Extended Abstract
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Paper/Poster Title	Agroforestry and household nutrition in southern Madagascar: does gender matter?

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

Food security is a pressing challenge in many countries in the Global South. As climate change is exacerbating the uncertainties in agriculture, farmers need to adapt their agriculture to a changing climate. Agroforestry is a promising adaptation strategy which should improve farmers' resilience to climate change but also their food security and nutrition. Yet there is lack of robust evidence on this relationship, nor much is known on the role of gender norms which shape this relation. On the one hand, women decide on food preparation, on the other hand, they have less control on the crop choice at the farm level but also on the use of harvest and income. This has consequences for the sign of the relationship between agroforestry and nutrition. To study this topic, I use data on southern Madagascar farmers, who are very food insecure and are subject to frequent extreme events. Using an instrumental variables approach, I estimate the direct link between agroforestry and nutrition, looking at the mediating role of gender. Results are informative for policies aiming at strengthening adaptation potential and food security.

Keywords	Agroforestry, nutrition, gender
JEL Code	O12, O13, Q18, Q54 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	100 – 250 words

Ensuring food security and nutrition remains a primary concern for many countries in the Global South, while frequent climatic (and non) shocks are creating a serious challenge for sustaining current levels of food security. Agroforestry has been praised for its potential as an adaptation strategy to climate change, in particular for addressing deforestation, biodiversity loss, and environmental degradation, but also for its potential to improving wellbeing and nutrition. Agroforestry affects nutrition directly through the provision of food but also indirectly, by improving yield and resilience, and income, affecting in turn food security and nutrition. Yet rigorous studies on the link between agroforestry and household nutrition are currently missing, and little is known about the role of gender norms in shaping this relationship.

On one hand, women are responsible for preparing food, on the other hand, they lack control on the planting choices and on the use of the harvest and of income, ultimately affecting the sign of the relation.

To bridge this gap, I focus on Madagascar, whose rural population is largely food insecure (65% prevalence of moderate or severe food insecurity in 2021, World Development Indicators; 2023), while its biodiversity-rich environmental resources are subject to quick depletion. Moreover, the frequency of cyclones and droughts urge

farmers to adapt their agriculture. Agroforestry is not new to Madagascar, as farmers have traditionally cultivated food and cash crop perennials in agroforestry systems (tsabo). Moreover, the traditional gender roles in the country prescribe a separation of roles between men and women.

Methodology	*100 – 250 words*

I aim to bridge this gap by establishing a causal link between agroforestry and food security and nutrition of the household, while exploring the mediating impact of the gender of the household head and the decision maker for agricultural decisions.

To this end, I use new cross-sectional representative data from three regions in southern Madagascar (Anosy, Androy and Atsimo Atsinanana) collected by PIK in 2023. The survey contains information on farm production, agricultural practices and food security and nutrition. In particular, I focus on the direct impact of having trees on the plot on households' nutritional score and food insecurity.

Methodologically, combining trees with other crops is endogenous to household choices, which in turn affect nutrition. Therefore, an instrumental variables approach is recommended. As instrument, I use the previous ownership of land by the mother or the father of the respondent. As trees are a long-term investment, the adoption decision strongly depends on the (perceived) tenure security of land and on a long enough presence on the farmd by the household's family. Other instruments are the fokontany's proportion of households using agroforestry excluding the respondent (the leave-out mean) and the occurrence of extreme weather shocks (cyclones and droughts) in the previous 5-10 years, which affected perennials in the past but not current food crops (hence nutrition).

Results	*100 – 250 words*

Descriptive statistics show that households with agroforestry have household heads who are older, more often male and more educated. They are also wealthier in assets, livestock but have similar land sizes.

Preliminary OLS results indicate a non-significant or positive relationship between agroforestry and food security. In particular, having trees on the plot shows a positive and significant association with the consumption of vitamin A-rich foods and the frequency of consumption of orange fruit foods. The association with food insecurity indicators is negative, accordingly.

Preliminary 2SLS results indicate that having the mother owning land is a strong and promising instrument for agroforestry on the plot, whereas the role of the father in

owning the land is not relevant. The leave-out mean also seems a good predictor of having trees on the plot. Importantly, the instruments and positively and significantly related to the endogenous variable, while their correlation with the dependent variables is not significant. Using the mother land and the leave-out mean as instruments agroforestry shows a mostly nonsignificant effect on most outcomes, and a negative effect on some food insecurity indicators (the frequency of skipped meals, of less food then needed and of limited access to variety).

Next steps involve including in the analysis the gender variables as mediators as well as climatic variables as instruments. In particular, indicators of extreme events lagged of 5 and 10 years, both dry events (droughts) and wet ones (strong rains associated with cyclones), and 5/10 years-lagged strong winds indicators.

Discussion and Conclusion	*100 – 250 words*

Climate change urges effective solutions in adaptation for agricultural systems in the Global South, which are dominated by smallholder agriculture. Agroforestry presents a multi-purpose adaptation strategy which not only improves environmental conditions, but can also (potentially) contribute substantially to reduce food insecurity.

Yet, establishing the direct impact of agroforestry on household nutrition is not an easy task. The difficulties are shaped by not only the endogeneity of agroforestry strategy adoption but also by the existence of different linkages connecting agroforestry and nutrition. Also, the availability of the right data is fundamental. Moreover, analysing the relationship between agroforestry and nutrition with the intermediation of gender is relevant for the interpretation of this relationship, and it can also shed light on possible obstacles which limit the efficacy of policies aiming to promote agroforestry. Indeed, the (future) results from this study, while creating supporting evidence of this relationship, will also inform on the design of policies aimed at strengthening household adaptation in agriculture and household resilience.