

# Essays on the impacts of climate-smart agricultural innovations on household welfare

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## SUMMARY

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This dissertation provides empirical evidence on the risk management and welfare effects of selected climate-smart land and crop management innovations in Sub-Saharan Africa (SSA). The dissertation comprises five chapters. The introductory chapter highlights the repercussions of climate change, soil degradation, post-harvest loss and population swells on the present and long-term development prospect of SSA. It also highlights the shift in the current agricultural policy focus towards increased promotion of climate-smart agricultural innovations as a way forward to spur agricultural growth in the face of environmental risks. The three chapters investigate whether climate-smart agricultural technologies and practices have the potential to enhance food and nutrition security, adaptive capacity and protect rural households from continuously sliding into poverty.

Chapter 2 provides microeconomic evidence on the household welfare effect of conservation agriculture (CA), a climate-smart agricultural practice currently receiving an increasing attention in SSA. The chapter focuses on the analysis of the impact of CA on household poverty in Ethiopia using panel survey data merged with novel weather data. The empirical strategy presented is a panel data switching regression model applied in a polychotomous CA technology choice setting that helps to account for farmer heterogeneity in the CA choice. The results indicate that minimum tillage, cereal-legume intercropping and their combination are the CA practices that reduce rural poverty. Disaggregating the results by rainfall endowment and wealth groups, we find evidence that the combination of minimum tillage and cereal-legume intercropping provides better welfare benefits in most circumstances. However, crop residue retention and its combined use with minimum tillage do not seem to be attractive. While the evidence suggests that CA plays a crucial role in dealing with the exigencies of being poor and mitigates production risks, we caution against exaggerated expectations of CA's economic benefits and a rigid recommendation of CA.

In the wake of climate change, there is a resurgence of interest in the promotion of crop diversification as a climate-smart agricultural practice in SSA. Crop diversity comes as a natural insurance mechanism to safeguard farmers from the adverse effects of shocks. Using rich panel survey data merged with historical rainfall data, chapter 3 sheds light on the household welfare and consumption smoothing effects of crop diversity in rural Uganda. The chapter contributes to emerging development economics literature that links diversity with household welfare. The empirical analysis is supported by panel data instrumental variables methods. The response of consumption to crop diversity for low- and high-consuming households is also estimated using

quantile regression instrumental variables methods. The results show that increasing crop diversity contributes to increased consumption and diverse diets. Crop diversification provides higher consumption benefits for households in the lower quantile of the consumption distribution than for households at higher quantiles, indication of its non-linear and heterogeneous consumption effect. Increased crop diversification also improves consumption smoothing through reducing households' reliance on less effective risk coping strategies such as informal insurance. Overall, the findings suggest that transforming agriculture towards a more diversified cropping system could be a viable pathway for improving household nutrition and reducing poverty.

Chapter 4 focuses on the analysis of the impact of improved storage technologies on household food and nutrition security, consumption expenditure and child growth in Ethiopia. Using endogenous switching regression models to control for unobserved and observed heterogeneity between improved storage users and non-users, we find evidence that use of improved storage technologies increases dietary diversity, reduces the risk of stunted growth for children under 5 years of age and lessens self-reported food insecurity. More important, the model results show that nonuser households would have experienced these benefits had they used improved storage technologies. The chapter contributes to the agricultural innovation adoption and impact literature that seems to be overly focused on preharvest and production.

Chapter 5 concludes with policy implications and suggestions for further research.