Possible economic and environmental impacts from changes to the coupled beef support payments for EU beef production.

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Abstract

The Luxembourg agreement of 2005 marked a new direction for EU agriculture with the decoupling of direct support payments for production. Under the CAP reform of 2013, Member States had the option to retain an element of coupled support for agriculture. Building on a previous study from Jansson et al. (2018), this study analyses the regional effects for beef production resulting from a redistribution of voluntary coupled supports (VCS) through area payments in the national budgets.

The redistribution of VCS payments is projected to result in a modest reduction in the income from beef production, the EU beef herd size as well as the total Greenhouse Gas (GHG) Emissions form EU beef production. However, these impacts vary across EU regions with some regions marginally increasing their beef production levels while other regions are projected to significantly reduce their beef meat activities. Especially Member States which had retained some form of VCS, a reduction in beef herd size and income is likely while those countries that had opted to fully decouple payments in 2005 are projected to show a slight increase in herd size and income. Generally, this leads to a decrease of the total GHG emissions, yet, an increase in GHG emission per livestock unit is seen due to a change in herd composition, production or feed intensity.

From the results, it can be inferred that VCS payments for the beef sector have the potential to encourage beef production in regions where it may be less profitable to do so (negative income before the redistribution of VCS in the national budgets). Therefore, the decoupling of the remaining coupled supports within the CAP would likely lead to a minor restructuring of beef production within the EU.

CAPRI model, Regional Analysis, Voluntary Coupled Support, CAP

JEL code

C54, Q11, Q18, Q54Introduction

Introduction

Despite the Common Agricultural Policy (CAP) accounting for 36.25% of the EU budget in 2018, citizens of the EU have demonstrated a positive view of agricultural supports (European Commission, 2019). A recent Eurobarometer study found that 92% of respondents from all EU member states agreed that agriculture is important for the future, not only in respect of production of food but also in fulfilling aims such as regional development or achieving environmental goals. These results indicate an EU-wide commitment towards agricultural policy support (Eurobarometer, 2017a). However, 71% of those surveyed want financial support for farmers to remain the same as at present or to increase over the next ten years. However, questions, persist in relation to how targeted should the current payment system be and what impact do these payments have on production and as a consequence the environment?

The current agricultural policies in EU Member States are largely regulated by the CAP (European Commission, 2019). Following the introduction of the Luxembourg agreement in 2005, some member states opted to implement full decoupling of agricultural support while other individual member states opted to retain some form of coupled payments. With the reform of 2013 some voluntary coupled support (VCS) for certain sectors undergoing economic, social or environmental difficulties in maintaining or increasing production was introduced (European Commission, 2016, Jansson et al., 2018). When introduced, the three main sectors receiving VCS payments were the beef and veal sector (41% of total VCS), the milk and milk products sector (20% of total VCS) and the sheep and goat meat sector (12% of total VCS) (European Commission, 2016)[1]. Therefore, no unilateral adoption of the fully decoupled support for ruminant and mainly beef production occurred. While some significant beef producing countries adopted full decoupling of support payments (e.g. Germany, Ireland and the UK[2] bar Scotland) others retained an element of VCS (majority of EU Member States, most noticeably France, Italy and Spain)(European Commission, 2010; Jansson et al., 2018).

In the case of France, Italy and Spain, they chose to operate a basic payment scheme (BPS) which is the primary support for farmers but also opted for voluntary coupled support payments targeted at cattle farmers. The Italian system uses a bovine premium scheme and a suckler cow premium scheme which together have a total annual budget of €106 million euros (European Commission, 2010). The French system uses a suckler cow premium scheme and a less significant calf premium scheme. The system which is currently used in Spain employs a suckler cow premium scheme and a calf premium scheme which has a total annual budget of €227.87 million euro[3](European Commission, 2010). As the relative importance of beef production varies between different regions of EU Member States as well as the market-based returns, the VCS payments can be expected to have a strong regional effect. See Appendix 1 for a further break down of these payments.

[1] These three sectors account for 73% of the total European VCS payments. Further sectors that receive VCS payments, but the amount allocated is equal or less 10% of total VCS payments are: protein crops, fruit and vegetables, sugar beet, cereals, olive oil, rice and others (European Commission, 2016).

[2] In the case of the UK is only partially decoupled, it has opted to fully decouple supports for England, Wales and Northern Ireland. However, there has been some retention of coupled support payments in Scotland (European Commission, 2014).

[3] Spain also employs a very small bovine special entitlement scheme with an annual budget of €1.4 million (European Commission, 2010)

The predicted effects of the VCS payments are an increase in beef and ruminant production which would not only have a positive economic effect due to an increase in farm income but also an environmental effect due to increased animal numbers and fertilizer usage. (Jansson et al., 2018) It is therefore important that when quantitatively analysing the redistribution of VCS in the national budgets of the EU Member States, not only to look at the economic impact of such a measure but also their environmental outcomes, in the form of climate change potential (GHG emissions). The development and implementation of agricultural policy has a significant effect on environmental outcomes and the relationship between agricultural activity and climate change can be characterised as circular and interdependent (Matei et al., 2010; Smith et al., 2014).

The CAPRI (Common Agricultural Policy Regionalised Impact) model is a quantitative partial equilibrium model with a specific focus on the agricultural sector, which provides a valuable predictive framework from which to understand possible outcomes of policy reform. The CAPRI model allows for economic, environmental and trade impacts of policy change to be analysed and to be responded to appropriately as a result. Further, due to its level of disaggregation, specific regional impacts down to NUTS 2 (Nomenclature of Territorial Units for Statistics) regions can be identified and analysed, which is of importance considering the VCS payments are predicted to have a strong impact at a regional level.

Building on previous work by Jansson et. al (2018) and due to the focus of the VCS payments being on beef producers, this paper examines the regional and environmental impacts of redistributing the remaining voluntary coupled support payments for beef in Europe in the national budgets of the single Member States. As VCS payments not only have an economic but also an environmental impact, the existing nexus between the European CAP and environmental policy will be discussed, indicating the necessity of using a model such as CAPRI that captures not only economic but also environmental factors. For understanding the results received, the CAPRI model and the scenarios examined will be described, before presenting the impact of redistributing VCS payments on different European regions. Closing, the results will be discussed, and conclusions drawn.

2 The existing Nexus between the European CAP and Environmental Policy

The agricultural policies in the EU are mainly regulated through the CAP. The five original objectives of the CAP which were set out in the Treaty of Rome in 1957 by the EEC[4], are (DAFM, 2019, p. 20):

(i) To increase agriculture productivity by promoting technical progress and by ensuring the rational development of agriculture production and the optimum utilisation of the factors of production in particular labour.

(ii) To ensure a fair standard of living for the agricultural Community.

(iii) To stabilise agricultural markets.

(iv) To secure availability of supplies.

(v) To provide consumers with food at reasonable prices. (DAFM, 2019)

[4] The EEC became known as the EU after the Maastricht treaty in 1992(European Parliament, 2019).

The CAP has undergone several reforms addressing trade distortionary effects, budgetary factors, income inequalities and more recently environmental challenges with a growing appreciation for the Multifunctional value of agriculture. Despite these policy changes the fundamental objectives of the CAP have remained the same.

As the CAP has evolved, there has been a movement away from support for market-based instruments (price supports) to support payments which were initially coupled to production and now are decoupled single farm payments, paid on a per-hectare basis for all qualified agricultural land (Jansson et al., 2018; Louhichi et al., 2015).

Previous to the Luxemburg agreement of 2005, the production linked payments (coupled supports) took many different forms. In the Irish context for example, these coupled payments included suckler cow premium, special beef premium, slaughter premium, extensification premium, cattle headage premium, sheep premium, set a side premium and cereal aid premium (Shrestha et al., 2007).

The Luxemburg agreement of 2005 decoupled payments from production using a historic approach whereby future farm payments would be based on the average supports received in the years 2000 to 2002 (Donnellan et al., 2009). Under the 2013 CAP reform, the individual Member States were obliged to harmonise the payment system across regions (Jansson et al., 2018). Further, Member States were restricted to keeping VCS for selected sectors within agriculture, up to a ceiling of 13% of their total national budget for direct payments (Jansson et al., 2018). This VCS is used to aid certain sectors undergoing economic, social or environmental difficulties in maintaining or increasing production, to a large extent targeted at cattle and other ruminants (Jansson et al., 2018). Some Member States such as Ireland, UK (except for Scotland) and Germany opted to fully decouple support payments for ruminant production while other Member States kept the VCS and opted for partial decoupling of their support payments (European Commission, 2016 & 2014). Hence, the system of support payments varies from country to country.

Due to changes in production volumes and production practices, the development and implementation of agricultural policy has had a significant effect on environmental outcomes. EU environmental policy, including the management of GHG emissions, revolves around strict environmental legislation agreed upon by all member states. These environmental policy standards are considered some of the highest in the world (BELLEC, 2016). Various international organisations, like the United Nations Economic Commission for Europe, The Organisation for Economic Cooperation and Development, and the United Nations Environment Program, and of course the European Commission itself, contribute to Europe's developing environmental policies (EAA, 2017).

Environmental issues do not respect political boundaries which means environmental impacts can be regional, local, global or shared by several states. While there are EU wide commitments to reduce GHG emissions, regional differences exist in the context, commitment and compliance with EU environmental goals. Each member state has its own set of goals and targets for their agricultural sectors. While diversity exists between each member state there is an established culture of adherence to environmental standards by the citizens of Member States in the EU. Environmental compliance assurance is generally viewed by EU citizens in a positive way as an overwhelming majority of Europeans want the EU to make sure that the environmental legislation is adhered to (Eurobarometer, 2017b).

The relationship between the agricultural policies and environmental policies are complex but can be crudely simplified in the following way: agriculture relies on climate, the availability of arable land and water resources, but the activity of agriculture can impact negatively on the environment in a number of ways including the production of greenhouse gases (GHG) which disrupt climates, can destroy arable land and endanger water resources. This relationship has been widely recognised and awareness of and concern about this has been growing globally (Matei et al., 2010; Smith et al., 2014). As a result, quantitative analysis must be able to simulate this nexus by taking into account environmental constraints on changes in the agriculture sector.

3 Methodology – the CAPRI model version 1.4

The CAPRI model is used to assess the potential impact of redistributing voluntary coupled beef support throughout the EU and assess the likely effects on farm profitability, herd size and consequently GHG emissions. The CAPRI modelling system has been used to examine a wide-range of policy reform scenarios of interest to individual member states and the European Commission over the last two decades (EUCLIMIT, 2012). The CAPRI model is a comparative static, partial equilibrium simulation model with a specific focus on the agricultural sector. The modelling system considers both the global market module as well as the supply module (Jansson et al., 2018). It is a spatial economic model that uses positive mathematical programming techniques in order to maximize regional agricultural income, which is subject to physical, biological and political constraints (Garvey et al., 2004).

Model inputs

The database used by CAPRI is unified, complete and consistent (Weiss and Leip, 2012). It has been derived from various official sources and uses data such as herd size, crop use, production, animal slaughtering statistics, foreign trade statistics as well as regional statistics (Weiss and Leip, 2012). The policy scenario's baseline analysis is sourced from the Agricultural Outlook published by the European Commission (Jansson et al., 2018). The CAPRI modelling system seamlessly integrates physical, economic data and environmental data from both input and output sources in order to examine the potential impact of alternative policy scenarios (Weiss and Leip, 2012). The model considers trade policy data alongside projected international changes in population and beef demand (Jansson et al., 2018).

This type of modelling system aggregates down to approximately forty trade blocks and detailed results for NUTS2 regions within the EU. CAPRI encompasses the whole of the EU 28[5], Norway, Turkey and the western Balkans at regional level (Nuts 2) and global agricultural markets at country or country block level. The CAPRI model's data includes selected countries neighbouring the EU 28 (Jansson et al., 2018). The model takes into account about sixty agricultural products and incorporates agricultural land uses (forestry is not included) (EUCLIMIT, 2012). Several environmental indicators are covered by CAPRI including emissions of ammonia, methane, nitrous oxide and carbon dioxide. Methane, Nitrous Oxide and Carbon Dioxide are converted into CO_2 equivalent based on the Global Warming Potential (GWP) values for a 100-year time horizon consistent with the second assessment report of the International Panel for Climate Change (IPCC) methodology (AR5) (Jansson et al., 2018). Hence, the CO_2 equivalent for one tonne of Methane (CH_4) has twenty eight times the effect of CO_2 while N_2O has two hundred and sixty five time the effect of CO_2 (IPCC, 2014).

[5] At the time of preforming this analysis the EU 28 included the UK.

Scenarios

The CAPRI model considers a wide variety of data sources when running baseline generation[6] and scenario analysis. In the reference scenario the current system of VCS payments is assumed to remain unchanged up to the year 2030. This reference scenario assumes business as usual, it is assumed to be in equilibrium, and does not take into account changes in policy i.e. does not take into account changes in BREXIT, WTO. The policy scenario in this paper is based on the analysis performed by Jansson et al, (2018), which considers redistributing VCS for agricultural activities including beef meat production. While Jansson et al (2018) examines European trends and the impact on global GHG emissions considering the potential for carbon leakage, this paper uses the CAPRI model at NUTS 2 level to analyse regional effects through comparisons with the projected baseline for European agricultural activities.

Similar, to the scenario analysis performed by Jansson et al (2018), the reference scenario assumes that the current CAP continues unchanged until 2030. This includes a range of projected exogenous changes including global population growth as well as changes in demand for agricultural outputs. The policy scenario "VCS-ex" includes the same macro-level assumptions as the reference scenario, but along with the redistribution of the VCS for ruminants in each member state to the decoupled Basic Payment Scheme available for all farmers, not just those with ruminants.

The introduction of the policy scenario "VCS-ex" is the same as those used by Jansson et al (2018) where the subsidies are implemented as subsidy per head under a budgetary ceiling level for each EU country. The total support received by each member state remains the same as in the reference scenario, but the released funds from abolishing VCS is instead reallocated to other direct payments (Jansson et al, 2018).

Model outputs

For agricultural and environmental policies to be effective, ideally it should be possible to quantify their effects. CAPRI model computations produce data in the form of absolute value differences for income as well as percentage value differences for beef herd size and GHG emissions from beef meat activities in reference to the baseline. The model also provides both absolute value differences and percentage differences for a range of indicators including economic (e.g. income from beef meat activities), agricultural activities (e.g. beef herd size) and emissions (e.g. GHG emissions from beef meat activities and nutrient surplus and runoff) at the NUTS 2 regional level. All the data in this scenario analysis is relevant to the year 2030 which is the end of the next multiannual financial framework (Jansson et al., 2018).

Limitations

While the model outputs data that is suitable for estimating EU wide policy change's impact on global GHG emissions there are other factors that contribute to global GHG emissions which are outside of the remit of the CAPRI model. As the model only considers EU agricultural contributions to GHG emissions by definition CAPRI does not consider non-agricultural contributions to GHG emissions.. The model's analysis of the EU agricultural sector does not consider forestry contribution both to trade and its environmental impacts. Further, the model cannot account for unexpected political, social or economic effects, but rests on the assumptions

[6] The CAPRI model in this analysis uses the year 2008 as the baseline year.

within the reference scenario with unchanged macro-economic conditions and CAP continued up to 2030 (Jansson et al., 2018).

As the model is an economic quantitative model, simplifying the existing and occurring decision processes in the agricultural sector, it cannot capture individual social decision behaviour. It does have a representative farm in each region, optimising farm income however, it does not take other decision-making factors into account and this will be discussed in Section 5. Discussions and Conclusions in an Irish context.

While this paper attempts to analyse the effects of redistributing coupled production supports in the EU by using a quantitative simulation model, the Irish context demonstrates the breath of contributing factors and possible unpredictable outcomes, which may potentially influence individual farmer decision making and therefore should also be considered when looking at the received simulation results.

The primary focus of this paper is on the beef meat industry, as the sector receiving the most support in the form of VCS payments (European Commission, 2016). It should be noted that other sectors will also show some marginal changes in activity levels and GHG emission, however this is beyond the scope of this paper.

4 Results

EU-wide, the redistribution of support in the "VCS-ex" scenario results in an average increase in per-hectare payments for agricultural land (including fodder) of 6.5%, compared to the reference scenario. While support directly to beef cattle decreased by 69% per head, that for dairy animals by 41% per head and that for sheep and goats by 36% per head.

Under the "VCS-ex" scenario, beef meat activities experience the strongest decrease in the EU. Overall income from beef meat activities for the EU28 is projected to decrease on average by €21.69 per head. The returns to beef meat activities decrease as the payments to farmers are not specifically for farmers with ruminants anymore. Instead the budget is included in the decoupled per hectare payments which is received by all farmers. As a result, herd size and production for beef meat activities is projected to decrease by 2.23%.

It is also of interest to note under the "VCS-ex" scenario producer prices for beef meat increase by 2.18% as supply of beef meat decreases (as seen in the decrease in herd size in the results) when the VCS payments are redistributed.

In line with the decrease in both income and herd size, total GHG emissions from beef meat activities also decreases by -2.09%. In contrast to the total decrease in GHG emissions, the GHG emissions per livestock unit from beef meat activities is projected to increase by 0.15%, driven through an increase in Methane emissions per livestock unit. (Table 1) This increase results from two reasons. Firstly, the feeding intensity throughout all animal categories included in beef meat activities[7] is increased leading to a higher yield per head (0.03% up to 0.22%). Secondly, the the average slaughter weight of cows increase in response to the higher beef prices. Both changes lead to an intensification of production which increases Methane emissions and consequently increases the GHG emissions per livestock unit from beef meat activities.

[7] Beef meet activities include other cows, heifer fattening high weight, heifer fattening low weight, male adult cattle high weight, male adult cattle low weight.

For the most part as seen in Jansson et al, (2018), changes in other sectors are limited with dairy, sheep, goat and crop sectors showing only marginal changes. These marginal changes occur as, outlined by Janson et al., 2018, the average decoupled payments received by all sectors increases by 6.5% across the EU in the "VCS-ex" scenario. The European-wide results illustrate the heterogeneity of the impacts of VCS but also show that most of the European countries had VCS implemented for ruminant production (Jansson et al., 2018).

VCS Redistribution Effects on European Member States

Taking a closer look at the main beef producing EU countries, two groups of countries can be identified. Firstly, those countries that kept the VCS for ruminant production. Secondly those where ruminant production has not received VCS such as Ireland, Germany and the UK (except for Scotland) before the policy change. As changes in the "VCS-ex" scenario are driven by the national redistribution of the support payments, changes in beef meat price for the producers are minor if any as seen at EU 28 level. The producer price change that is experienced under this "VCS-ex" scenario for beef is a consistent percentage increase of 2.20% [8]for the selected member states (France, Italy, Spain, Germany, UK and Ireland). However, as one would expect there are variances in the absolute price for producers at member state level.

[8] Price transmission inside of the EU is a limitation in CAPRI. There is a "pool market" for EU-west, where all beef supply enters and that satisfies all countries' demand. Therefore, the producer price effects do not get diversified across member states as one would expect expected. Thus, these simulations do capture the impact of changed subsidies well, but not of the changed prices that well.

Table 1 Possible effect on beef meat activities of redistributing VCS

	Income €/Head	Herd Size '000 Head	Yield '000 Head	Total GHG Emissions of Beef Meat Activities kt CO_2-eq	Weighted Average GHG Emissions per Livestock Unit of Beef Meat Activities kg CO_2-eq
EU 28					
Ref	-11.47	18607.61	337.88	55335.71	2973.82
VCS-ex	-33.16	18192.12	338.02	54179.75	2978.20
% Change	-189.20%	-2.23%	0.16%	-2.09%	0.15%
France					
Ref	-112.36	5217.81	338.68	15394.70	2950.41
VCS-ex	-158.14	4968.88	338.69	14680.06	2954.40
% Change	-40.74%	-4.77%	0%	-4.64%	0.14%
Italy					
Ref	-16.26	991.10	340.47	2497.34	2519.77
VCS-ex	-41.86	973.98	340.97	2445.66	2510.99
% Change	-157.51%	-1.73%	0.15%	-2.07%	-0.35%
Spain					
Ref	101.16	1965.69	268.62	5484.25	2789.99
VCS-ex	72.61	1870.85	268.69	5228.32	2794.62
% Change	-28.22%	-4.82%	0.03%	-4.67%	0.17%
Germany					
Ref	-156.45	1356.95	320.84	4065.75	2996.24

VCS-ex	-146.50	1377.04	321.35	4133.80	3001.94
% Change	6.36%	1.48%	0.16%	1.67%	0.19%
Ireland					
Ref	336.68	2132.06	354.30	6530.84	3063.16
VCS-ex	335.94	2164.28	354.63	6636.03	3066.16
% Change	0.68%	1.51%	0.09%	1.61%	0.10%
UK					
Ref	744.80	2448.58	374.51	7905.22	3228.49
VCS-ex	755.62	2507.04	374.89	8097.30	3226.83
% Change	1.45%	2.39%	0.10%	2.43%	0.04%

Source: Own compilation from the CAPRI model.

For those countries (e.g. France, Italy and Spain) that had opted to retain a VCS payment post Luxembourg reform, the redistribution of the remaining supports is projected to lead to a reduction in production due to some low profitability or loss-making beef meat activities. (Table 1) Take for example in Spain where income from the suckler herd[9] drops by €28.91 per head (27.29%) and the total number of sucklers also decreases by 5.52% due to the redistribution of the current suckler cow support payments (Appendix Table 2) Also under the "VCS-ex" income from Spanish male adult cattle high weight increases by €44.70 (28.88%) with the total number of Spanish adult male high weight cattle[10] increasing by 0.55%. This shows a change in the herd composition in response to the redistribution in the VCS payments for Spain which were received by suckler cows and calves but not Spanish male adult cattle under the original scenario (Appendix Table 2). Similarly, in both Italy and France the trend also continues, where income decreases for sucklers, a decrease is then also seen in the total number of sucklers as well as an increase in both income and herd size for adult male high weight cattle due to the redistribution of VCS payments. The decrease in producer income from beef meat activities compared to the reference scenario is projected to result in a decrease in herd size leading to a decrease of -4.67% in total GHG emissions for beef meat activities for Spain.

Contrary to the observed reductions, the GHG emissions per livestock unit increases by 0.17%. This increase is due to the fact that the number of high weight animals increases although in general the herd size is decreasing. The ratio between the two weight categories changes in favour of high weight animals leading to an increase in production intensity resulting in higher methane emissions per livestock unit and as a result in GHG emissions per livestock unit being

[9] The suckler herd is defined as other cows in the CAPRI model.

[10] Adult male cattle are defined in CAPRI as either high weight or low weight.

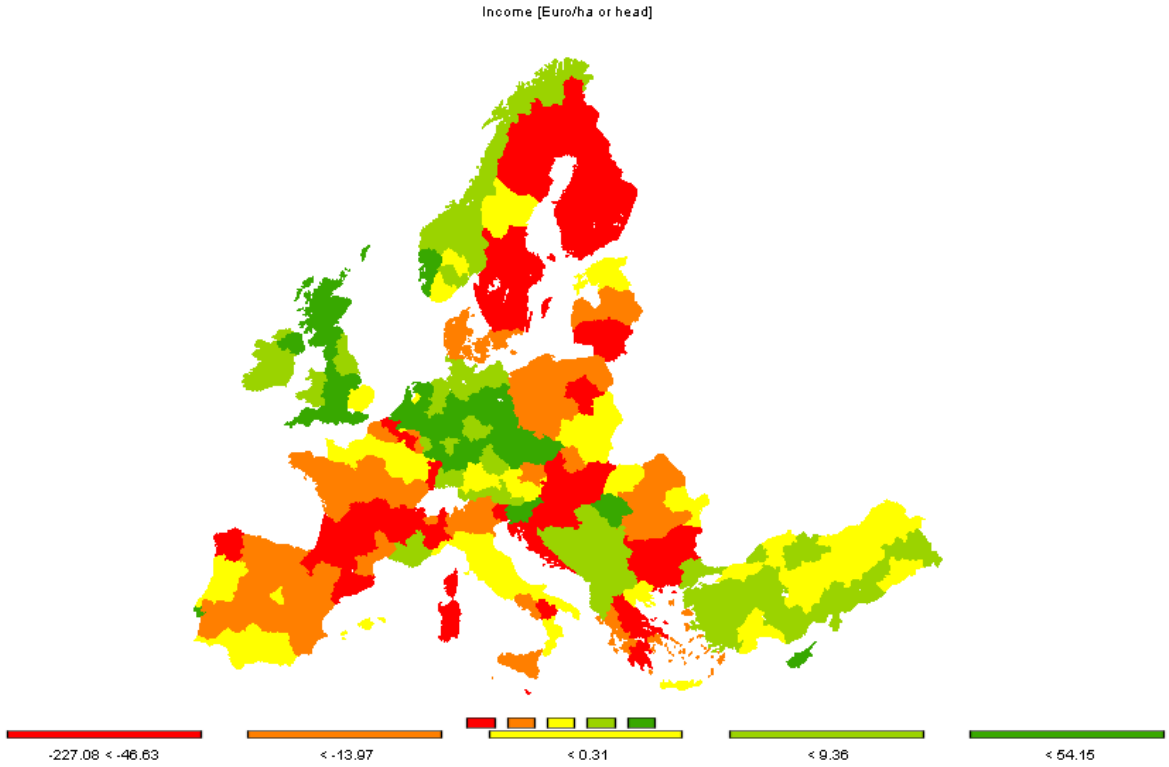
higher. Similar effects in herd size, total GHG emissions and GHG emissions per livestock unit for the beef meat activities can be noted for France.

In contrast to France and Spain regarding the changes in GHG emission per livestock unit, Italy is projected to experience a marginal decrease by 0.35% due to a reduction in Methane emissions per livestock unit from beef meat activities even though total GHG emissions from beef meat activities decrease. (Table 1) This occurs as income and herd size throughout all beef cattle classes[11]in the beef meet activity decrease and minor increases in yield changes appear.

Main beef producing EU Member States which do not have VCS payments in the reference scenario gain slightly from an equalisation of production conditions throughout the EU (e.g. Ireland, UK, Germany), which is contrary to the overall EU projections. (Table 1) Those, who gain in the "VCS-ex" scenario, are those who already under the former production's conditions were generating positive income from beef meat activities such as Ireland, Germany and the UK. (Figure 1).Through the redistribution of the VCS payment and the resulting decrease in production in those Member States, countries such as Ireland, Germany and UK will increase their herd size and their income which lies above the EU 28 income from beef meat activities (Figure 1 and Figure 2), closing the occurring EU supply gap. Further, those member states who gain through the redistribution of VCS, experience an increase in the total GHG emissions as well as the GHG emissions per livestock unit from beef meat activities of below 0.05% due to a slight increase in Methane emissions of the livestock unit from beef meat activities. (Table 1) This increase results from a change in herd size. No increase in production intensity through changes in feeding intensity or herd composition is seen in the "VCS-ex" policy scenario.

[11] Beef cattle include in the CAPRI model is other cows, heifer fattening high weight, heifer fattening low weight, male adult cattle high weight, male adult cattle low weight.

Figure 1: Possible effect of the redistribution of VCS on the income of beef meat activities (absolute differences to baseline)



Source: CAPRI model.

Not only are there clear differences to be seen between EU Member State but considerable regional differences within countries can be expected due to differences in the profitability of beef production as well as the reliance on the coupled support payments between regions along with the relative importance of beef production in the different regions of EU Member States (Figure 1).

Regional NUTS 2effects of removing VCS for beef production

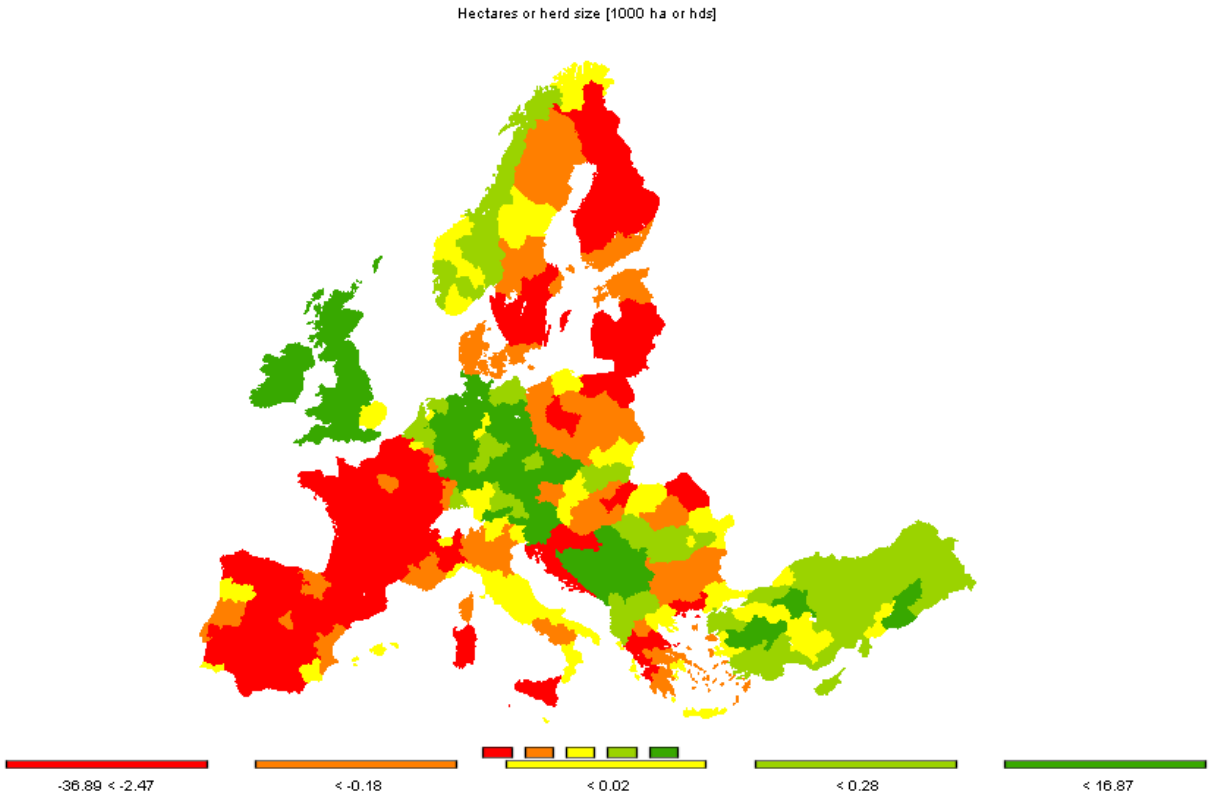
Although regional differences within EU Member States are expected, only minor if any producer price changes appear throughout the EU NUTS 2 regions[12]. The effects on NUTS 2 regions of the main beef producing Member States that opted not to retain some form of VCS, is similar to the effects appearing for the respective Member State (Ireland[13], UK and Germany). As seen in Figure 1 and Figure 2, all regions in the respective Member State are projected to increase their income and their herd size marginally and consequently increase their total GHG emissions as well as their GHG emissions per livestock unit Figure 3 (max. 0.13% increase). The increase

[12] The NUTS 2 regions that will be discussed in the following show the two trends appearing in the regarded Member States. They present the highest possible reactions to the policy changes. All the other NUTS 2 regions react similar or less strong.

[13] Ireland's two regional levels of Border, Midland and Western and Southern and Eastern which has subsequently been redefined. "There are now three NUTS 2 Regions which correspond to the Regional Assemblies established in the 2014 Local Government Act and are groupings of the new NUTS 3 Regions. The revisions made to the NUTS boundaries have been given legal status under Commission Regulation (EU) 2016/2066" (CSO, 2019)

in GHG emissions per livestock unit is due to an increase in Methane emissions per livestock unit. The rate of increase in production levels varies within Members States between NUTS 2 regions due to differences in production conditions and the relative profitability of beef production in the individual regions, for example within Ireland the Southern and Eastern region is projected to show a larger increase in income and herd size than in the border, midland and western region. (Figure 1 and Figure 2) Similarly, within the UK the increase in beef production in the South East of England is greater than the increase projected for the North West of England. Increases which occur in Methane emissions per livestock unit for beef meat activities arise primarily as a result of the increase in herd size.

Figure 2: Absolute changes in the herd size of beef meet activities through the redistribution of VCS to basic payments. Differences are compared to baseline for 2030.

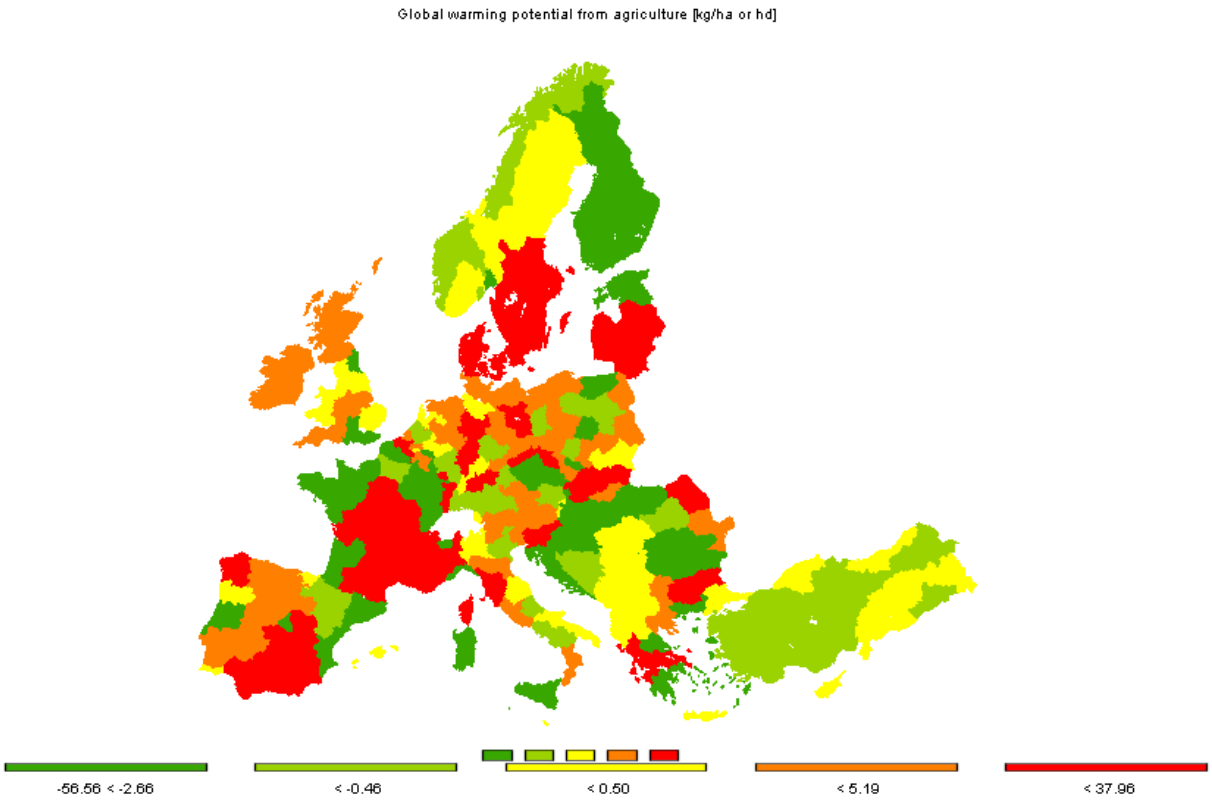


Source: CAPRI model.

Simulation results for NUTS 2 regions of the selected Member States that had opted to retain a VCS indicate that the negative profitability of production in these regions contributes to the effects seen through the redistribution of the VCS payments. The reduction in beef production as well as income that is expected for NUTS 2 regions will be lower for NUTS 2 regions that have a high positive income from beef meat production under the reference scenario such as Basse Normandie (France), Aragon and Andalucía (Spain) and Lombardia (Italy). Than in comparison to the reduction projected for regions such as Alsace (France) and Calabria (Italy) that already had a negative income under the VCS payments. It appears that beef production in Alsace and Calabria has and will remain not profitable as can be seen in Figure 1 which shows the changes in income across the different EU regions in the "VCS-ex" scenario, compared to the baseline. On

the contrary, beef meat production in regions such as Basse Normandie, Aragon, Andalucía and Lombardia is profitable with or without additional support payments.

Figure 3:Absolute changes in to baseline in the VCS-ex scenario. GHG emissions per livestock unit of beef meat activities through the redistribution of VCS



Source: CAPRI model.

Although in general the total GHG emission for beef meat activities decrease throughout the regions in France, Spain and Italy, the reasons for regional changes in the GHG emissions per livestock unit are heterogenous for the single regions. The GHG emissions per livestock unit for beef meat activity in Spanish NUTS 2 regions are expected to almost remain unchanged compared to baseline. The changes that are seen are marginal and shown in Figure 3. In Italy, increases in the GHG emissions per livestock unit for beef meet activity is found in those regions that contrary to Italy as a whole increase their yield per head. This means an increase in feeding intensity which results in an increase in Methane emissions per livestock unit. NUTS 2 regions in France that generate a negative income from beef meat activities experience an increase in Methane emissions per livestock unit due to changes in the weight ratio of the cows towards high weight animals increasing production intensity (Figure 3).These regions thereby follow the national trend per livestock unit. Contrary to this are French NUTS 2 regions that have and still do generate a positive income from beef meat activities. These few regions reduce the GHG emissions per livestock unit of their beef meat activities as they reduce their herd size (Figure 2) but do not change anything in their production intensity.

5 Discussion and Conclusion

The Luxembourg agreement of 2005 marked a new direction for EU agriculture with the decoupling of direct support payments for production. Under the CAP reform of 2013, however, Member States had the option to retain some level of coupled payments for specific sectors on the grounds of economic, social or environmental difficulties. As the uptake was voluntary and the design of the VCS depends on the individual Member State, VCS across Member States are not unilateral and differ from country to country. This possibly leads to a situation of a common market but where farmers, depending on the country they are situated in, experience different production conditions and therefore different market conditions for a specific sector. Removing VCS to equalise production and market conditions throughout the EU could lead to an impact mainly on a very regional and sectoral level. As VCS mainly target cattle production, this paper analyses the regional effects of removing voluntary coupled supports for beef production throughout the EU.

The results from removing VCS in the EU and redistributing them towards area payments would have a modest impact in all ruminant sectors regarding the producers' income as well as in herd size number, yield and environmentally, using the GHG emissions indicator compared to baseline values.

Within the EU 28 the main beef producing countries which had previously no VCS implemented (Ireland, Germany, UK excluding Scotland) showed only a minor increase in income, producer price and herd size, as well as GHG emissions. Countries who operated without a VCS for beef increase production in order to close supply shortfall. Increases in the total GHG emissions of beef meat activities thereby result from an increase in the total beef herd size. NUTS 2 regions of these three countries follow this trend, gaining from the equalisation of the production and market conditions throughout the EU.

On the other hand, main beef producing EU member states that had kept the VCS payments (France, Italy and Spain) showed a reduction in both the income and herd size. Environmentally, the total GHG emissions decreased while there is an in an increased GHG emissions per livestock unit for France and Spain due to changes in the countries' herd size composition leading to an increase in high weight animals and consequently an increase in methane emissions. Out of all the main beef producing EU Member States, Italy is the only country that decreases both its total GHG emissions and GHG emissions per livestock unit of beef meat activities due to generally not changing its production or feeding intensity.

Assessing the NUTS 2 regions of these three countries indicated two tendencies occurring from the redistribution of VCS to area based payments. The first one appears for those regions that were producing profitably with VCS generating an income from beef meat activities above the EU average such as Basse Normandie, Aragon, Andalucía and Lombardia. Although all these regions experience a decrease in income and herd size through the redistribution of VCS, they remain profitable. The second tendency occurs for those regions that were not profitable even when receiving VCS, earning an income below the EU 28 average. These regions such as Alsace and Calabria experience a high loss in income and reduction in herd size, particularly above the EU 28 average loss.

Regarding changes in GHG-emissions, a heterogenous picture occurs throughout all European Member States and especially at NUTS 2 regions. Depending on the initial situation of the single

region, emissions may decrease or increase. The reasons for increasing emissions vary but are attributable to increases in herd size, changes in herd composition to increases in feeding and production intensity.

While the CAPRI model is an economic quantitative model, simplifying the existing and occurring decision processes in the agricultural sector, it cannot capture individual social decision behaviour. In the case of fully decoupling payments from production in Ireland, the predicted effects were a decrease in beef production due to a decrease in herd size of up to 18% (Donnellan et al., 2009). Further there was also concern that there would be a decrease in the landscape services that were produced as well as agricultural commodities (Donnellan et al., 2009). In reality, the introduction of full decoupling meant for Irish farmers that it was no longer a requirement to produce basic commodities (beef or sheep meat) in order to qualify for support payments, instead farmers were required to maintain their land in good environmental and agricultural condition. Instead of a dramatic decrease, beef production remained relatively stable. This stability in Irish beef production was to be expected as farmers are incentivised by more than income in order to engage in agricultural production, placing a value on lifestyle factors such as independence and pride. These non-pecuniary benefits which farmers perceive mean that decisions are made not only on economic grounds (Howley et al., 2012).

The results indicate that those NUTS 2 regions throughout the EU, that have been producing profitably with and without VCS experience lower negative economic and environmental impacts through the redistribution of these coupled payments. NUTS 2 regions that have not been profitable even with VCS experience higher losses in both income and herd size without VCS payments.

The rational used in the Luxembourg agreement of 2005, for allowing some continuation of the VCS payments to certain sectors and regions undergoing economic, social, experiencing environmental difficulties, or in maintaining or increasing production was focused on the essential role that these sections or regions play, which great than just purely the support of agricultural production. When assessing the affects of possible policy change it should be kept in mind that knock on effects manifest for the whole supply chain to the agricultural sector as well as the downstream processing of agricultural produce which can play a significant role in the sustainability of rural communities.

From the results, it can be inferred that VCS payments for the beef sector have the potential to encourage beef production in regions where it may be less profitable to do so (negative income before the redistribution of VCS in the national budgets). Therefore, the decoupling of the remaining coupled supports within the CAP would likely lead to only a minor restructuring of beef production within the EU.

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Appendix 1

Table 2 Current Beef VCS Payments in place

Member State/ Region	**Measure**	**Applicable quantitative limit (heads)**	**Amount per unit (heads), in EUR** 2015
Spain	***Beef and veal, all***	***4,968,191***	***11-150***
	Calves, mainland and islands	2,845,971	11-57
	Suckler cow, mainland and islands	2,103,000	89-150
	Bovine, 2014-special entitl. with land	19,220	75
France	***Beef and veal, all***	***3,974,812***	***37-132***
	Suckler cow, different farm sizes	3,845,000	71-132
	Calve premia	129,812	37
Italy	***Beef and veal, all***	***1,562,188***	***54-127***
	Bovine premium	1,241,850	54
	Suckler cow	320,338	127

Source: European Commission, 2016