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Impacts of Improved Chickpea Adoption on Smallholder Production and Commercialization in Ethiopia

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ABSTRACT

Enhancing agricultural productivity through the adoption of proven technologies presents a credible pathway to economic development and poverty reduction. The adoption of improved chickpea varieties has the potential to contribute not only to food security but also to economic growth and development as well as poverty reduction among the poor, since the adoption of such improved varieties are both pro-poor and environmentally friendly. Chickpea serves as a source of proteins and nutrients for poor households with the improved varieties having a very high value with potential for export. We therefore analyzed the impacts of improved chickpea adoption on smallholder production and commercialization employing a triple hurdle (TH) model on a panel data of three rounds (2008, 2010, 2014), drawn from 614 households in potential chickpea areas in Ethiopia. The TH model is specified to tackle the research objectives wherein the first hurdle models the binary decision to produce chickpea or not with a probit model, the second hurdle tackles the decision to participate in markets using a probit maximum likelihood estimator while the third hurdle specifies the intensity of market participation or commercialization using a truncated normal regression model. The study found the cultivation of improved chickpea varieties to have a significant positive effect on the commercialization of chickpea. Expectedly, the study found the decision to produce to be driven by age, gender, input cost, distance to cooperative, experience, area of cultivation, and TLU. The decision to sell in output markets is influenced by the farmer's educational level, household income and area of land owned by the farmer. The expected quantity sold in the market is affected by the household's age, education, area of cultivation, total asset holding of the household, off-farm income and the- total quantity of chickpea produced. This study therefore affirms the importance of improved chickpea varieties for commercialization and thus provides support for policies targeting poverty alleviation in rural areas.

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Introduction

Although well known for its agro-ecological suitability in the cultivation of chickpeas and high revenue gotten from exports, the production and market participation of smallholders in Ethiopia is not satisfactory and below the available potential (Shiferaw and Teklewold, 2007). Despite the potential opportunities in cultivating this crop, a lot of smallholder farmers are not participating in the production and commercialization of chickpea. This suggests that there are both household-specific characteristics and other factors which constrain households from participating in these activities. Production and commercialization of chickpea have largely been constrained by lack of improved seeds and novel technologies, poor soils, inefficient input, and output market access and lack of knowledge about these improved technologies. Chickpea plays a crucial role in food security and poverty reduction in Ethiopia; however, market imperfections have led to a stagnation of the sector with producers remaining in subsistence production (Shiferaw and Teklewold, 2007).

To harness and exploit the full potentials of chickpea, ICRISAT in collaboration with national agricultural research organization of Ethiopia have developed and distributed about 11 stress tolerant and high yielding chickpea varieties with both desirable agronomic and market traits (Asfaw et al., 2011). Adoption of these improved seeds is improving at a fast and dynamic rate in Ethiopia (Verkaart et al., 2017). Increased adoption increases agricultural productivity and helps sustain food self-sufficiency. That notwithstanding, increased adoption and transition to productivity-oriented agriculture firmly depend on opportunities available in markets (Asfaw et al., 2011). Thus the promotion of market orientation in smallholder agriculture remains a vital tool in the development of an efficient value chain that can supply food (Okoye et al., 2016). This study therefore aimed to analyze the linkage between the adoption of improved chickpea and smallholder production and commercialization in Ethiopia while controlling for endogeneity and heterogeneity in the study sample.

Material and Methods

The study relied on a balanced sample of 614 households collected in 2008, 2010 and 2014 panel years in the lume-ejere, Minjar shenkora and Gimbichu districts. Because households were randomly selected, both chickpea and non-chickpea farmers were interviewed.

As a result of market imperfections for most developing countries, production and consumption decisions are non separable. So we employed the non-separable agricultural household model developed by Singh et al. (1986) wherein a household decides to maximise its utility subject to certain constraints.

$$\text{Max}_{c_i, z_i, b_i, s_i, x_i} U(c, z_u)$$

A flexible extension of the double hurdle model, a triple hurdle model was specified to address the research objectives. Heterogeneity in the study sample was addressed using the correlated random effect model since it is well suited for non-linear panel data models. Endogeneity was tackled with the control function approach. To obtain both consistent and unbiased estimates of parameters in panel models, the exogenous regressors must be independent of unobserved heterogeneity. There is the prevalence of household heterogeneity that influences production and commercialization but is not observed. This creates selection bias as some households will indeed produce and sell more chickpea in the market than others.

Results and Discussion

The correlated random effect estimates of the small holder chickpea production and commercialization are presented in table 1 below. The goodness of fit in all the hurdles (χ^2) was highly significant ($p < 0.01$) indicating suitability of the explanatory variables in explaining the variations in the decision to produce and market chickpea. The likelihood ratio test also indicates that the slope coefficients for these participation decisions are significantly different from zero. Rigorous econometric analysis shows the positive impact of improved chickpea adoption on smallholder production and commercialization in Ethiopia. Adoption positively impacted commercialization by increasing yields and making farmers food self-sufficient. As expected, younger farmers were observed to be more committed to the production of chickpea. 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. Production and commercialization were also influenced by the agro-ecological zone.

Table 1 CRE model of chickpea production and market participation

Variables	Production Decision	Market participation	Marketed surplus
Plant improved		0.24079***	478.266**
Head age	-0.00237**	-0.00045	-10.0039**
Input cost	-0.00001**		
Head gender	0.07349**	-0.04602	138.635

Head education		-0.00561*	39.2243**
Household income		2.21e-06**	-0.00232
Distance to the main market	-0.00097	-0.00232	-14.8701
Distance to cooperative	-0.00637**		
Experience	0.00159*		
Area of cultivation	0.0412***	0.01773*	87.9248***
Market price	0.03970	-0.02989	-211.425
Off-farm income		6.00e-06	-0.10076***
TLU	0.01437**	-0.00843	24.1584
Total household value		-7.81e-06	0.10104***
Total production		-0.00007	0.60465***
Lume-ejere†	0.12425***	0.10691***	970.546***
Minjar-shenkora†	-0.11692***	-0.02763	1007.066***
Year 2010‡		0.00748	397.535***
Year 2014‡	0.12423***	-0.00908	503.728***
Constant		0.89834	-2681.201***
Sample size	1228	1510	
Pseudo- R ²	0.1964	0.1335	
Log-likelihood	-460.229	-618.380	1237
χ^2	0.0000	0.0000	-9109.37
			0.0000

Notes: ***p<0.01, **p<0.05, *p<0.1

Conclusions and Outlook

This study implicitly supports the hypothesis that increased technology adoption is a critical positive determinant of smallholder commercialization and therefore a pathway to poverty reduction and economic development. Hence good policies should be set aside to maintain and augment the adoption rates of these improved technologies. Furthermore, there should be an enabling environment to boost and ascertain smallholder participation in output markets.

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