

## **Estimating the impact of environmental performance of farm productivity; a case study of the UK livestock sector**

In the face of global environmental challenges, the nexus between environmental practices and farm business performance has become a focal point for agricultural economists. This intersection is crucial for understanding the long-term resilience and the economic viability of farm operations. Environmental practices encompass a wide array of strategies aimed at i.e., maintaining biodiversity, maintaining soil quality, and protecting water sources etc. As such the relationship between environmental practices and farm business performance is multifaceted and dynamic allowing agricultural producers to mitigate the ecological footprint of their activities through increasing input efficiency and/or reducing negative environmental externalities while maintaining the economic viability of farm operations.

To reduce agricultural ecological footprint includes reducing GHG emissions, and to protecting water quality and preserving biodiversity. Therefore, farms must prioritize knowledge-intensive farming practices that minimizes harmful inputs. However, sustainable farming practices could always be compromised in favour of seeking higher productivity.

In this research, we aim to measure the impact of environmental performance on farm productivity, we will use data from a survey addressing livestock farms in the UK, obtained from the second State of Rural Enterprise (SORE) survey conducted by the National Innovation Centre for Rural Enterprise (NICRE). The survey was carried out during May to August 2023, and covers farm businesses across three English regions: the North East, the South West, and the West Midlands. The survey includes comprehensive data on number of livestock, farms' income, intermediary inputs (organic and conventional), energy usage, labour, land-size, and government support, in addition to environmental and economic management practices.

In this research we will simultaneously examine i) the relationship between environmental practices and input use, and ii) input use and labour productivity. More precisely, in the first step we will estimate the carbon equivalent emissions for each farm. In the second step, we will use three-stage least squares simultaneous equations to estimate whether implementing environmental practices has a significant impact on chemical fertilizers, feed concentrates and pesticides (or carbon emissions) use while simultaneously examine the relationship between a farm's input use (carbon emission) and its labour productivity. To account for assumption bias these will be estimated simultaneously using conditional mixed process models which assume seemingly unrelated regressions to have correlated error terms.

The innovation of the study lies along the fact that both environmental and economic decision making are incorporated in the model and that the model is estimated differently for those that include environmental protection in their decision making through deduced inputs and those who do not. Although not estimated yet based on the existing literature, results are expected to show connections between environmentally friendly decision making and reduced inputs, and reduced productivity with increased environmental performance.