



Climate-Smart Agriculture, Welfare, and Income Risk Management in Ethiopia

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October 2022 / No.CCEDA-004

Despite significant gains in poverty reduction in Sub-Saharan Africa, rural poverty remains a concern in the region (Barrett et al., 2017; Hansen et al., 2019; Clay and Zimmerer, 2020). The agriculture sector in the region continues to underperform because farmers rely on unsustainable farming practices that lead to land degradation and poor soil fertility (Marenya and Barrett, 2009; Tiftonell and Giller, 2013; Grabowski et al., 2016; Mekuria, 2018; Yigezu, 2021). Moreover, climate change appears to be a major source of risk for agricultural production. One option for sustainable agricultural production is “climate-smart” agricultural practices that support production and enhance adaptive capacity (Bradshaw, Dolan, and Smit, 2004; Di Falco, Veronesi, and Yesuf, 2011; Lipper et al., 2014;

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Asfaw et al., 2016). Thus, it is important to establish this link of substitutability or complementarity of different livelihoods options of farmers such as adopting CSA and other income risk management strategies such as migration and off-farm employment, scaling up CSA practices or promoting off-farm employment to improve farmer's resilience against the effect of climate change. This brief provides insight into the link between CSA and household welfare and income risk management in SSA using data from a low-income country context using Ethiopia as a case.

Key messages

- Adoption of CSA can significantly increase the welfare and risk management capacity of rural households.
- Impact of combining CSA and off farm income guarantees better income risk management and lowers poverty (both Monetary and multidimensional) compared to the case where a household is not practicing CSA.
- However, policies that seek to leverage the welfare benefits of CSA need to acknowledge the capacity of households in adoption CSA and non-farm strategies.

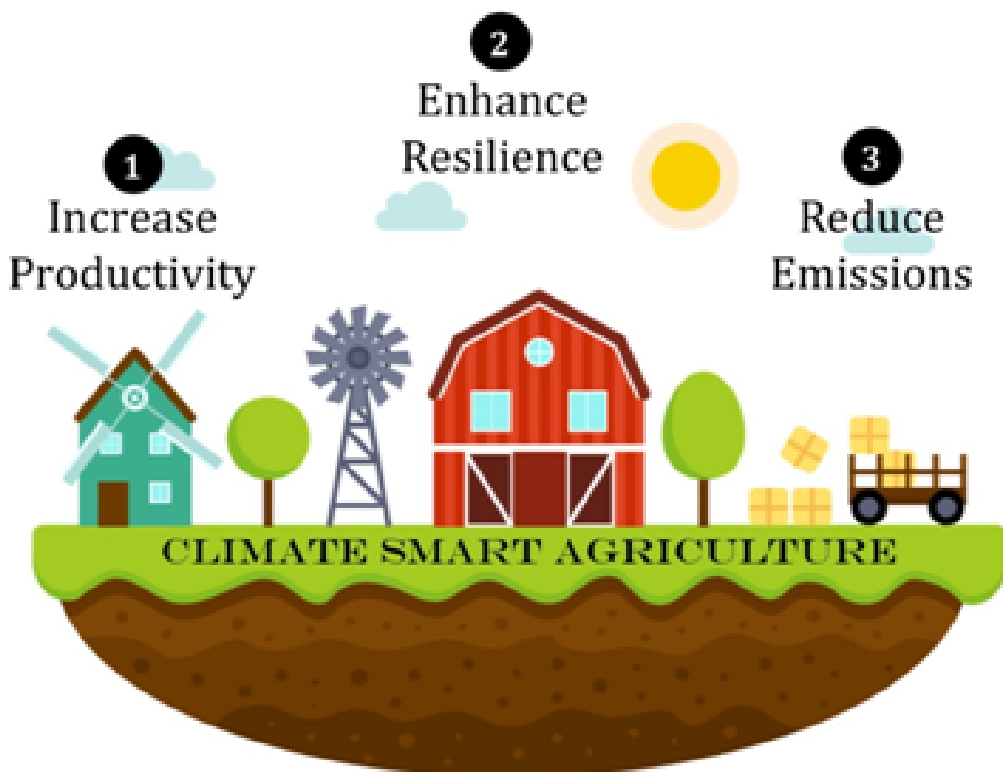
Climate change and welfare in Africa

Due to increases in temperature and changes in rainfall patterns (climate change) and lack of structural transformation, Africa is at the crossroad and facing a two-fold challenge: (i) to raise agricultural productivity to feed a surging population that is projected to reach 2 billion by 2050 and to meet their changing dietary preferences, and alleviating rural poverty (Di Falco, Veronesi, and Yesuf, 2011; Ittersum et al., 2016); and (ii) to address the negative consequences of current and projected climate change and strengthen resilience. Addressing these challenges is a priority in the current agricultural development policy in the region, given that a considerable share of Africa's GDP is derived from agriculture – mostly rain-fed agriculture. Solving these intertwined challenges requires a new paradigm to transform African agriculture. Because the farming systems are capital deficient, prone to weather extremes, and have poor quality soils (Marenja and Barrett, 2009; Kassie et al., 2015; Hörner and Wollni, 2021), the development and promotion of technologies and practices that improve resilience and increase agricultural productivity have no parallels in the process of African agricultural transformation (Dzanku, Jirström, and Marstorp, 2015). Promotion of “climate-smart” agricultural (CSA) practices is a unique way forward for African agricultural transformation.

The empirical evidence on impact and effectiveness of CSA is inconclusive

One option for sustainable agricultural production is CSA that support production and enhance adaptive capacity (Bradshaw, Dolan, and Smit, 2004; Di Falco, Veronesi, and Yesuf, 2011; Lipper et al., 2014; Asfaw et al., 2016). See Figure 1. Adoption of CSA in Africa is low, there is growing empirical evidence that documents constraints for low up-take of CSA and adherence to conventional farming. High upfront investments, yield uncertainties, and financial constraints are among the major factors that deter farmers' adoption of CSA in developing countries (Ngoma, 2018). Studies establish the link between CSA and welfare (Mujeyi, Mudhara, and Mutenje, 2021; Ngoma, 2018; Ogada et al., 2020; Tambo and Mockshell, 2018; Teklewold, Gebrehiwot, and Bezabih, 2019; Teklewold, Kassie, and Köhlin, 2013; Tesfaye, Blalock, and Tirivayi, 2021). However, there is a dearth of empirical evidence that explores the complementarity between climate risk management strategies such as CSA and other income risk management options such as off-farm employment and migration.

Figure 1: CSA



Source: World Bank

The analysis

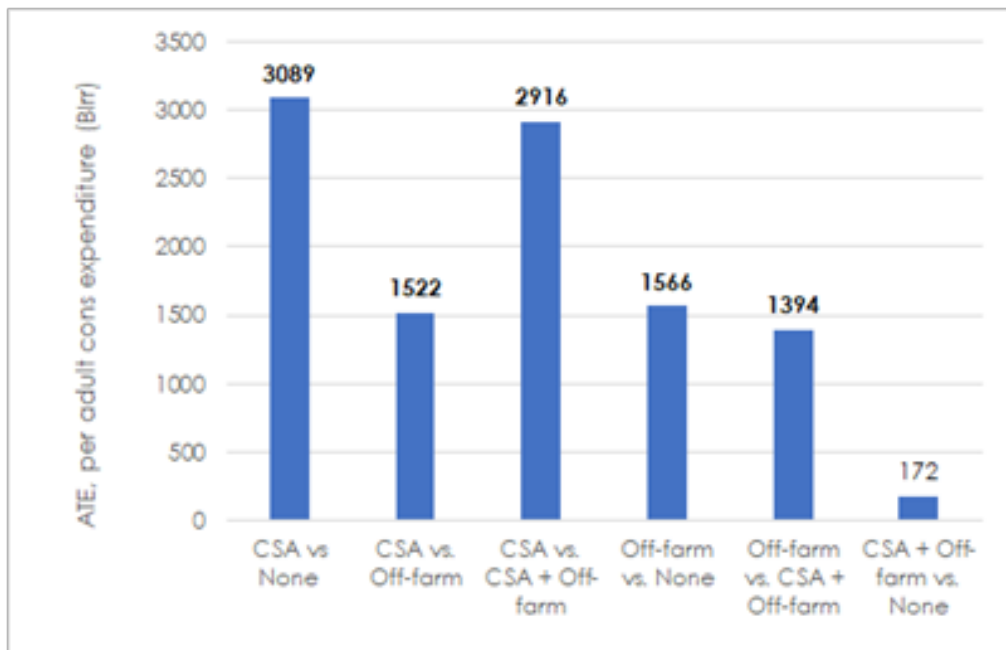
The study evaluates the effects of adoption of two risk coping strategies CSA practices and non-farm coping mechanisms (namely, off-farm employment and migration and their combination) using nationally representative data from Ethiopia combined with innovative climate data and employing a Multinomial Endogenous Switching Regression (MESR) model. The Ethiopian Socioeconomic Survey (ESS) collected under the Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) of the World Bank in collaboration with the Central Statistical Agency (CSA) of Ethiopia. ESS is a publicly available rich agro-referenced nationally representative data (at both the urban and rural levels). It provides a rich array of information on household characteristics, income sources, household assets, consumption expenditure, shocks, coping strategies, food security, land holdings, crop production, and livestock ownership.

Key findings

1. Non-farm employment and CSA are substitutes; non-farm employment's crowding out effect of CSA adoption.

- We estimate the welfare effects of CSA and non-farm coping strategies on annual household consumption expenditure per adult equivalent. The ATE shows the difference in consumption for all households who had adopted a specific strategy and the comparison group. The results show that both CSA adoption and non-farm coping strategies have positive welfare impacts (Figure 2). However, the highest welfare benefit is obtained when CSA is adopted in isolation, even compared to the simultaneous adoption of both strategies. The ATE for all households who adopted CSA compared to non-adopter is an increase of about Birr 3,089 in consumption expenditure per adult equivalent per annum. The corresponding effect of non-farm coping strategies is Birr 1,566. The ATE of households who adopted both strategies simultaneously compared to non-adopters is positive but insignificant. Results suggest that the two livelihood strategies are substitutes, and we document non-farm employment's crowding out effect of CSA adoption. The possible explanation for the observed results could be their competition for productive labor.

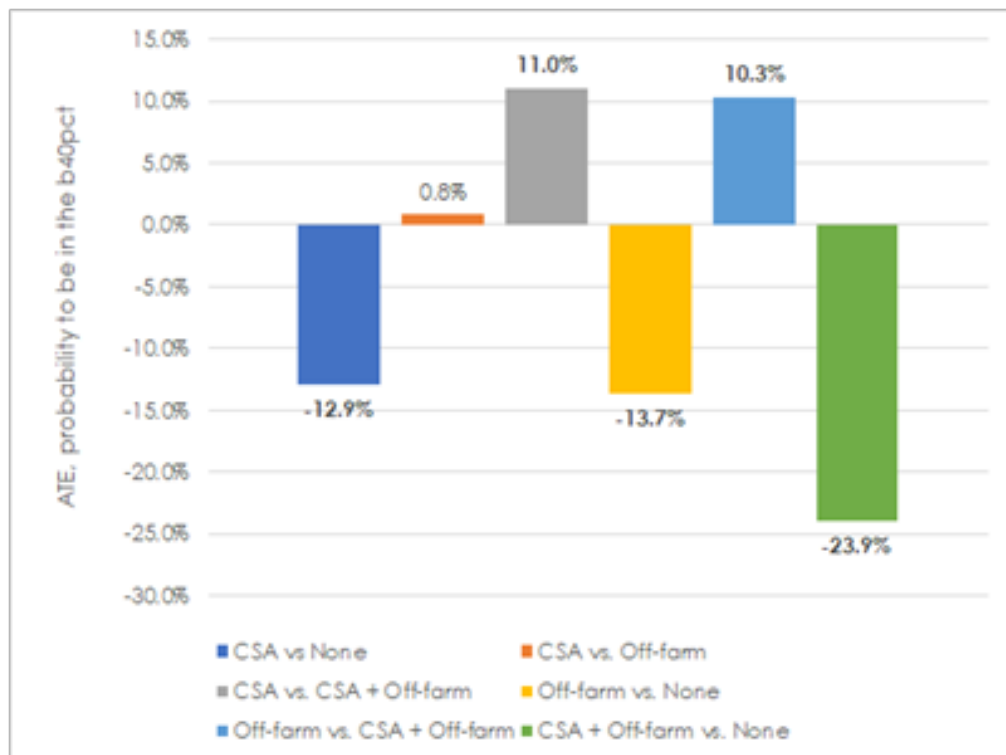
Figure 2: Estimated impacts of CSA, non-farm employment, and their combination on consumption: ATE estimates



2. However, households that adopt CSA and off-farm coping strategies simultaneously are less likely to be monetary poor.

- Households that adopt CSA are less likely to be poor (have a consumption expenditure less than 40% of the national average or be in the bottom 40 percent) compared to non-adopter. Off-farm coping strategies (compared to the reference group) also decrease the probability that a household would be poor (in the bottom 40 percent) by 13.7 percentage points. However, adoption of CSA and off-farm coping strategies reduces poverty more than the adoption of CSA and non-farm employment separately suggesting that the two livelihood or risk management options are complementary in that their combination has the highest poverty reducing effect.

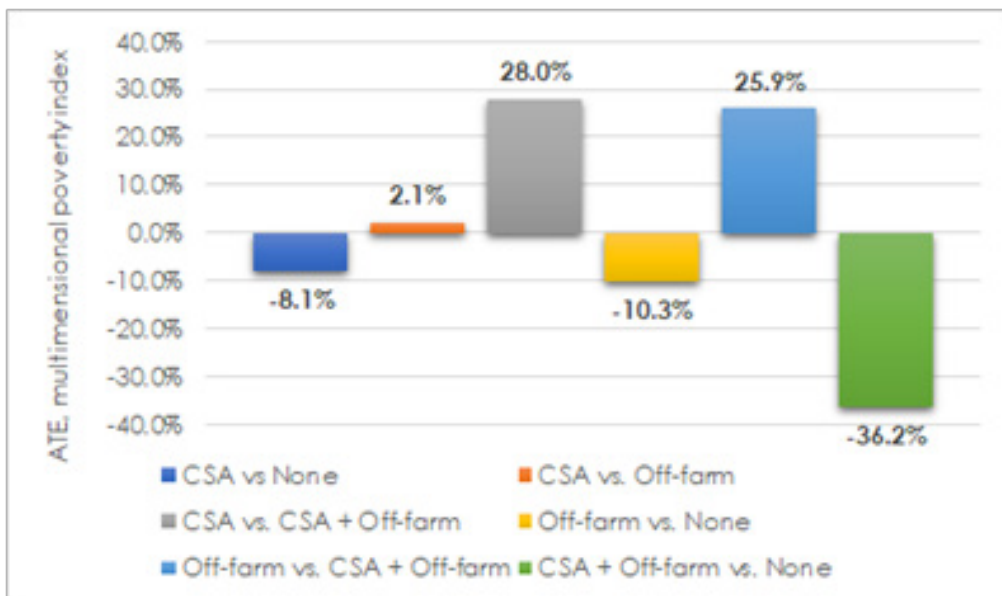
Figure 3: Estimated impacts of CSA, non-farm employment, and their combination on monetary poverty: ATE estimates



Combining CSA and off-farm coping strategies also generates the lowest multidimensional poverty index

- We also used multidimensional poverty index (MPI) as an additional welfare measure to show the welfare effect of CSA adoption on non-monetary welfare indicators. The results show that CSA adoption, off-farm coping strategies, and their combination reduce the probability of being poor (in non-monetary terms) by 8, 10, and 36 percentage points, respectively, compared to non-adopters (Figure 4). The results show that the combination of CSA and off-farm coping strategies generates the highest poverty reducing benefits than the adoption of CSA and off-farm coping strategies such as wage, self-employment and migration in isolation.

Figure 4: ATE estimates of CSA, non-farm coping strategies and their combination on MPI



A call to action – more needs to be done in prompting CSA adoption

Overall, our results suggest that, in a country like Ethiopia where markets are not complete and institutions are lacking, the adoption of CSA significantly increases the welfare and risk management capacity of rural households. Most of the CSA practices we have considered in this study (e.g., zero tillage, natural fertilizer, other soil fertility management practices) are adopted by households in the lower segment of the income distribution, an indication that they are likely to be adopted by poor rural households. There could, however, be other factors that constrain the adoption of CSA that would lead to suboptimal adoption of CSA. Policies that seek to leverage the welfare benefits of CSA need to acknowledge the capacity of households in CSA adoption and non-farm employment.

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