Investigating the influence of recent policy initiatives and structural changes on soil fertility and GHG emissions in the EU agriculture

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Objective

Investigating the driving forces that contribute conditioning the way the agricultural sector address climate and soil health issues in the EU.

Background

To date, around 60-70% of soil ecosystems in the EU are unhealthy and suffering from continuing degradation. Around 45% of EU soils have low or very low organic carbon content (below 2%).

Nevertheless we know that increasing in soil organic carbon in agriculture allows:

- mitigating climate change
- making soil more resilient to disturbances and weather extremes
- Increase soil fertility, soil biodiversity and productivity, reducing chemical input needs

Background

There is some evidence that:

The observed **reallocation of the land** among larger and efficient farms together with the increasing intensification of farming practices put significant pressure on the land system:

- growing rise of agro-industrial farms pushed by the concentration of the food market
- growth in energy crop cultivation pushed by energy policies

Agricultural policies demonstrated having sometimes ambiguous impacts on soil health, climate mitigation, biodiversity conservation:

- Greening requirements have addressed few farms and AEC-measures have not contributed to significantly change existing production methods
- Coupled payments contributed to favour the concentration of farming systems and decoupled payments to push-up land prices, limiting access to land to small farms

Methodology

Enhanced qualitative comparative analysis (QCA) with fuzzy sets:

- based on Boolean algebra which allows dealing with medium to large observations, n ≥ 10 (26-28 NUTS 1 level EU territorial observations in our study).
- allows identifying **necessary** and **sufficient** conditions (causes) for an outcome (effect) to occur

Necessary conditions – a cause is defined necessary if it must be present for a certain outcome to occur
Sufficient conditions – a cause is defined sufficient if it can produce a certain outcome

Consistency and the coverage parameters of fit, 0-1 ranging, allow to verify the existence of necessary and sufficient conditions for an outcome to occur

Consistency - the degree to which the empirical evidence is in line with the statement of nec. or suff.
Coverage – the empirical importance of results

Type of conditions	Consistency thresholds	Coverage thresholds
Necessary	0.90	0.6
Sufficient	0.75	-

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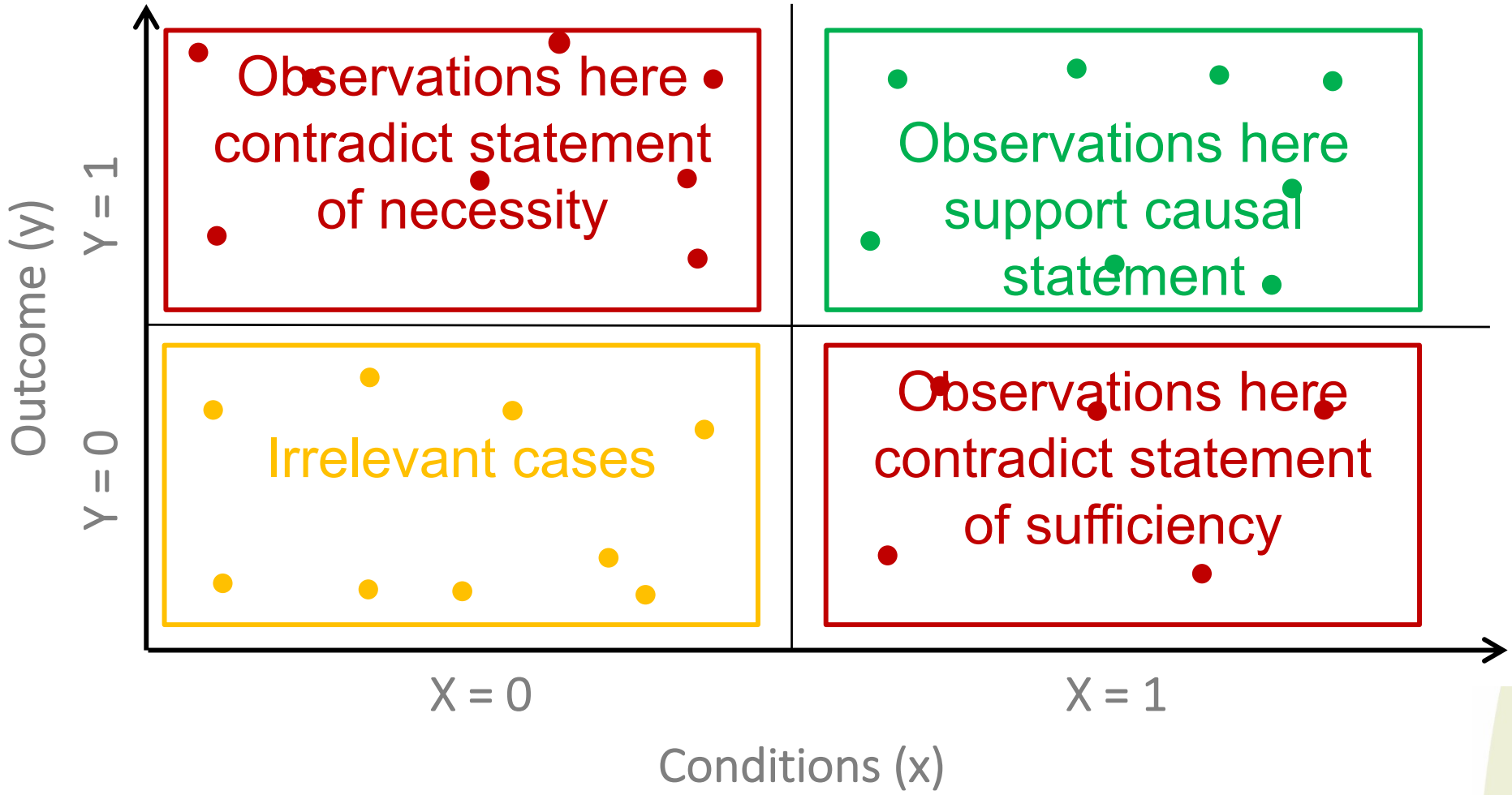
Methodology



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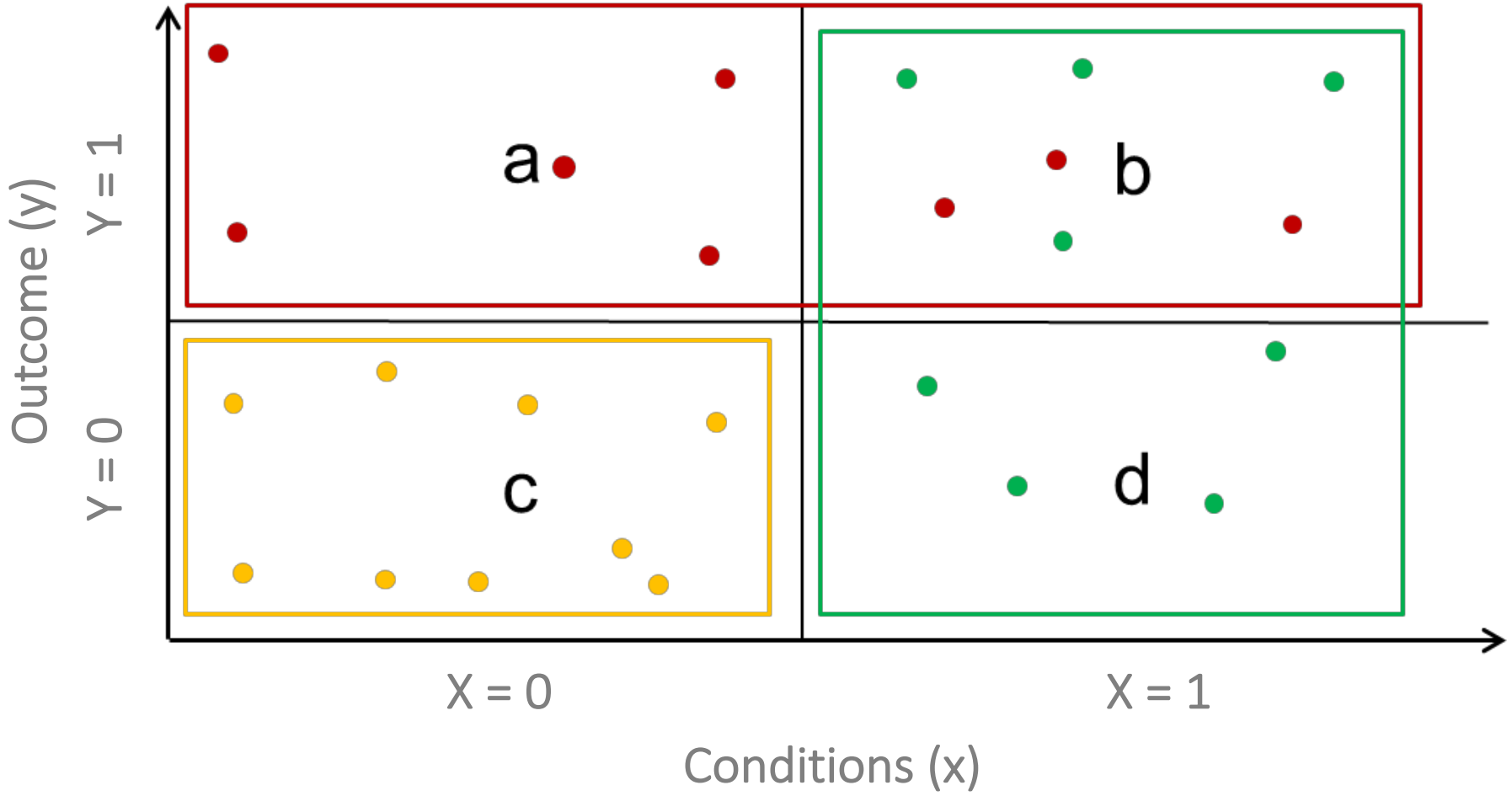
Methodology

Type of conditions	Consistency	Coverage
Necessary	b/(a+b)	**b/(b+d)**
Sufficient	b/(b+d)	**b/(a+b)**



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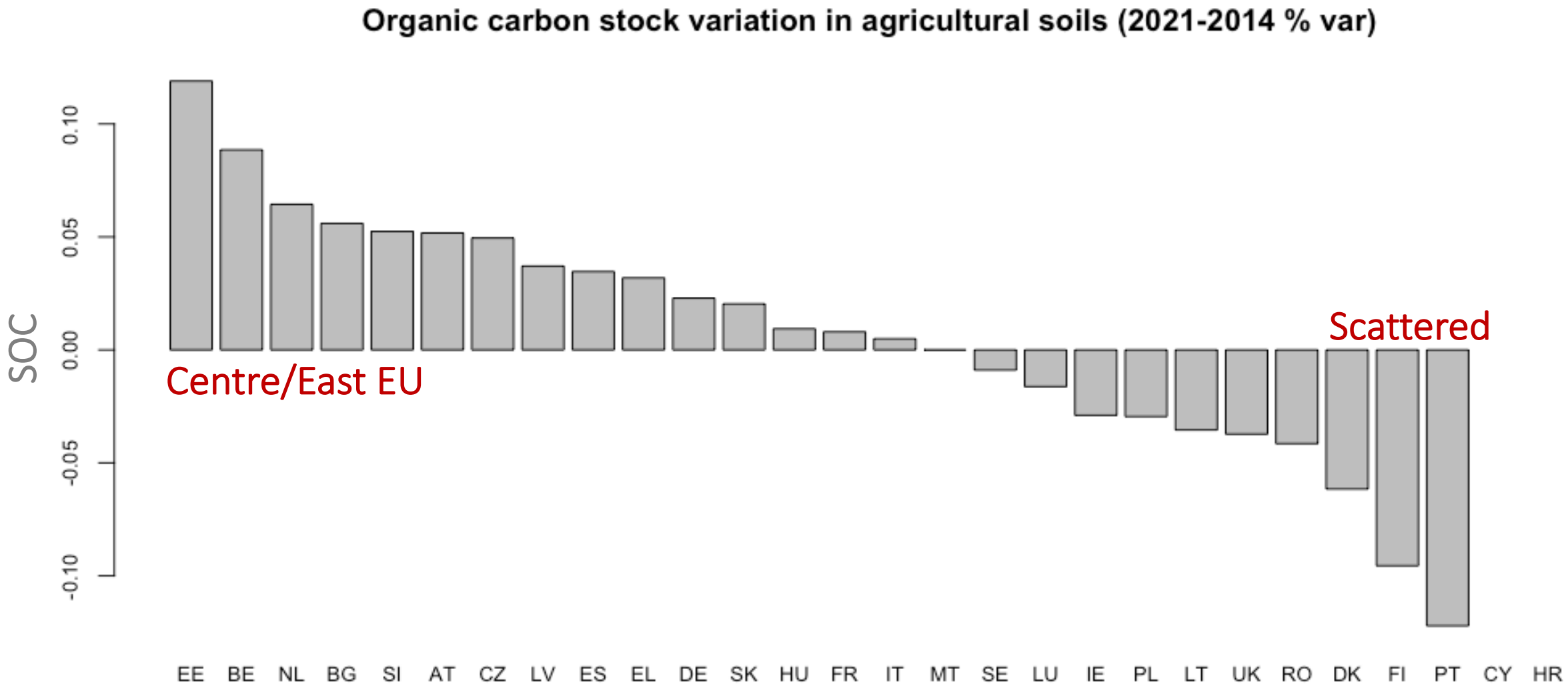
Provisional Data

Type of set		Set	Description	Source
Outcome		GHG	2021-2014 variation of GHG emissions from agriculture' (% var).	European Environment Agency.
		SOC	2021-2014 variation of organic carbon content in agricultural soils (% var).	Joint Research Centre.
Conditions	Structural changes	LANDSP	2021-2014 UAA variation of farms with a size higher than 100 ha (% var).	Eurostat.
		LVKSP	2021-2014 size variation of livestock farms larger than 300 LSU (% var).	
	Type of policy interventions	FUNDORG	Funds ratio addressed to promote organic farming (RDP Measure 10) on the total 2014-2021 CAP funding (%).	Declarations of expenditure for the European Agricultural Fund for Rural Development.
		FUNDFRT	Funds ratio addressed to promote afforestation (RDP Measure 8) on the total 2014-2021 CAP funding (%).	
		FUNDVCS	Funds ratio addressed to coupled payments on the total 2014-2021 CAP direct payments (%).	
	Scope of policy interventions	LANDCSQ	Percentage of agricultural and forest land under management contracts contributing to carbon sequestration or conservation, focus area 5E (% on the UAA).	Annual implementation reports of Rural Development programs.
		LANDGHG	Percentage of agricultural land under management contracts targeting reduction of GHG and/or ammonia emissions, focus area 5D (% on the UAA).	

Provisional Data



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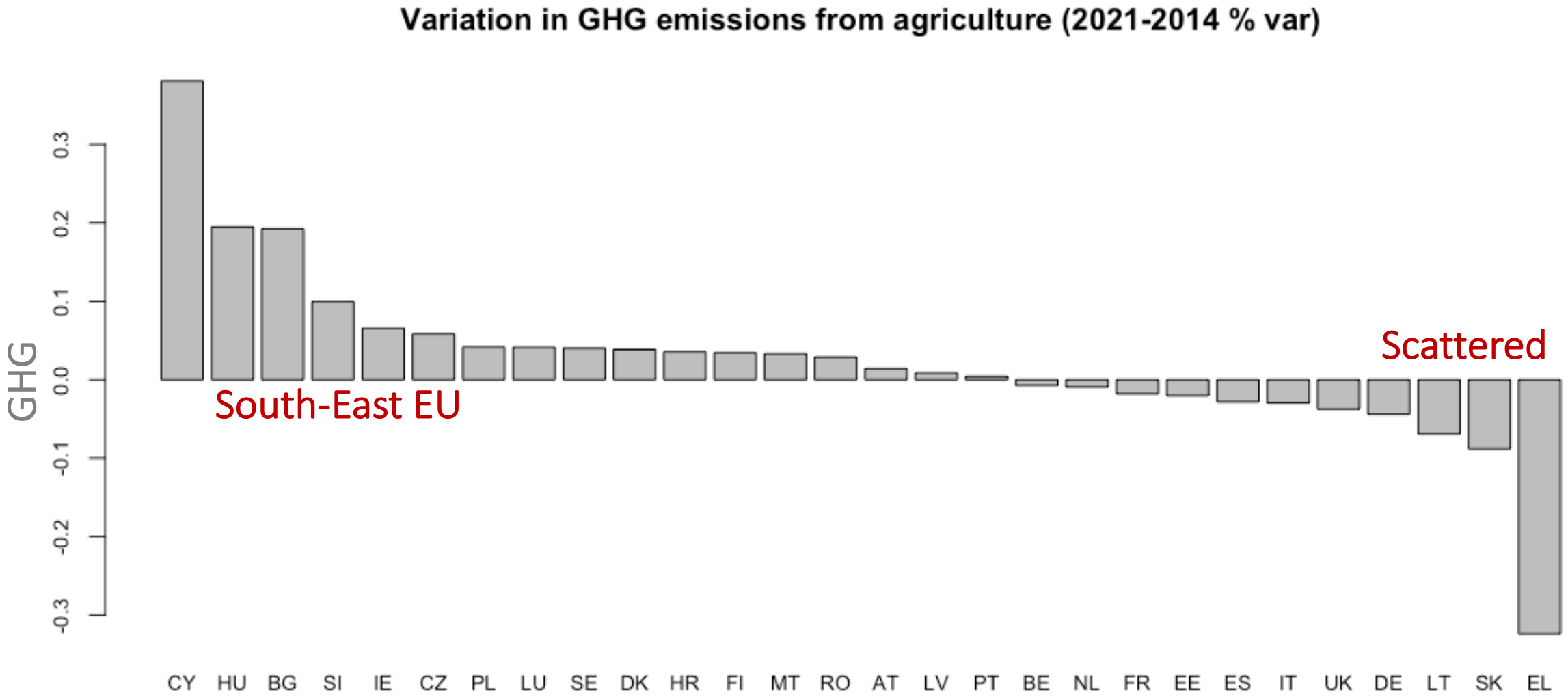
Provisional Data



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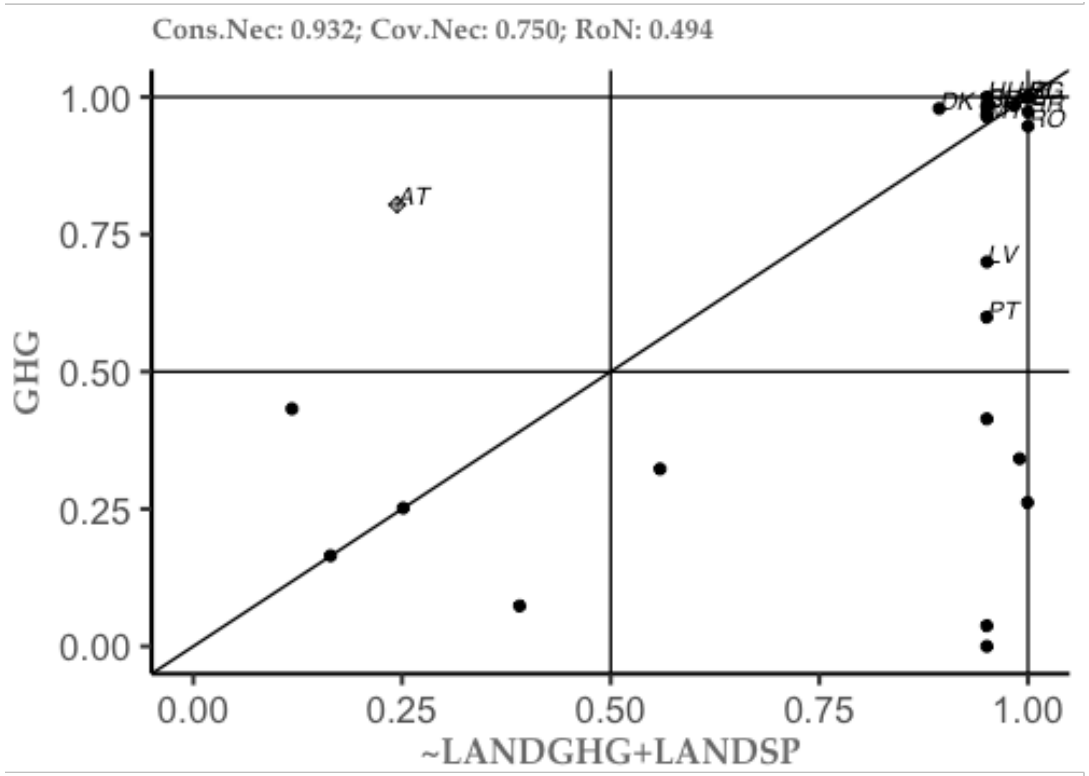
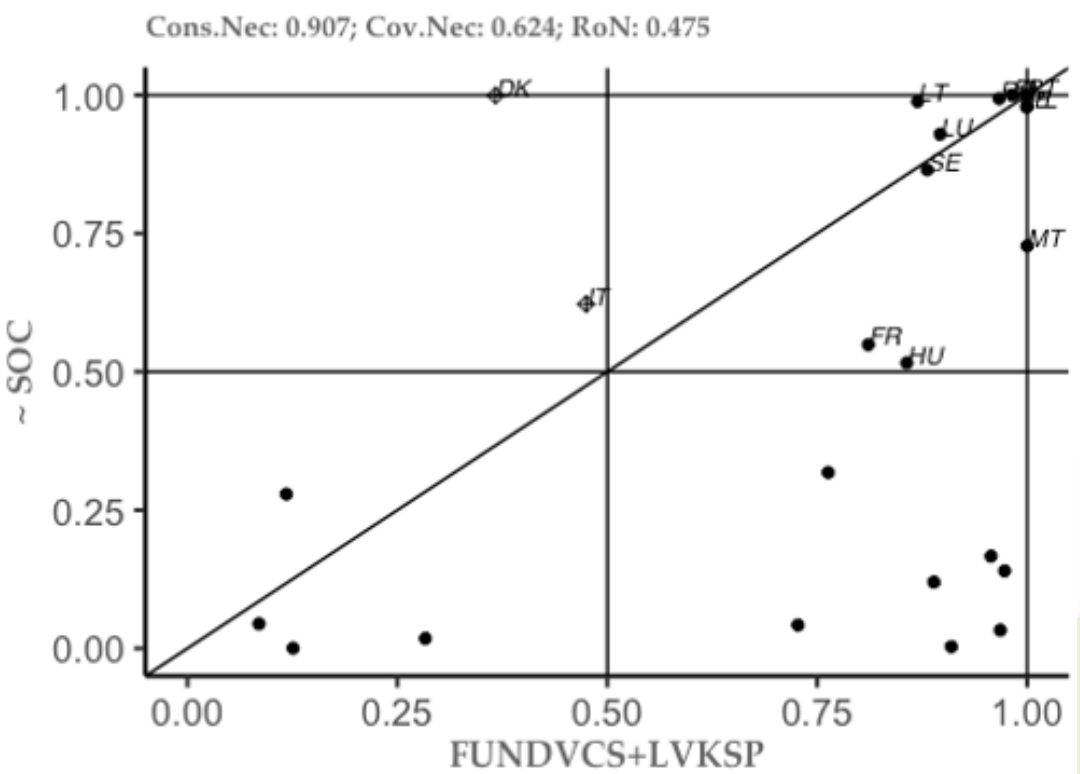
Provisional results - Analysis of Necessity





- The increase of GHG emission is associated with land concentration and/or with the reduction of agricultural land under management contracts
- The reduction in SOC is associated with livestock concentration and/or with the provision of coupled funds to agriculture

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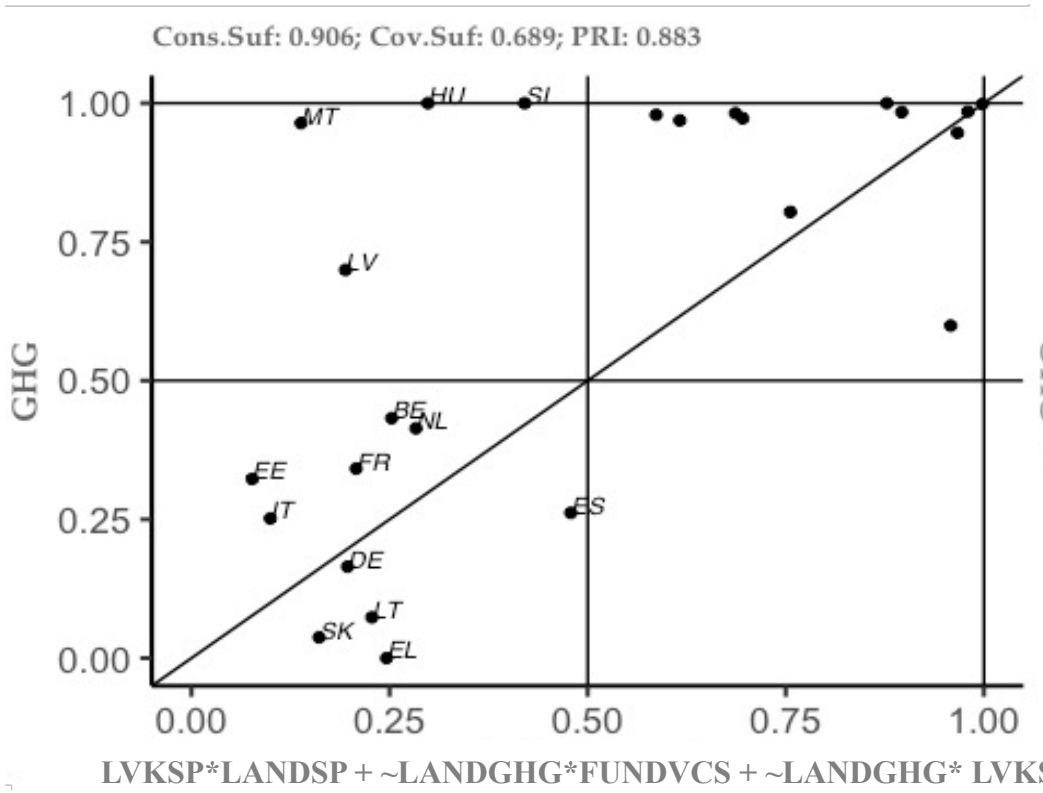
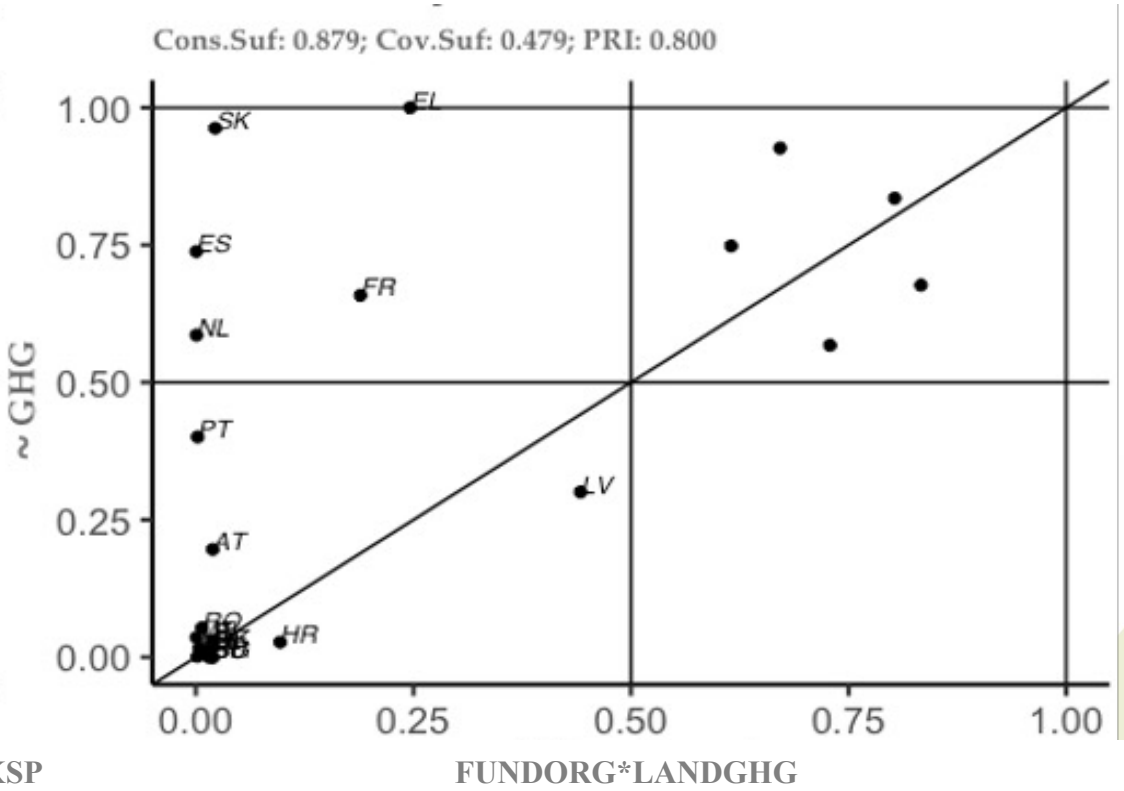
Provisional results - Analysis of Sufficiency





The increase of GHG emission is associated with:

- the combination of livestock and land concetration for East EU
- the low % of land under management contracts and coupled payments for North EU
- the low % of land under management contracts and livestock concentration for Centre EU

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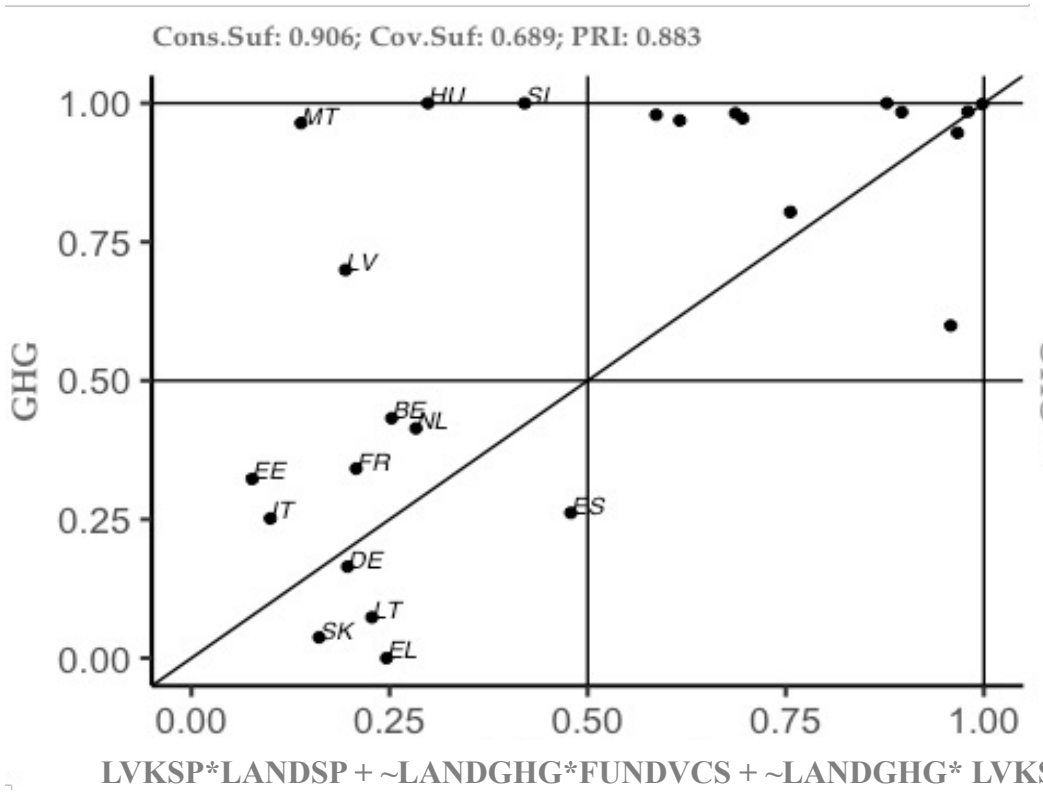
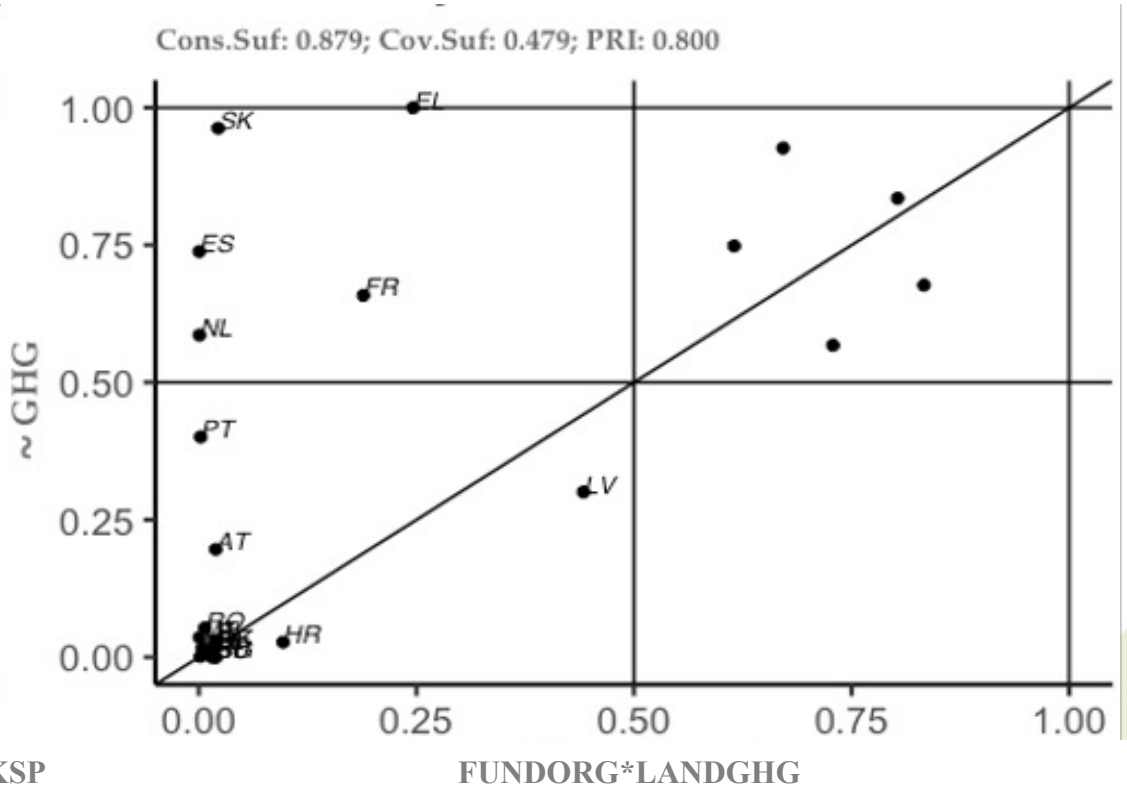
Provisional results - Analysis of Sufficiency





The reduction of GHG emission is associated with:

- the high funds for organic farming coupled with the high % of land under management contracts

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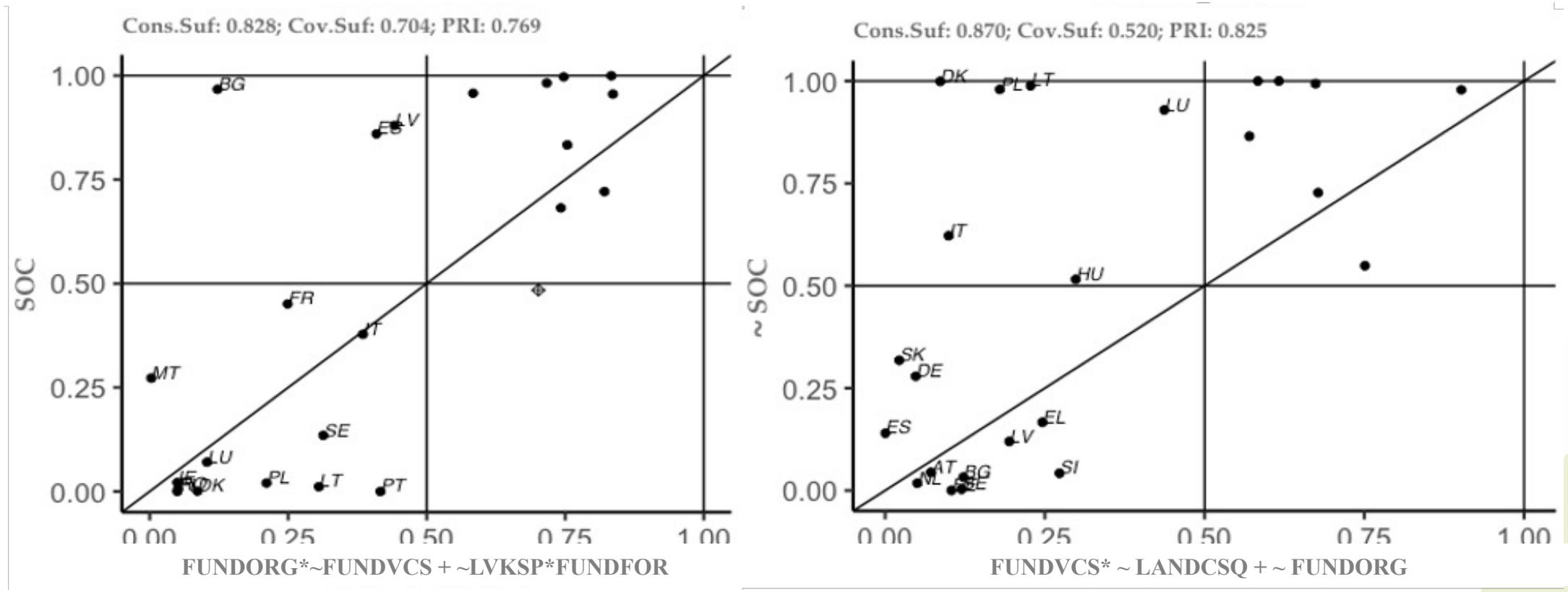
Provisional results - Analysis of Sufficiency



The reduction of SOC is associated with:

- the high funds for coupled payments and the low % of land under management contracts for north EU
- The low funds for organic farming in other areas

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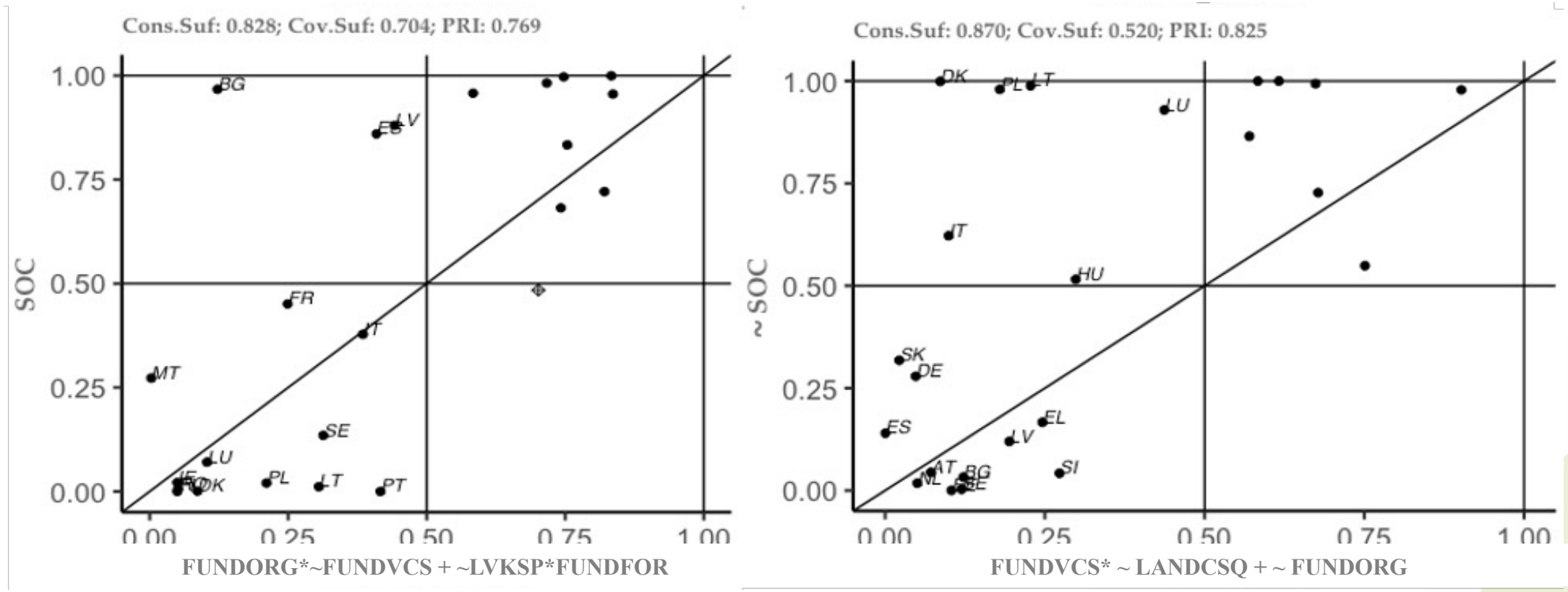
Provisional results - Analysis of Sufficiency



The increase of SOC is associated with:

- The high funds for organic farming coupled with the low funds for coupled payments for Centre EU
- The reduction of livestock concentration and the high funds for afforestation for East EU

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Concluding remarks

Negative impacts *- increase of GHG emissions and the reduction of SOC*

Negative impacts occurs with the concentration of farmlands and livestocks or with the lack of desired incentives/excess of perverse incentives

The presence of perverse incentives is sufficient in addressing the increase of GHG emissions and the reduction of SOC in the absence of desired incentives

Positive impacts *- reduction of GHG emissions and the increase of SOC*

The presence of desired incentives is sufficient in addressing the positive impacts, even the presence of perverse incentives

The reduction of farmland and livestock concentration are sufficent in addressing positive impacts even in the absence of incentives (including perverse incentives)

Concluding remarks

Farmland and livestock concentration

↓

Key negative driving forces

to climate mitigation and soil fertility

Policy suggestions:

Ensuring a fair and equitable distribution of the agricultural land through:

- CAP: Capping of the basic payments, Top-up payments for the first hectares, Small farmers and young farmers schemes, etc.
- Property rights: rights of pre-emption for neighbouring farmers, obligation for tenants to engage in farming, restrictions on the right to purchase by legal persons, etc.
- Environmental policies: better tying of EU env. policies to national landscape policies, etc.

Regulatory bottlenecks:

- There is no compentence of the EU on land, neither exclusive nor shared (Part 1, title 1 of the TFEU)