Distances to climate targets 2030 in EU-27 agriculture: explorative analysis

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Extended abstract prepared for presentation at the 181st seminar of the EAAE
"Greenhouse gas emissions in the EU agriculture and food sector: potential and limits of climate mitigation policies and pricing instruments"
Berlin, Germany
October 5-7, 2022

Climate change mitigation is one of the major global challenges, especially in agriculture, since it both suffers from and contributes to climate change. In order to reach national and sectoral greenhouse gas (GHG) targets, constant progress monitoring, as well as cross-country and cross-sectoral comparisons are crucial. The latter is rather limited, especially for agriculture, since there is no formulated EU-wide GHG target specifically for agriculture; instead, agriculture is currently considered as a part of the so-called Effort Sharing Sector, i.e., sectors beyond the EU Emission Trading Scheme and LULUCF. The EU Effort Sharing Regulation (EU Commission, 2021) sets binding national emission targets for 2030, expressed as percentage changes from 2005 levels and assigned to each Member State (MS) based on its gross domestic product (GDP) per capita. Although these climate targets hold for all effort-sharing sectors together, for this analysis we only consider agriculture and assume that every sector within the Effort Sharing Regulation aims to contribute to GHG targets proportionally. It is important to highlight that this assumption implies high heterogeneity in terms of required efforts from the agricultural sector. In particular, the higher the contribution of agriculture to total national GHG emissions (Fig. 1), the more difficult it is for the agricultural sector to ensure a proportional contribution.

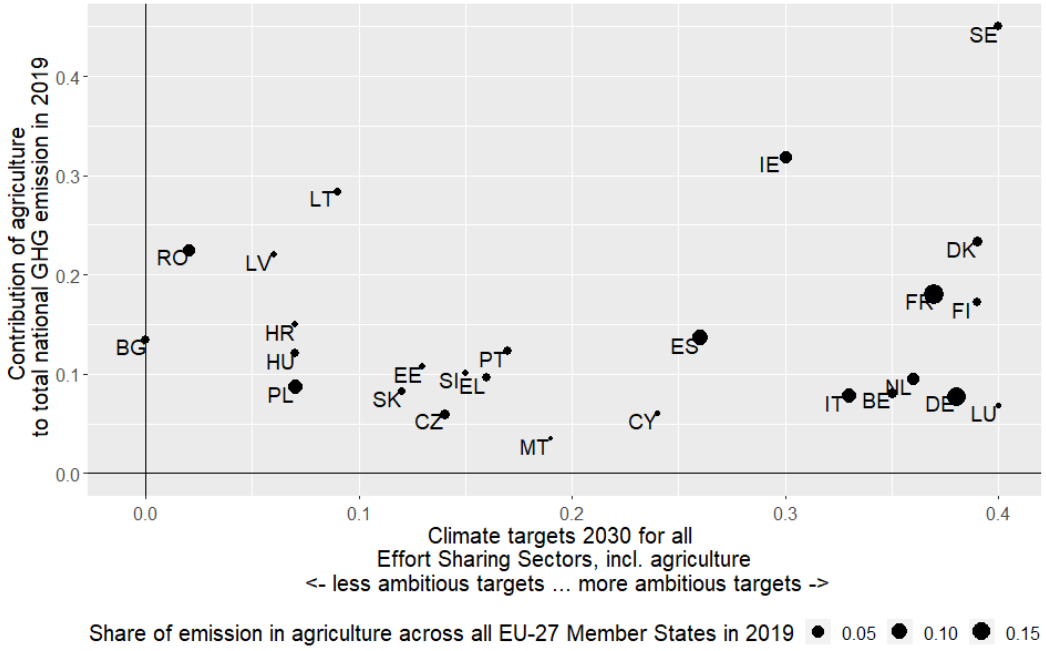

Figure 1. Targeted reduction of greenhouse gas emission for Effort Sharing Sectors by 2030 and contribution of agriculture to national GHG emission in 2019

The theoretical background of climate change mitigation is twofold. On the one hand side, climate change is a global public bad (Hasson et al., 2010), characterized by marginal social costs being higher than marginal private costs. This leads to an optimal level of climate change mitigation being higher than the one that the markets determines. On the other hand, since nations aim to decrease GHG emission beyond the level that would be achieved due to a decrease of associated output, the concept of total factor productivity (Murty et al., 2012) could be applied to analyse national performance in terms of climate targets.

The progress towards climate targets is, among others, documented in the UNFCCC biannual projection reports (BR). For each EU MS, we derived a so-called 'distance to climate targets for 2030', i.e., the relative difference between the targeted GHG emission in agriculture and the projected one:

$$Distance\_to\_targets = \frac{Projected\_CO_2eq - Targeted\_CO_2eq}{Targeted\_CO_2eq}$$

where $Projected\_CO_2eq$ stays for GHG emission from agriculture projected for 2030 in the latest UNFCCC biannual report; and $Targeted\_CO_2eq$ stays for GHG emission from agriculture in 2030, according to the EU

Effort Sharing targets proportionally inferred on agriculture. The revealed heterogeneity across MSs is remarkable: while Malta and Croatia are going to reach their 2030 targets very well, ten MSs, including Germany, France, and Denmark, are expected to emit in 2030 over 50% more GHG in agriculture than targeted. Employing the Jenks natural breaks classification, we assigned each EU MS to one of the two classes: (i) with low; and (ii) with high distances to climate targets (green and red colours respectively on Fig. 2).

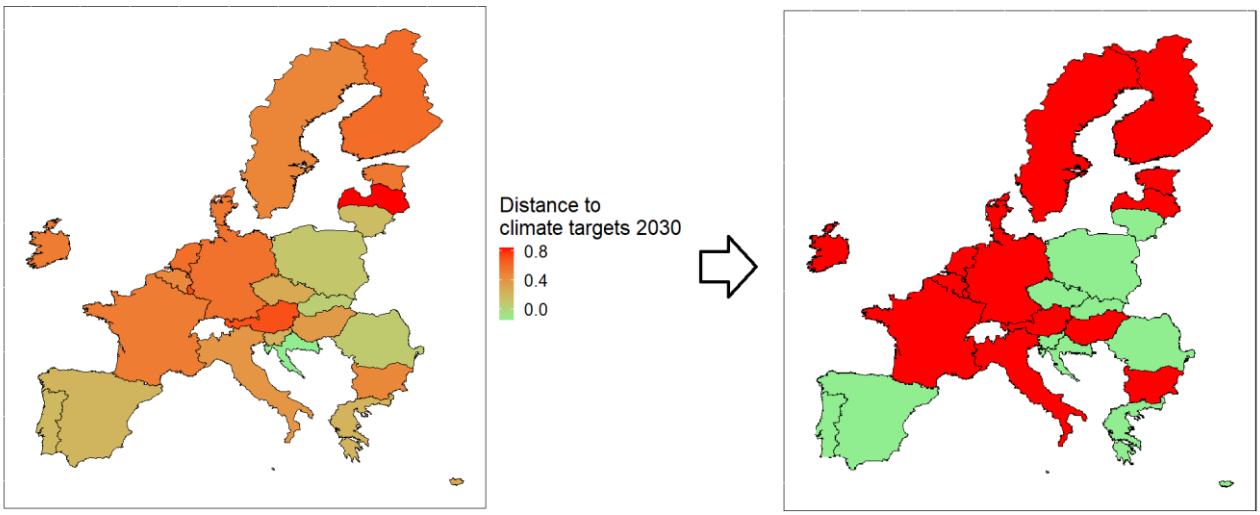

Figure 2. Two classes based on distances to climate targets 2030 for agriculture, defined according to the Jenks natural breaks classification

Next, we compared a range of other variables among classes using the Mann-Whitney-U test. We discovered that despite their low distance to climate targets, MSs from this class reported higher agricultural emission per capita and higher total emission per GDP. These countries also invested substantially less in mitigation measures, even if compared per euro of GDP or per tonne of GHG emission. At the same time, no difference across classes was revealed in the number of implemented measures, in the agricultural GDP per capita, or in the share of agriculture in total GDP.

Our conclusions are twofold. On the one hand side, distribution of targets 2030 across the EU MSs is based on the Effort Sharing Regulation and with this on GDP per capita; yet, there is no significant difference in GDP from agriculture per capita between the two classes. The targets put a special responsibility on the EU MSs with high GDP per capita and high share of agricultural emissions to develop and implement mitigation options in agriculture (Richards et al., 2018). In this case, the current distribution of targets might hit agriculture particularly hard. On the other hand, large positive distance to climate targets is associated with significantly higher investments into climate change mitigation, as well as lower difference between mitigation costs under the baseline scenario and under maximum feasible technological GHG reduction. This result can hint that the EU MSs with large distance to climate targets might face higher abatement cost. These hypotheses should be tested in follow-up research. Another promising avenue for further research is a cross-country analysis of mitigation measures (Bryngelsson et al., 2016).

Table 1. Differences and similarities between the classes based on the Mann-Whitney-U test

	High or positive distance to climate targets	No significant difference between classes	Low or negative distance to climate targets
GHG emission		Share of GHG from agriculture	
		Total GHG per capita	
	Higher agri GHG per capita 2019	Agri GHG per capita 2005	Lower agri GHG per capita 2019
		Share of agricultural GHG by activity (e.g., manure management, on-farm energy use, etc.)	
GDP and trade	Higher GDP per capita	Agri GDP per capita	Lower GDP per capita
	Lower share of GDP from agriculture 2005	Share of GDP from agriculture 2019	Higher share of GDP from agriculture 2005
	Lower GHG per € of GDP	Agri GHG per € of agri GDP	Higher GHG per € of GDP
		Net agri export per agri GDP	
Mitigation measures	Lower difference of costs between baseline and max feasible technological GHG reduction	Number of implemented mitigation measures	Higher difference of costs between baseline and max feasible technological GHG reduction
	Higher investments into mitigation measures (total, per € of total GDP, per € of agri GDP)	Number of implemented mitigation measures by keywords (e.g., „organic“, „soil“, „manure“, „forest“, etc.)	Lower investments into mitigation measures (total, per € of total GDP, per € of agri GDP)

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