The impact of agricultural subsidies on environmental pollution in the European Union

Abstract

The agricultural production in the European Union (EU) accounted for 40 % of the total land area of the EU Member States, providing farming opportunities for 10 million workers. In the EU, agriculture is also responsible for a significant share of greenhouse gas emissions. The research investigates how the evaluation of agricultural subsidies under the Common Agricultural Policy (CAP) can contribute to agricultural sustainability in the European Union. The research question addresses the implementation of climate agreements into CAP regulations and the influence of agricultural subsidies on greenhouse gas emissions. Panel data econometrics is employed to analyse the effectiveness of EU subsidies on diminishing agricultural emissions between 2004 and 2019. The results suggest that some agri-environmental measures included in the Common Agricultural Policy served to cut GHG emissions by increasing the area of organic farming. The expansion of organic farming and CAP payments on rural development contributed significantly to CO2 emissions reduction in the EU. On the other hand, CAP direct payments stimulated GHG emissions. Regarding CAP reforms, the Health Check carried out in 2009 helped reduce while Ciolos reform in 2013 stimulated GHG emission for a period analysed. The results draw attention to the need for action to curb EU agricultural emissions by reforming or restructuring the system of direct agricultural subsidies.

Keywords: Sustainable agriculture, environmental pollution, Common Agricultural Policy, European Union

JEL Code Q14, Q53, Q18

Introduction

The European Union has set a target to achieve carbon neutrality by 2050. The Common Agricultural Policy (CAP) of the EU can also play a significant role in achieving this target. The last agreement on the CAP reform was adopted in December 2021. The new legislation that starts in 2023 aims to provide a fairer, greener and more performance-based CAP (European Commission 2022).

The EU agricultural production accounted for 40 % of the Member States' total land area, providing farming opportunities for 9.7 million workers in crop and livestock production, producing 309.9 and 45.2 million tonnes of goods, respectively (Eurostat, 2018). In addition to this, the European Union is one of the world largest agricultural exporters. In 2018, it exported goods in 137 billion EUR, while its imports reached 138 billion EUR on global market (Eurostat, 2019).

In the European Union, agriculture is responsible for long-lived greenhouse gas emissions such as 53% of methane and 74% of nitrogen dioxide. In the EU, 42% of agricultural emissions are derived from the enteric fermentation of animals, 38% from soil management, 16% from manure management and 4% from other sources (Barrett et al. 2010).

However, the CAP during its reforms put more emphasis on Agri-environmental payments and extended the measures helping climate mitigation, the research on analysing the impact of EU agricultural policy on emission is limited (Lesschen et al. 2009, Vlontzosa and Pardalos 2017, Zafeiriou et al. 2018).

The research examines how direct and indirect agricultural subsidies under Common Agricultural Policy can contribute to agricultural sustainability via emission reduction in the European Union, where the primary sector has a long tradition in most Member States.
The research addresses how the implementation of climate agreements into CAP regulations may influence greenhouse gas emissions. More specifically, it investigates the results achieved and task to do in the future to achieve low-emission sustainable agriculture.
The findings suggest policy recommendations for decisions and policymakers in agriculture.

Relevant literature

Agriculture is significantly hit by changing climatic conditions, and at the same time, agriculture has to adapt to climate-related risks. Furthermore, the sector also contributes to the development of global warming, as higher emissions of methane (CH_4) and nitrogen dioxide (N_2O) are associated with agricultural activities. Following carbon dioxide, methane has the highest negative impact on Earth's climate. In addition, nitrogen dioxide emitted can persist in the atmosphere for up to a century (Hansen et al. 2007). Furthermore, Knickel et al. (2013) argue that the intensification along with modernization brought increased productivity and employment driven by demand, while many people lost their jobs in the agricultural sector. Automation, the use of pesticides to manage risks and new animal husbandry practices had not only had a positive impact on productivity and competitiveness, but have also increased the environmental impact of production, in line with the deterioration in food quality.

Impact of EU agriculture on climate change
In the EU, 42% of agricultural emissions come from enteric fermentation, 38% from soil management, 16% from manure management and 4% from other sources (Barrett et al. 2010).
In the last decade, the share of organic farming in the European Union has increased by 65%, although they account for 8% of the total agricultural area only (European Commission, 2019).
In the EU, small farms dominate agriculture (Davidova et al. 2012). Two-thirds of the 10 million EU farms have less than 5 hectares of land and the majority of these farms do not exceed 2 hectares. Approximately 20 million people work on EU farms including full- and part-time farm managers and workers, seasonal labour, and farmer's family members (Eurostat Farm Structure Survey 2016).
The size and distribution of farms depend on many factors: different natural conditions, economic situations, and political systems may also play a role. Certain farms may have large surfaces because they keep land under cereal production or breed animals on extensive grazing areas. On the other hand, fruit groves or the use of common land (e.g. sheep and goat farms) often relate to farms with small land areas. Although they are not counted as large farms based on hectares of land, these are very large farms based on their high animal numbers compared to the average pig and poultry farm (European Commission 2020a).
In the European Union, agriculture is responsible for long-lasting greenhouse gas emissions (53% of methane and 74% of nitrogen dioxide). 42% of agricultural emissions are derived from the enteric fermentation of animals, 38% from soil management, 16% from manure management and 4% from other sources in the EU (Barrett et al. 2010).
The EU's role in mitigating climate change in the agricultural sector is crucial because the EU sets environmental standards and co-finances most of the Member States' agricultural expenditure. The development of environmental-related components in the CAP has undergone several stages.

Role of CAP and its reforms in climate change

Automation, the use of pesticides to manage risks and new animal husbandry practices have not only had a positive impact on productivity or competitiveness but have also increased the environmental impact of production, causing the deterioration in food quality.

By 2013, the CAP had reached a stage of reconsideration. The Ciolos reform has laid the foundations for a future strategy with enough potential to harness environmental components. One of the three main objectives for the period of 2014-2020 is dedicated to sustainability and agri-environment, which is also strongly linked to the achievement of food security and regional development (Popp and Jámbor 2015).

All the green components to be achieved can be classified under direct payments, which have remained unchanged in the CAP, with cross-compliance as a permanent core instrument. The greening entered in its final form in 2015 as compulsory compliance, providing a 30% input from direct payments if all its subcomponents are met by farmers (European Commission, 2017). Crop diversification, permanent grassland, ecological areas, must be enforced, but are not mandatory for farmers who participate in an agri-environment scheme (Jámbor and Mizik, 2016). For rural development, six priorities have been established, one of which encourages GHG and ammonia reduction, although Member States can set additional targets in this category (EEA, 2019).

Impact of climate conventions

Building on the achievements of the past and the international climate conventions adopted in 2015, the CAP also build on them from 2020. The European Green Deal was launched in 2020, with the main objective of achieving carbon neutrality in the EU by 2050. To reach this target, Member States are expected to achieve GHG reductions up to 55% by 2030 compared to 1990 (European Commission, 2019). The link between sustainable farming and food production is specifically addressed in the Farm to Fork Strategy. The strategy aims to reduce the use of environmentally harmful pesticides by 50%, fertilisers by 25% and to devote 25% of the EU's total arable land to organic farming by 2030 (European Commission, 2020b). The CAP could also include organic farming and production regulations from 2023. If the CAP measures were aligned with the Farm to Fork Strategy, farmers would be assured of support and visible results in GHG reductions would be achieved. Annual payment plans are undoubtedly on the horizon for farmers who applies sustainability practices (organic farming, integrated pest management and agroecological processes), but these would only come into effect on a voluntary basis (Metta, 2020). The main agricultural measures in 2013 have been extended until the end of 2022, with being the requirement to devote 37% of the existing support envelope to environmental provisions (European Parliament, 2021).

Since 2013, climate action has been one of the main objectives of the CAP. It seeks to ensure a sustainable future for European farmers, provide more targeted support to smaller farms, and allow greater flexibility for EU countries to adopt measures to local conditions.

Agriculture and rural areas are central to the European Green Deal, and the new CAP will be an essential tool in reaching the ambitions of the Farm to Fork and biodiversity strategies (European Court of Auditors 2021).

Influence of CAP subsidies on mitigation

The CAP better incentivised the application of effective mitigation practices in the 2014-2020 period compared to 2007-2013. In contrast, the CAP funds attributed during 2014-2020 to climate action had little impact on agricultural emissions, which have not changed significantly since 2010. Most mitigation measures supported by the CAP have a low potential to mitigate climate change. Livestock emissions, mainly driven by cattle, represent 50% of emissions from

agriculture and have been stable since 2010. On the other hand, the CAP did not support limiting livestock numbers; or provide incentives to reduce them.
Emissions from chemical fertilisers and manure, accounting for almost a third of agricultural emissions, increased between 2010 and 2018. Furthermore, the CAP supports practices that may reduce the use of fertilisers, such as organic farming and grain legumes. However, these practices have an unclear impact on GHGs. In addition, the CAP supported farmers who cultivated drained peatlands, which emit 20 % of EU-27 agricultural GHGs. Although available, rural development support was rarely used for their restoration. Finally, the CAP supports for afforestation, agroforestry and conversion of arable land to permanent grassland did not increase in 2014-2020 compared to 2007-2013 (European Court of Auditors 2021).
In sum, the impact of CAP subsidies on emission reduction is ambiguous or sometimes might be controversial. Based on the literature on the role of CAP subsidies played in GHG emission, the following hypothesis are investigated:

H1 CAP support for rising in the organic farm area helps reduce agricultural GHG emission in the EU.

Many research demonstrated that organic farms are responsible for less carbon emission from combusted fossil fuels by using less natural gas, diesel, and gasoline and no synthetic fertilizers or pesticides in the management of soil fertility and pests (Gomiero et al. 2011, Reganold and Wachter 2016, Meemken et al. 2018).

The CAP funds attributed to climate action had little impact on agricultural emissions. Most mitigation measures supported by the CAP have a low potential to mitigate climate change (European Court of Auditors 2021).

H2 The CAP direct subsidies raise GHG emissions from agriculture in the EU.

After the mid-term review of Agenda 2000 reform, several supporting measures were introduced from an agri-environmental perspective, including an increase in the amount of CAP Pillar II (Rural Development) subsidies, as well as, the introduction of cross-compliance and mandatory modulation (Halmai, 2020). These measures reinforced the EU’s commitment to environmental protection.

H3 CAP payments on rural development may indirectly contribute to emission reduction.

By 2013, the CAP had reached a stage of reconsideration. One of the three main objectives for the CAP 2014-2020 is dedicated to sustainability and agri-environmental measures (Popp and Jámbor 2015). Since 2013, climate action has been one of the main objectives of the CAP. It provides more targeted support to smaller farms, and allow greater flexibility for EU countries to adopt measures to local conditions (European Court of Auditors 2021).

H4 Recent CAP reforms attempted to cut agricultural emissions.

The following section presents the methodology and database applied in this study.

Methodology and data

Panel data econometrics is used to analyse the effectiveness of EU agricultural subsidies on the agricultural CO2 emissions between 2004 and 2019. In this research, the CAP-related determinants of CO2 emission are investigated for the 27 EU member states. The following equation is estimated:

$$ln(agrco2)_{it} = \beta_0 + \beta_1 organic_{it} + \beta_2 ln(rural\ payments_{it}) + \beta_3(\ direct\ payments_{it}) + \varepsilon_{it} \quad (1)$$

where
i denotes EU-27 Member State, t is time expressed in year
β_0 is the constant, β_i are the estimated coefficients
ε_{it} captures the error term

The dependent variable captures the EU agricultural GHG emissions (emissions in CO_2 equivalent, based on the Intergovernmental Panel on Climate Change, IPCC Fifth assessment report AR5, expressed in kilotons). The applied explanatory variables consist of organic farming, the total payments of the Common Agricultural Policy, including the CAP direct payments and the total support for rural development in Euro. The data are collected from the Food and Agriculture Organization Statistical Database (FAOSTAT), European Union Statistical Database (EUROSTAT), the Farm Accountancy Data Network (FADN), Public Database (SO), and the Research Institute of Organic Agriculture FiBL database (Table 1). Fixed effects, dynamic, and cointegrated panel regression estimations are applied.

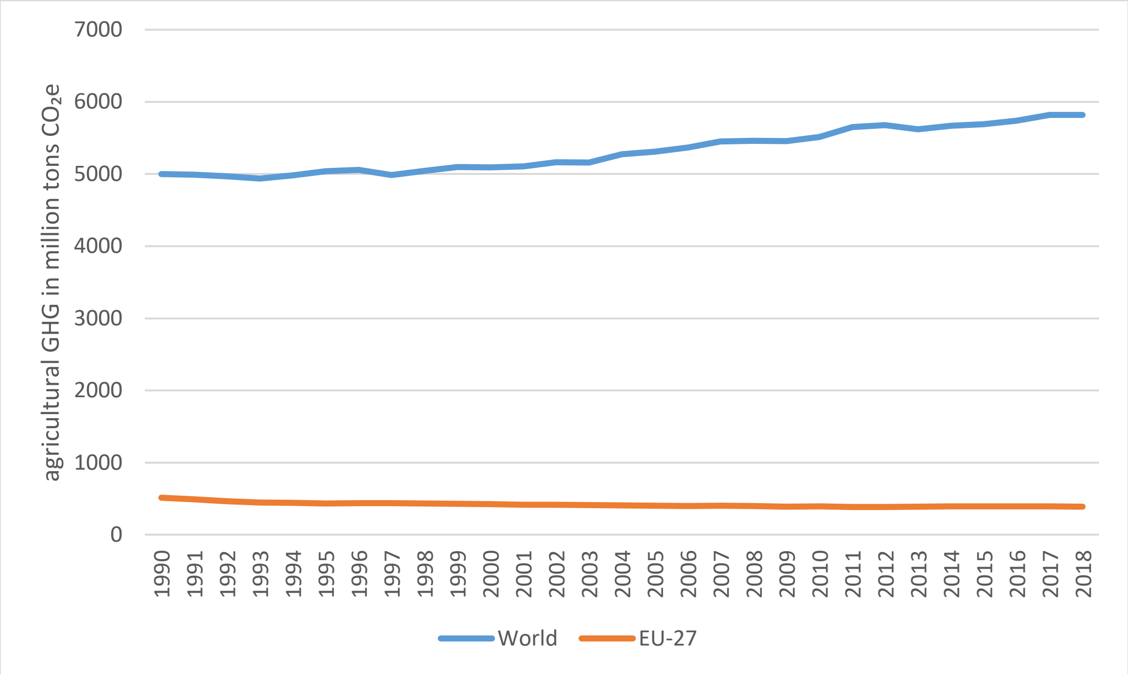
Table 1 Description of variables

Variables	Description	Data source
ln_agr_CO_2	Emissions (CO2eq) IPCC AR5 Agriculture kilotons	FAOSTAT (2021)
organic_area	Organic farm area, share of total farmland in per cent	FiBL (2021)
ln_rural_payments	Total support for rural development in Euro	EUROSTAT FADN (2021)
ln_direct_payments	Total direct payments in Euro	EUROSTAT FADN (2021)
Health_Check_2009	1 if Year >2008, 0 otherwise	own composition
Ciolos_reform_2013	1 if Year >2012, 0 otherwise	own composition

Source: own composition

Considering the period of 1990-2018, Figure 1 shows that EU-27 agricultural emissions have decreased by 23,9% over 26 years while the world agricultural emission increased by 16,4%. This can be explained by EU energy efficiency, agri-environmental measures, new climate regulation adopted.

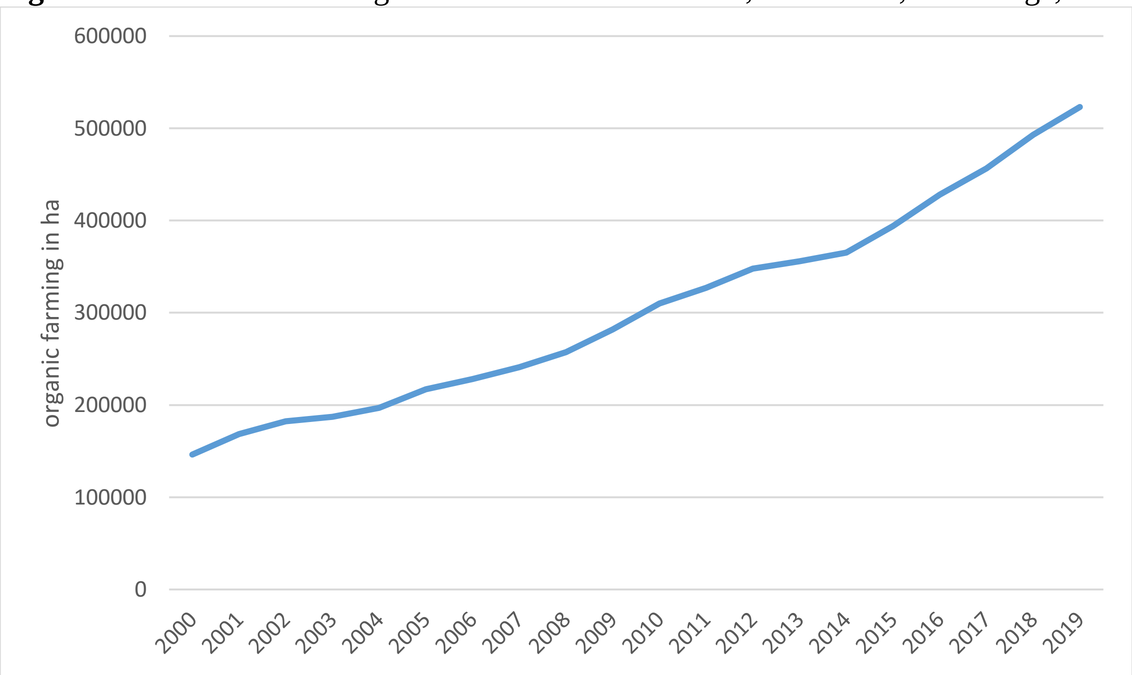
Figure 1 Changes in the World and the EU-27 agricultural GHG emissions measured in CO_2 equivalent in million tons, 1990 and 2018



Source: own composition based on Climate Watch (2022) data

Many additional factors have increased the global agricultural-related GHG emission over the decades. Among others, livestock farming, rice cultivation (wet fields release CH_4 through fermentation processes in the soil), animal manure and fertiliser use on arable land (N_2O), and landfill and wastewater practices (Olivier et al. 2017). Since the late 2000s, the slight increase in emissions has been caused by increased agricultural activity and deforestation in tropical regions (Ritchie and Roser 2022). The organic farm area was increased by 257 % (376 thousand ha) compared to 2000 in the EU-27 Member States (Figure 2).

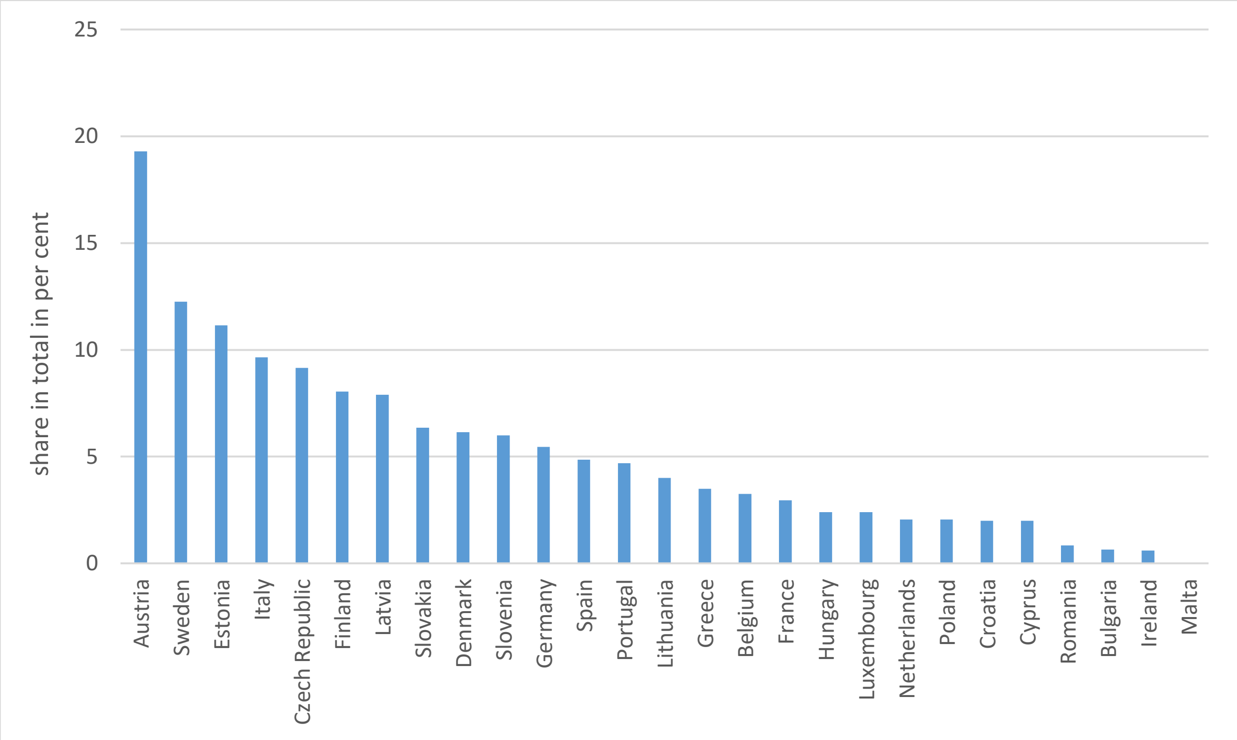
Figure 2. Evolution of the organic farm area in the EU-27, in hectares, on average, 2000-2019



Source: own composition based on FiBL (2021)

Regarding the share of organic farms in the EU total land area, Austria accounted for the highest proportion of organic area (19,3%), followed by Sweden (12,25%) and Estonia (11,15%) (Figure 3).

Figure 3. Share of organic farm area in the total farm area in the EU, in per cent, 2000-2019



Source: own composition based on FiBL (2021)

Results

Panel tests for autocorrelation suggest that data has first-order autocorrelation. Variables are cross-sectionally dependent. Furthermore, additional tests confirmed that variables contain unit roots (Appendix). Pedroni and Westerlund's tests indicate that cointegrated relation exists between variables (Table 2).

Table 2 Test for cointegration

Cointegration tests	Statistic	p-value
Pedroni		
Modified Phillips-Perron t	2.5451**	0.005
Phillips-Perron t	-6.4447**	0.000
Augmented Dickey-Fuller t	-7.0662**	0.000
Westerlund		
Variance ratio	-1.9301**	0.027

** p<0.05

Since variables are autocorrelated, cross-sectionally dependent and cointegrated, various panel estimation techniques (Panel Fixed Effect, Arellano-Bond linear dynamic panel-data estimation, Panel Corrected Standard Error model, Fully Modified Ordinary Least Squares,

Dynamic Ordinary Least Squares Regressions) were performed to assure the robustness of the results.
Regression estimates suggest that the agri-environmental measures included in the Common Agricultural Policy helped increase the share of organic farming, which have stimulated the reduction of GHG emissions between 2004 and 2019. CAP reforms have encouraged farmers to set up organic farms by introducing green components and allocating a high percentage of subsidies for sustainable production. Of the variables examined, the expansion of organic farming and total payments on rural development contributed significantly to EU greenhouse gas emissions reduction. In turn, direct CAP payments increased GHG emissions in all models estimated (Table 2). Regarding CAP reforms included, the Health Check carried out in 2009 helped reduce while Ciolos reform in 2013 stimulated GHG emission (FE and DPD) in the dynamic model but helped reduce emission in cointegrated regressions (FMOLS and DOLS) in the EU-27.

Table 2. Estimation results, 2004-2019

VARIABLES	(1) FE ln_agr_ CO_2	(2) DPD ln_agr_ CO_2	(3) PCSE ln_agr_ CO_2	(4) FMOLS ln_agr_ CO_2	(5) DOLS ln_agr_ CO_2
L.ln_agr_ CO_2	0.711***	0.711***			
	(0.038)	(0.0335)			
organic_area	-0.002*	-0.001*	0.065***	0.073	0.078
	(0.000)	(0.000)	(0.006)	(0.049)	(0.060)
ln_direct_payments	0.036**	0.036***	1.153***	1.210***	1.311***
	(0.017)	(0.007)	(0.068)	(0.327)	(0.402)
ln_rural_payments	-0.008**	-0.008**	-0.853***	-0.949***	-1.023***
	(0.003)	(0.003)	(0.072)	(0.248)	(0.318)
Health_Check_2009	-0.012**	-0.012***	-0.097***	-0.135	-0.209
	(0.004)	(0.004)	(0.034)	(0.578)	(1.131)
Ciolos_reform_2013	0.007**	0.008**	-0.159***	-0.216	-0.197
	(0.003)	(0.004)	(0.030)	(0.532)	(0.963)
Constant	2.281***	2.281***	4.609***	4.866**	4.514*
	(0.407)	(0.283)	(0.217)	(2.112)	(2.569)
Observations	413	386	413	412	410
R-squared	0.629		0.278	0.089	0.310
Number of pid	27	27	27		

Note: FE -Panel Fixed Effect, DPD - Arellano-Bond linear dynamic panel-data estimation, PCSE- Panel Corrected Standard Error model, FMOLS - Fully Modified Ordinary Least Squares, DOLS - Dynamic Ordinary Least Squares
Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Since the variables contain unit roots, the models were estimated in the first differenced form. The panel cointegrated regression (FOMLS, DOLS) in differenced form was in line with results in level form (Table 3).

Table 3 Estimation results at the differenced level

	(1)	(2)
	FMOLS	DOLS
VARIABLES	D.ln_agr_CO_2	D.ln_agr_CO_2
D.Organic_area	-0.002**	-0.002
	(0.001)	(0.002)
D.ln_direct_payments	0.029***	0.075***
	(0.007)	(0.013)
D.ln_rural_payments	-0.006***	-0.005
	(0.002)	(0.004)
Health_Check_2009	-0.002	-0.004
	(0.002)	(0.004)
Ciolos_reform_2013	0.007***	0.001
	(0.001)	(0.003)
Constant	-0.005***	-0.003
	(0.002)	(0.003)
Observations	385	383
R-squared	0.021	0.099

Note: FMOLS - Fully Modified Ordinary Least Squares,
DOLS - Dynamic Ordinary Least Squares
Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Discussion and Conclusion

The share of EU emissions from agriculture in total is approximately 10%. Agriculture is responsible for many long-lived greenhouse gas emissions (CO_2, CH_4 and N_2O) in the EU. The European Union has set a target to achieve carbon neutrality by 2050. The Common Agricultural Policy of the EU can also play a significant role in achieving this target. The new legislation that starts in 2023 provides for a fairer, greener and more performance-based CAP (European Commission 2022).

The paper investigates the evaluation of agricultural subsidies under the CAP. Panel data econometrics is employed to analyse the effectiveness of EU subsidies on diminishing agricultural emissions between 2004 and 2019.

The result indicates that recent CAP reforms contributed to increasing the share of agri-environmental subsidies, creating supporting elements that encourage greener and more sustainable agricultural production. Regression estimates suggest that the agri-environmental measures included in the CAP helped increase the share of organic farming, which have stimulated the reduction of GHG emissions between 2004 and 2019. The organic farmlands increased by 257 % by 2019 compared to 2000.

CAP reforms have encouraged farmers to set up organic farms by introducing green components and allocating a high percentage of subsidies for sustainable production. Moreover, the expansion of organic farming and total payments on rural development contributed significantly to EU GHG emissions reduction.

In contrast, the analysis of the CAP direct subsidies has highlighted its weaknesses in climate mitigation such as CAP direct payments increased GHG emissions in the estimated models. Considering CAP reforms, the Health Check carried out in 2009 helped reduce while the Ciolos reform in 2013 stimulated GHG emission in the dynamic model but assisted to reduce emission

in cointegrated regression models in the EU-27. This suggests that the effect of EU policies on GHG emissions mitigation is mixed in line with (Zafeiriou et al. 2018).
Despite the increased climate ambition of the EU, cross-compliance rules and rural development measures changed little from 2014 through 2020 compared to 2007-2013. These schemes did not motivate farmers to adopt effective climate mitigation measures. While the greening scheme was supposed to improve the environmental performance of the CAP, its impact on climate has been limited (European Court of Auditors 2021).
In the future, specifically targeted subsidies and raising support for sustainable organic farming could be one of the solutions for policymakers. Moreover, from environmental aspects, it might be advantageous to consider extending green financial supports as it would create an additional stimulus for agriculture, providing resources for sustainable, low carbon production and incentives for emission cuts in the sector. The results draw attention to the need for action to curb EU agricultural emissions by reforming the system of direct payments (single area payment, farm payments) and agricultural subsidies as a whole.
Sustainability can have incorporated into EU policy by expanding green finance and investment, the greening of budgets, increasing the spending on information technology, research and innovation, education and training.
Several policies are designed to achieve sustainability in the EU, such as Farm to Fork strategy, ecosystems and biodiversity, but its climate impacts are still unknown. Further research is needed to evaluate the climate impacts of the Farm to Fork strategy.
The limitation of the research is that the panel data is not strongly balanced. CAP subsidies were available from 2004 having missing values for certain countries and years.

Appendix

Table A. summary statistics, 2004-2019

Variable	Observation	Mean	Standard Deviation	Min	Max
ln_agr_CO_2	432	8.769	1.497	4.386	11.302
organic_area	432	5.845	5.126	0	26
ln_direct_payments	417	9.280	0.974	6.990	11.725
ln_rural_payments	413	7.967	1.385	2.565	11.091
Health_Check_2009	432	0.688	0.464	0	1
Ciolos_reform_2013	432	0.438	0.497	0	1

Table B. Pesaran (2004) and Pesaran (2015) CD-test for cross-sectional dependence

Variable	CD-test	p-value
ln_agr_CO_2	41.981	0.000
organic_area	69.956	0.000
ln_direct_payments	26.349	0.000
ln_rural_payments	16.84	0.000

Note: Under the null hypothesis of cross-section independence, CD ~ N(0,1)

Table C. Fisher-type unit-root test based on Augmented Dickey-Fuller tests

Level		**Differenced**	
ln_agr_CO_2	p-value	D.ln_agr_co2	p-value
Inverse chi-squared (54)	0.034	Inverse chi-squared (54)	0.000
Inverse normal	0.091	Inverse normal	0.000
Inverse logit t (139)	0.059	Inverse logit t (139)	0.000
Modified inv. chi-squared	0.025	Modified inv. chi-squared	0.000
organic_area		D.Organic_area	
Inverse chi-squared (54)	0.999	Inverse chi-squared (54)	0.000
Inverse normal	1.000	Inverse normal	0.000
Inverse logit t (134)	1.000	Inverse logit t (134)	0.000
Modified inv. chi-squared	0.998	Modified inv. chi-squared	0.000
ln_direct_payments		D.ln_direct_payments	
Inverse chi-squared (54)	0.000	Inverse chi-squared (54)	0.000
Inverse normal	0.000	Inverse normal	0.000
Inverse logit t (139)	0.000	Inverse logit t (139)	0.000
Modified inv. chi-squared	0.000	Modified inv. chi-squared	0.000
ln_rural_payments		D.ln_rural_payments	
Inverse chi-squared (54)	0.000	Inverse chi-squared (54)	0.000
Inverse normal	0.000	Inverse normal	0.000
Inverse logit t (139)	0.000	Inverse logit t (139)	0.000
Modified inv. chi-squared	0.000	Modified inv. chi-squared	0.000

Source: own composition based on sample data

Table D. Maddala and Wu (1999) Panel Unit Root test (MW)

Specification without trend							
Variable	lags	chi_sq	p-value	Variable	lags	chi_sq	p-value
ln_agr_CO_2	0	74.407	0.034	organic_area	0	21.165	1.000
ln_agr_CO_2	1	70.892	0.061	organic_area	1	16.648	1.000
ln_agr_CO_2	2	61.047	0.238	organic_area	2	14.940	1.000
ln_agr_CO_2	3	57.982	0.331	organic_area	3	12.904	1.000
ln_agr_CO_2	4	57.118	0.360	organic_area	4	28.393	0.998

Pesaran (2007) Panel Unit Root test (CIPS)

Specification without trend							
Variable	lags	Zt-bar	p-value	Variable	lags	Zt-bar	p-value
ln_agr_CO_2	0	-1.000	0.159	organic_area	0	-1.962	0.025
ln_agr_CO_2	1	-0.919	0.179	organic_area	1	0.628	0.735
ln_agr_CO_2	2	0.532	0.703	organic_area	2	4.268	1.000
ln_agr_CO_2	3	3.283	0.999	organic_area	3	3.582	1.000
ln_agr_CO_2	4	22.160	1.000	organic_area	4	22.160	1.000

Source: own composition based on sample data

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