Extended Abstract
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Paper/Poster Title	**Does shifting to organic and ecofriendly production techniques allow to reduce energy consumption in the farm sector?**

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	***200 words max***
This paper assesses whether shifting from conventional farming to eco-friendly practices (i.e., organic farming (ORG) and Agro-Environmental Climate (AEC)) allows for reduced energy consumption. The analysis is developed on the whole Farm Accountancy Data Network (FADN) of Italy spanning 2014 to 2021 by using the Staggered Difference-in-Differences methodology (Callaway and Sant'Anna, 2021). This allows us to overcome several gaps in the literature. First, of all, it allows for a dynamic evaluation of treatment by considering the six years following the adoption of the eco-friendly techniques. Furthermore, the overall energy consumption is also decomposed into direct and indirect components. Finally, energy is standardized per unit of land and per unit of production. Results suggest that shifting to ORG may not reduce energy consumption, and when it exists, the reduction is reduced after the first year. In contrast, shifting to AEC allows us to do so during all the periods of engagement. These findings allow for relevant policy considerations. The decision of the EU to strongly increase organic farming may not result in a reduction of energy consumption. However, it could be possible to reduce energy consumption and increase eco-friendly practices by supporting more AEC than ORG.	

Keywords	Energy, Organic farming, Agro-Environmental Climate practices, Difference-in-differences
JEL Code	Q40 ;Q18, Q12

Introduction	***100 – 250 words***
The EU Green Deal and the Energy Efficiency Directive (2012/27/EU) have set ambitious targets for organic farming and energy consumption reduction, respectively. Literature reports (see f.e. (Smith et al., 2015)) Organic farms, which are generally more energy-efficient than conventional ones, have shown the potential to contribute to lower energy consumption and increased energy efficiency in agriculture. However, variations in energy consumption exist within organic farms, and there are exceptions for some crops. This study uses data from the Italian FADN 2014-2021, considering the Types of Farming (ToF) related with crop production and follows the DiD methodology of (Callaway & Sant'Anna, 2021) (CS2021), to compare energy expenditure in organic, conventional, and Agro-Environmental Climate (AEC) farms on and after the year of adoption. The results reveal that organic farming has a controversial impact on the reduction in energy expenditure, while AEC measures, which are more focused on reducing environmental impact, reduce expenses	

considering both the area utilized and the production level calculated by the total revenue. This research highlighted how the CAP measure specifically designed to reach agro-environmental climatic goals is more efficient in energy consumption in comparison with organic farms, which are focused on multiple goals.

Methodology	***100 – 250 words***

This study utilizes data from the Farm Accountancy Data Network (FADN) considering the ToF 1,2,3 and 4, from 2014 to 2021, encompassing 11,021 observations for organic farming, 37,880 for conventional farming, and 7,057 for Agri-Environment Climate (AEC) measures. The methodology is grounded in the Difference-in-Differences (DiD) approach, a quasi-experimental design that estimates the causal effect of a treatment on an outcome by comparing the average change over time in the outcome variable for the treatment group to the average change over time for the control group. In this context, the treatment groups are Organic or AEC, while conventional farms represent the control group. The outcome variable is the decline in energy consumption, categorized into direct (fuel, electricity, and gas) and indirect (fertilizer and cover crops expenditure) energy expenditure, with the total being the sum of direct and indirect energy expenditure. The study also employs two types of standardization in ratio to Utilized Agricultural Area and Total Revenue.Total revenue in organic farming is adjusted using the Laspeyres index between the typologies of farms to take into account of the difference in price levels between organic and AEC or Conventional farming The study follows the approach proposed by CS2021, which allows for consideration of multiple time periods and the effect of the treatment during and after the first year of adoption, unlike classical DiD and double robust to reduce selection and omitted variable bias.This approach provides a more nuanced understanding of the dynamic impacts of different typologies of farms on energy consumption.

Results	***100 – 250 words***

The study found that organic farming methods generally consume less energy compared to conventional farming. This is primarily due to the lower energy requirements for indirect and total energy expenditure. However, when considering energy consumption per total revenue, organic farming tends to consume more energy. AEC farmers was found to have lower energy expenditure compared to both conventional and organic farming. This suggests that AEC practices may be more energy-efficient, potentially due to the specific techniques or technologies employed in these typologies of farms. In light of the requirements specifically set forth by this CAP measure to achieve significant reductions in agro-climatic-environmental impact. These findings align with existing literature, which generally indicates that organic farming is less energy-intensive than conventional farming. However, the energy efficiency of a farm can vary significantly depending on various factors, including the specific practices used, the crops grown, and the local environmental conditions. In conclusion, while organic farming has controversial outcomes with more expenditures, considering the expense in total revenue in comparison with this value reported in the ratio with UAA, AEC shows a significant reduction in energy consumption in all the dimensions investigated.

Discussion and Conclusion	***100 – 250 words***

The impact of organic farming on energy expenditure is a contentious issue. While it can reduce energy use when considering the UAA, its lower production levels make it more energy-intensive overall. AEC, despite their primary focus on environmental impact reduction, also decrease energy expenditure when considering both the utilized area and the production level. The EU strategy that increases the AEC measure with Eco-scheme and AEC in the II pillar of CAP can reduce energy consumption and simultaneously increase environmentally friendly actions. However, this discussion has limitations. It uses indirect measures of energy consumption by evaluating only the expenses, not the amount of energy. Moreover, the analysis does not evaluate the level of biodiversity and agronomic characteristics between farm typologies, which is a goal of the AEC and Organic CAP measures. In conclusion, while organic farming and AEC measures have potential benefits in terms of energy expenditure, their effectiveness varies depending on the specific context and the metrics used for evaluation. Further research is needed to fully understand their impact across different types of farming and countries.

References

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