



## **Hans H. Ruthenberg-Graduierten-Förderpreis 2019/**

## **Hans H. Ruthenberg Award for Graduates 2019**

Martin Paul Jr. Tabe-Ojong “A Double Hurdle Model of the Impacts of Improved Chickpea Adoption on Smallholder Commercialization in Ethiopia (Panel Analysis)”, University of Bonn, 2017

Supervisor: Prof. Dr. Thomas Heckelei

### **Summary**

The transition of smallholder agriculture from subsistence to market-orientation has been a core theme in the fields of development and agricultural economics over the last few decades (Barrett, 2008). The understanding of this transition from subsistence agriculture characterized by low productivity and food self-sufficiency to a market-oriented agriculture characterized by high productivity and marketing surplus is of utmost significance for most developing countries reliant on agriculture (Wickramasinghe and Weinberger, 2013). Farming in Ethiopia is still labour intensive with the prevalent use of rudimentary production techniques. However; the use of improved seeds and other improved technologies is currently receiving increased attention and is subject to policy intervention.

Existing literature supports the premise that the adoption of improved seeds leads to improved welfare and poverty reduction through higher productivity and/or increased returns (Awotide et al. 2013; Mendola, 2007; Verkaart et al., 2017). Nevertheless, even with the emergence of these novel technologies and techniques, productivity remains relatively low leading to low incomes and farmers largely remain in poverty. According to the World Bank (2008), poverty amongst smallholder farmers can be reduced through output market participation as this will increase returns to farming. Moreover, increased adoption and the transition to intensified agriculture strongly depends on opportunities available in markets (Asfaw et al., 2011) as well as the objectives and opportunities smallholder farming households consider (Mausch et al., 2017). Thus, the promotion of market orientation in smallholder agriculture requires efficient food value chains. Successful market participation gives farmers the opportunity to generate surplus production for income generation as weH as leads to growth and improved livelihoods (Michler et al., 2018; Verkaart et al., 2017). Furthermore, it avails farmers the opportunity to exploit comparative advantages, thereby generating surplus production that maximizes growth and generates market linkages by supplying inputs, thus enhancing growth and development. As a result, market participation can be regarded as a tool to achieve agricultural productivity and profitability.

Three closely related studies on the processes and effects of the introduction and adoption of improved chickpea varieties in Ethiopia have been published in the recent past. They have

established that the adoption of improved chickpea varieties has indeed increased welfare levels of adopting households (Verkaart et al., 2017) and that the adoption process has been driven by significantly higher returns to these varieties which made them attractive and helped the widespread adoption (Michler et al., 2018). This process has been supported by the fact that good market access is given in the study regions and no major hurdle to adoption appears to be present (Verkaart et al., 2019). Adding to this body of work, this thesis analyses the linkage between the adoption of improved chickpea varieties and smallholder production and commercialization. While previous work hinted at the fact that the increased returns were also realized through increased sales, the decision on the degree of commercialization has been treated as an explanatory variable rather than as a distinct decision taken by the farmer. We are closing this gap to provide a richer picture of the success of improved chickpea in this Ethiopian region and support wider learning from this case. We attempt to control for endogeneity and heterogeneity using the control function approach and the Mundlak-Chamberlain's, correlated random effect model respectively. Specifically, we seek to (1) Determine if there exists a causal relationship between improved chickpea adoption and the household market participation decision; (2) To estimate the extent by which the adoption of improved chickpea influences the quantity of chickpea sold in markets.

Our contribution to the literature on smallholder commercialization is thus twofold. Firstly, we empirically test the hypothesis that the adoption of an improved seed variety drives the participation of farmers into output markets. Secondly, constrained by data limitations, most studies on market participation employ cross-sectional data making causal identification difficult (Van den Broeck et al., 2017). Smallholder commercialization is a dynamic process which is best understood by observing changes over time. The presence of omitted variables in the form of time invariant unobserved household characteristics like risk aversion, managerial ability and preferences may bias our estimates if not well controlled for. We overcome this limitation by using a three-period panel data collected by the International Crop Research Institute for the Semi-arid Tropics (ICRISAT) in 2008, 2010 and 2014 households in the Shewa region of Ethiopia. Our conceptual framework is based on the basic non-separable agricultural household model which posits that as a result of market failure and imperfections in product and credit markets, the production and consumption decisions of farms households are non-separable.

Empirically, we employ the limitedly used triple hurdle model framework<sup>1</sup> (TH) to elicit the production and commercialization decisions of households. The TH is a flexible extension of the double hurdle market (DH) participation model with an additional tier for the production decision. The DH approach begins modelling from production, implicitly assuming all households in a study area are producers. However, not all households like in our case produce a particular crop, despite them being potential producers. It thus becomes relevant to explicitly model the decision to produce as any policy which encourages producers to participate in markets may also induce non-producers to begin producing and subsequently participate in markets (Burke et al., 2015). This model increases the external validity of the results while providing intuitive results. For purposes of brevity, our first hurdle is the decision to produce chickpea, which involves both the improved and local varieties. Our second and third hurdle is then the decision to sell conditional on producing and the sales quantity conditional on participating in the market respectively. In specifying this TH model, we then control for the adoption of improved chickpea in the second and third hurdles.

---

<sup>1</sup> The triple hurdle model is a more flexible extension of the double hurdle model and was employed since it fits the research objectives better. However it was chosen at a time when the topic of the thesis was registered and couldn't be changed.

The econometric analyses reveal the positive impact of improved chickpea adoption on smallholder production and commercialization in Ethiopia. On average, adoption of an improved chickpea variety leads to an increase in the likelihood of the household participating in markets by 13.3%. Conditional on participating in the market, adoption shows a positive and significant impact ( $p < 0.05$ ) on the quantity of chickpea sold in the market. Given that we control for area cultivated, the higher yields associated with adoption clearly allow selling more to the market after satisfying home consumption. This is also consistent with expectations and a previous study on maize marketing in Kenya (Alene et al., 2008). Other factors which significantly influenced the decision to produce chickpea are gender, input cost, distance to cooperative, farmer experience, the area of cultivation, market price and TLU. The decision to sell in output markets is influenced by the education level of the household head, household income, and area of land cultivated by the household. Finally, the expected quantity sold in the market is driven by household head's age, education, the area of cultivation, the price of chickpea, off-farm income and the total quantity of chickpea produced. This result thus provides supporting evidence for the development of novel technologies like improved seeds and other techniques for Ethiopia as tools to increase the commercialization of the agricultural sector. The results indicate that modern chickpea varieties do support a market-oriented development pathway in this region of Ethiopia. Even though not directly implied by our empirical results, this may hint at the importance of strengthened extension services and making improved seeds available and affordable to farmers in order to support commercialization. Since education increases commercialization, extension services should be geared at improving the knowledge base of farmers through on farm demonstration, farmer field schools and business schools.

Another key finding is that younger farmers are observed to have a greater probability of chickpea production than older farmers. Policy efforts that support younger farmers in their access to modern inputs and other services may help to further increase smallholder production levels. An interesting observation from the analysis partially conflicting with previous findings is that rising total assets decrease the probability to participate in the chickpea market but increase the quantities sold conditional on participation. Households with a higher living standard apparently are less interested in commercializing chickpea production but the available assets are put to productive use once the decision is made. Finally, to encourage market participation, interventions in Ethiopia should particularly focus on improving the access of households to land. Findings show that the greater the area of land cultivated, the greater the willingness to participate in output markets to sell more based on the participation decision already made.

## References

- Alene, A. D., Manyong, V. M., Omany, G., Mignouna, H. D., Bokanga, M. and Odhiambo, G. (2008) 'Smallholder market participation under transactions costs: Maize supply and fertilizer demand in Kenya', *Food Policy*, vol. 33, no. 4, pp. 318-328.
- Michler, J. D., Tjemström, E., Verkaart, S. and Mauseh, K. (2018) 'Money Matters: The Role of Yields and Profits in Agricultural Technology Adoption', *American Journal of Agricultural Economics*, in print.
- Van den Broeck, G., Swinnen, J. and Maertens, M. (2017) 'Global value chains, large-scale farming, and poverty: Long-term effects in Senegal', *Food Policy*, vol. 66, pp. 97-107.
- Verkaart, S., Munyua, B. G., Mausch, K and Michler, J. D. (2017) 'Welfare impacts of improved chickpea adoption: A pathway for rural development in Ethiopia?', *Food Policy*, vol. 66, pp. 50-61.
- Verkaart, S., Mauseh, K., Claessens, L. and Giller, K. (2019) 'A recipe for success? Learning from the rapid adoption of improved chickpea varieties in Ethiopia', *International Journal of Agricultural Sustainability*, 17(1), pp. 34 - 48.