	.1	.1	23.3
>16 and <=100 ESU	796	-11	-11	101.7	-1.3	-1.3	12.8
>100 ESU	1,725	-4	-4	56.3	-.2	-.2	3.3
Residual	1,323	10	10	226.3	.8	.8	17.1

Table 8: Re-distribution of decoupled payments at MS level

				EU-Aggregates and MS			
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU
EU-Aggregate	Million €	change to Baseline			% to Baseline		
EU-15							
Belgium	590	-15	-12	-266.	-2.5	-2.1	-45.1
Denmark	955	-34	-34	-364.4	-3.6	-3.6	-38.2
Germany	5,234	0	96	-1,356.9		1.8	-25.9
Austria	691	-1	0	68.1	-.1		9.8
Netherlands	822	-2	4	-397.6	-.3	.5	-48.3
France	7,688	110	78	-983.7	1.4	1.	-12.8
Portugal	601	-19	-18	256.6	-3.1	-3.1	42.7
Spain	4,977	-81	-91	1,759.9	-1.6	-1.8	35.4
Greece	2,176	-92	-78	-956.7	-4.2	-3.6	-44.
Italy	4,213	-133	-141	-963.7	-3.1	-3.3	-22.9
Ireland	1,242	-12	13	-269.1	-.9	1.1	-21.7
Finland	541	-10	-8	4.6	-1.8	-1.5	.8
Sweden	698	-34	-34	38.6	-4.9	-4.9	5.5
United Kingdom	3,526	3	-16	65.	.1	-.5	1.8
EU-10							
Czech Republic	891			-90.8			-10.2
Estonia	101			82.7			81.7
Hungary	1,319			-26.6			-2.
Lithuania	380			204.5			53.8
Latvia	146			217.7			148.6
Poland	3,045			584.6			19.2
Slovenia	140	-1	-1	-24.4	-.9	-.9	-17.5
Slovak Republic	388			64.7			16.7
Cyprus	53			-18.4			-34.4
Malta	2			.1	-5.8	-5.8	2.5
Bulgaria	755	0	0	415.1	.	.	55.
Romania	1,660	0	0	1,526.4	.	.	91.9

Table 9: Summary of re-distribution effects at farm, Nuts2 and MS level

Re-distribution of SPS between	unit	flat-rate Scenario			
		Nuts1	MS	EU	No.
Farm types	%	9%	12%	19%	
	Δ mio. €	3,673	5,249	8,175	1,837
Nuts2	%	4%	10%	17%	
	Δ mio. €	1,564	4,076	7,344	276
Member States	%	1%	1%	13%	
	Δ mio. €	274	313	5,503	27

Table 10: Change to baseline: Land Rent per UAA by economic size groups and type of farming across EU-25

	EU-25									
	Baseline	Nuts1	MS	EU	Nuts1	MS	EU	Nuts1	MS	EU
Type of Farming	€/ha				change to Baseline			% to Baseline		
Cereals, oilseed & protein crops	245	224	217	204	-21	-28	-40.3	-8.4	-11.5	-16.5
General field & mixed cropping	295	255	246	228	-40	-49	-67.2	-13.5	-16.6	-22.8
Dairying	301	267	258	231	-34	-43	-69.6	-11.4	-14.3	-23.1
Cattle- Dairying -rearing & fattening	224	202	201	187	-22	-23	-37.1	-9.8	-10.4	-16.5
Sheep, goats and other grazing livestock	162	149	144	140	-13	-17	-21.6	-7.8	-10.7	-13.4
Granivores	360	304	303	295	-55	-57	-64.7	-15.4	-15.8	-18.
Mixed livestock holdings	213	202	200	192	-11	-14	-20.9	-5.2	-6.4	-9.8
Mixed crops-livestock	253	233	227	210	-20	-26	-42.9	-7.7	-10.2	-17.
Vineyards	597	533	538	539	-65	-59	-58.6	-10.8	-9.9	-9.8
Fruit and citrus fruit	793	654	631	660	-139	-162	-133.7	-17.5	-20.4	-16.9
Olives	485	336	292	299	-149	-193	-186.5	-30.7	-39.8	-38.4
Permanent crops mixed	516	365	351	341	-151	-165	-174.7	-29.3	-31.9	-33.9
Horticulture	1,361	1,036	1,003	1,056	-325	-358	-304.9	-23.9	-26.3	-22.4
Economic Size Class										
<=16 ESU	241	210	207	200	-31	-34	-41.7	-12.9	-14.2	-17.3
>16 and <=100 ESU	262	231	225	210	-31	-38	-52.	-11.8	-14.3	-19.8
>100 ESU	292	264	251	232	-28	-41	-60.3	-9.6	-14.1	-20.7
Residual	257	245	239	231	-13	-18	-26.5	-4.9	-7.1	-10.3

Figure 1: Re-distribution of decoupled payments for farm types in EU-25