Extended Abstract
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Paper/Poster Title	Paper/Poster Title

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 study addresses the multifaceted challenges posed by changes in meteorological conditions on European agriculture, examining both long-term shifts and the often-overlooked intra-annual weather variability, also characterized by extreme events like droughts and heavy rain. Leveraging farm-level panel data spanning nearly two decades in Austria, we employ a systematic econometric framework to unravel the intricate relationships between intra-annual weather fluctuations and farm performance. Our analysis incorporates higher-order statistical moments to assess the impact of weather variability, focusing on two key research questions: 1) the effects of intra-annual weather variability on European arable farms, and 2) the differential impact of extreme events compared to small deviations in the weather distribution. While empirical results are pending, theoretical expectations suggest significant effects, particularly in rainfall variability. This study especially contributes crucial insights into the nuanced dynamics of intra-annual weather variability for Europe, providing potential information for climate change policy within the context of the Common Agricultural Policy.	

Keywords	Intra-annual weather variability, climate change, econometrics
JEL Code	Q12, Q15, Q54 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

Changes in meteorological conditions pose a multiple challenge for agriculture, encompassing mainly long-term shifts in temperature (climate change) but also unanticipated shifts in the within-year weather distribution, with sometimes strong impacts by droughts, heavy rain, and heat shocks, summarised under the term ‘extreme events’. While existing studies within the field of climate econometrics have primarily focused on inter-annual measures like changes in annual mean temperature, some research suggests that weather's impact might be underestimated (*Fishman 2014; Shortridge, 2019*). This discrepancy could be attributed to the oversight of the effect of such shifts in the weather distribution, particularly intra-annual variability, but has rarely been addressed in Europe.

This research seeks to address this gap, presenting one of the first systematic examinations of such variability. Leveraging farm-level panel data of Austrian farms over nearly two decades, the study endeavours to unravel the relationships between intra-annual weather fluctuations and farm productivity, focusing explicitly on the context of European agriculture. In particular, we integrate higher-order statistical

moments of the weather distribution in a panel data regression framework to analyse the following research questions:

1. Are European arable farms affected by intra-annual weather variability and if yes, through which ways?
2. Do extreme events have a particularly large impact on income compared to small deviations in the weather distribution?

This work contributes to the analysis of intra-annual weather variability's impact on European farm performance, filling a gap in climate econometrics. Utilizing a comprehensive panel dataset, we aim to isolate and disentangle the impact of inter- and intra-annual variability.

Methodology	***100 – 250 words***

Our research employs a systematic econometric framework, in order to investigate the research questions proposed. To test research question (1), we initially use a panel data fixed effects model with farm net revenues as the dependent variable. Beyond standard meteorological variables (e.g., mean temperature) extensively studied in previous literature (see, for example, *Deschenes and Greenstone, 2007; Fishman, 2016*), we integrate higher moments of distributional measures (i.e. skewness, and kurtosis of intra-annual temperature and rainfall). This approach enables a standardized yet nuanced exploration of weather variability beyond existing metrics. The study then advances to test non-homogeneity formulated in research question (2), scrutinizing whether larger deviations from mean moments (i.e. heat days, heavy rainfall, etc.) yield more pronounced effects. This exploration is crucial for discerning the impact of extreme weather events on agricultural outcomes. While the exact specifications are pending, potential methods include quadratic terms or stepwise linear regression. Fixed effects and relevant explanatory variables are meticulously incorporated into all specifications to control for potential biases.

The analysis specifically focuses on crop farms in Austria to account for heterogeneous effects between different production and farm types. We utilize a farm-level dataset with detailed information on economic data and farm characteristics, spanning over almost 20 years. Combined with daily, spatially refined meteorological data (1x1km grid), this enables an in-depth exploration of intra-annual weather variability and its potential differential effects on farm net revenues.

Results	***100 – 250 words***

As of the current phase, the study remains in the finalization of its methodological development. While empirical results are pending, we can draw on theoretical insights and existing literature to formulate expectations for our research questions. We anticipate significant effects for research question (1), especially for variables like standard deviation, signalling increased rainfall variability. Previous studies, incorporating measures such as the Gini Coefficient of wet days, support our expectations (*Shortridge, 2019*). For temperature, we foresee stronger effects from an increase in very hot days, potentially surpassing insights from mean temperature. The impact of other higher statistical moments currently remains uncertain. Additionally, we explore non-homogeneity effects to discern if extreme deviations intensify impacts formulated in research question (2). We attribute such non-homogeneity to the severe consequences of events like droughts or flooding influencing the weather distribution.

As empirical results are pending, our study aims to unveil these dynamics, offering nuanced insights into the intricate relationship between intra-annual weather variability and farm performance.

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

While extensive research underscores the substantial impact of long-term, inter-annual meteorological changes on agriculture, scant attention has been given to intra-annual weather variability, especially in the context of Europe. Addressing this gap, our study utilizes a unique individual farm-level dataset and spatially refined meteorological data to delve into this less-explored dimension of climate change. Employing panel data models, we scrutinize the relationship between intra-annual weather variability and farm net revenues. Leveraging almost two decades of panel data allows for a meticulous examination of weather patterns.

The use of higher-order statistical moments offers a standardized measure for intra-annual weather variability, facilitating a nuanced investigation of distributional shifts. While empirical results are pending, we anticipate significant effects of higher-order statistical moments on farm net revenues in Austria. This aligns with the broader narrative emphasizing the pivotal role of intra-annual weather variations in shaping agricultural outcomes. The exploration of non-homogeneity adds depth, highlighting potential differential impacts of extreme weather events on farms.

This research contributes essential insights into the impact of weather distribution shifts compared to standard inter-annual measures, such as annual mean temperature. By addressing the existing gap, we aim to unravel how intra-annual weather variability influences farm competitiveness providing potential insights for opportunities of adaptation and contributing to climate change policy design in the context of the Common Agricultural Policy.

Literature:

Deschênes, O., & Greenstone, M. (2007). The economic impacts of climate change: evidence from agricultural output and random fluctuations in weather. American economic review, 97(1), 354-385.

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