Climate-Smart Agriculture: capturing the synergies among mitigation, adaptation and food security

EMERGING EVIDENCE FROM MALAWI

Key points:

- Six different agricultural practices and drivers of adoption have been analyzed for the country of Malawi using LSMS-HIS data.
- Factors driving the adoption decisions are fairly different as are the practices themselves which make it difficult if not impossible aggregating them into one variable.
- Favourable rainfall outcome affect positively the decisions to adopt short-term practices such as improved seed and inorganic fertilizer, whereas unfavourable rainfall outcome encourages farmer to adopt planting trees, maize-legume intercropping, use of organic fertilizer and soil and water conservation measures.
- Land tenure security increases the likelihood that farmers adopt strategies that will capture the returns from their investments in the long run and reduces the demand for short-term inputs.
- Access to extension advice, social capital and collective action also affect positively the adoption decisions.
- Results show that adoption of agricultural practices has a positive and statistically significant impact on maize productivity suggesting positive synergies between adaptation strategies and food security.

In Malawi, the CSA project contributed to the evidence on the adoption of a number of agricultural practices which contribute to adaptation to climatic changes. These include legume intercropping, soil and water conservation (SWC), tree planting, use of organic fertilizer, use of inorganic fertilizer and improved seeds. We conducted the analysis using the Integrated Household Survey (LSMS-IHS) data from 2010/2011 complemented with historical rainfall data obtained from National Oceanic and Atmospheric Administration's Climate Prediction Centre (NOAA-CPC) and bio-physical data obtained from Global Agro-ecological Zones (GAEZ) database.

We analysed factors governing farmers' decision to adopt adaptation strategies and evaluated the potential impact of adoption on crop productivity by using **multivariate econometric regression**. We also tried to uncover distributional impact, particularly where these households are heterogeneous on key dimensions such as land holding, gender and geographical region.

We found robust evidence that the propensity of adopting a specific agricultural practice is conditioned by whether another practice has been adopted. These results support the notion of **interdependency** between adoption decision of different agricultural practices which may be attributed to

complementarities or substitutability between the practices. Results also show that the adoption decisions of different farm practices are quite distinct and to a large extent the factors governing the adoption decision of each of the agricultural practices are also different. The results suggest the **heterogeneity** in adoption of agricultural practices and accordingly, the **unsuitability** of aggregating them into one adaptation/ risk-mitigating variable.

The adoption model results show that favourable rainfall outcome affect positively the decisions to adopt short-term inputs such as improved seed and inorganic fertilizer whereas unfavourable rainfall outcome encourages farmer to adopt planting trees, maize-legume intercropping, use of organic fertilizer and SWC measures which in turn helps conserving soil moisture, improve soil organic matter and reduce soil loss from erosion and flooding. Based on the evidence that climatic condition plays an important role in farmers' adoption decisions, it is natural to conclude that improving the access to reliable **climate forecast information** is key to facilitating adaptation.

Results also show the importance of **land tenure security** which increases the likelihood that farmer adopt strategies that will capture the returns from their investments in the long run and reduces the demand for short-term inputs like inorganic fertilizer and improved seed.

Access to extension advice and the presence of organizations/institutions within the community (e.g. development committees and/or credit and savings organizations) affect positively the adoption of maize-legume intercropping, SWC and tree planting suggesting the importance of information and networks. **Collective action** also affect positively the adoption of farm management practices that have public goods spillover (such as SWC) whereas it affects less the adoption of practices with limited spillover, suggesting that both formal and informal institutions matter in governing farmers' adoption decisions to adapt to climate change.

The final piece of evidence comes from the impact estimates: on average adoption of each of the agricultural practices considered has a positive and statistically significant impact on quantity of maize produced per acre of land. Adopters of improved maize seed enjoys about **98% increase** in quantity of maize produced per acre of land compared to the non-adopters. Farmers adopting maize-legume intercropping harvest about 80% more maize per acre of land compared to farm households who do not adopt. The same story holds true for adoption of planting tree and SWC measures –73% and 54% increase in maize productivity for adopters compared to the non-adopters respectively.

Whereas these findings suggest positive synergies between adaptation strategies and food security, some caution needs to be taken given the interdependence of practices as well as the heterogeneity of impacts across farm size, gender and geographical region.

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