Extended Abstract
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Paper/Poster Title	Within Growing Season Weather Variability and Adaptation in Agriculture: Evidence from Cropping patterns of Ethiopia

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Abstract	***200 words max***
Several studies that examined the effects of climate change and weather variability predicted grim futures for agriculture. Thus, strengthening farmers' adaptive capacity and understanding how prompt they respond to environmental changes provides valuable information for effective policy formulation. Using nationally representative community-level panel data collected over seven years, we investigate whether and how farmers adjust their land allocation decisions in response to within-growing season weather variability. We show that farmers detect within-growing season weather variability and respond promptly by adjusting land allocation decisions. To the best of our knowledge, this adaptation margin has not been documented before. We also confirm that the effect of weather variability on the share of maize land is partly realized through substitution with other crops. In addition, our results also reveal the presence of a weather variability-induced expansion of maize production into areas that are less suitable for maize cultivation.	

Keywords	Weather variability, Adaptation, Land allocation, Crop substitution, Spatial effects
JEL Code	Q1,Q15,Q24,Q54,C33

Introduction	***100 – 250 words***
Most farm management decisions are made based on expectations about weather conditions before the realization of the actual weather conditions, and such subjective expectations are heavily influenced by past weather experience. Both economics and psychology literature show that recent realizations of an event can disproportionately affect human expectations. However, the great bulk of existing researches that examine focus on farmers' responses to long-term climatic	

conditions, ignoring the fact that short-term weather events might have a disproportionately larger influence on farmers' expectations about future weather conditions. Jagnani et al. (2021) is a notable exception that shows how smallholder farmers adjust fertilizer and agrochemical use decisions to adapt to within-growing season weather variability. We extend their work by investigating if and how smallholder farm households adjust their land allocation decisions in response to within-growing season weather variability. Existing studies that investigated the role of weather variability in land allocation decisions either focused on past weather conditions or defined land-use decisions broadly by aggregating land covered by all crop types as a single variable. However, since each crop has its own unique optimal heat and moisture requirement, the impacts of weather variability might be disproportionately stronger for some crops and might encourage farmers to reallocate resources to crops that suit current weather conditions better. Besides, we also investigate the role of natural endowment in farmers' adaptation decisions by examining if farmers' responses depend on the suitability of the fields for maize production using the FAO-GAEZ suitability database.

Methodology	***100 – 250 words***

We compiled datasets from different sources. The Central Statistics Agency of Ethiopia (CSA) conducts one of the world's largest annual agricultural surveys, which includes over 36,000 private farm households. We use this dataset to create our outcome indicators over the period 2010-16. To investigate the role of land suitability on farmers' responses to weather variability, we use the maize suitability index constructed for rain-fed farming with the assumption of low input utilization from the FAO-GAEZ dataset. Our weather variables of interest are precipitation and temperature accessed from different sources. We follow related studies and created indicators that enable us to control for both the amount and distribution of rainfall and temperature than aggregate averages. For each survey period, we construct two stages of the crop growth cycle. The two stages are (1) the planting and fertilizer application period, which covers 60 days after the beginning of the planting date, and (2) the initial planting stages (or pre-planting period), which accounts for the land preparation period and covers 60 days before the planting days. We use a spatial panel data model (Spatial Durbin Model) that enables us to control for the effects of

both space and time, and spatial interactions across neighbouring locations of the study area, as failing to account for such interactions may lead to biased and inconsistent estimates.

Results	***100 – 250 words***

We find that within growing season weather patterns significantly influence farmers' land allocation decisions. More precisely, an additional day above 22^0C in the initial growing period increases the size of land allocated to maize production by 3.2 percent compared to a day with an average temperature below 18^0C. Similarly, an extra day with a temperature range of between 21^0C and 22^0C, 19^0C and 20^0C, and 18^0C and 19^0C leads to a 3.7%, 1.6%, and 1.9% increase in the size of land allocated for maize production compared to a day below 18^0C in the initial growth period. Likewise, one extra wet day during the planting period reduces the size of land allocated to maize by 2.7 percent. We also investigate if the effect of weather variability on land allocated for maize is realized through substitution with other crops. The result reveals that higher temperature during the initial planting period increases the share of land coved by maize relative to cereals, pulses, and oilseeds. Our findings are robust to the inclusion of additional socioeconomic controls, own price (future or lagged price), or previous year's growing season weather conditions. We also present suggestive evidence for the presence of weather variability-induced expansion of maize production into areas that are less suitable for maize production. The relation between higher temperature levels and maize production could be because of the nature of the crop. Warming temperatures are expected to boost staple crop output, including maize, due to their hastening impact on photosynthetic processes.

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

By estimating the effects of within-growing season weather variability on the land allocation decision of farm households, we documented a notable adaptation margin that has been overlooked in the previous studies. This is crucial, given the projected increase in the frequency and magnitude of weather variations. Hence, the result contributes to the understanding of the climate change impacts on crop yield since neglecting such margins could lead to biased estimates. It is also vital to underscore

the fact that farm households' decision to expand maize production to confront dryness might be at the cost of crop rotation. In addition, the expansion of maize into less suitable areas might have implications for farm productivity. Hence, future research could look into the effects of such adaptive responses on economic losses (including the effects on farm productivity and profitability). Furthermore, the substitution of cash crops by staple crops like maize to withstand weather variability might also have implications for farm households' market participation and diet quality. This might underscore the importance of investing in the production and distribution of drought-resistant seeds for high-value crops.