Production Efficiency of Smallholder Onion Producers in Amhara Region, Ethiopia

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1. Introduction

- Onion has paramount health advantage, and it is indispensable in improving the taste of Ethiopian foods (CSA, 2022; Alemu et al., 2022).
- Hence, onion production has gained popularity in Ethiopia, contributing to the overall vegetable production (Taffese et al.,2023).
  - Evidenced by **7.4% and 34%** increase in area coverage and production of onion production from 2019/20 to 2020/21 (CSA, 2022).
- However, its productivity in Ethiopia (**122.8 qt ha-1**) is far below the world average productivity of **211.2 qt ha-1** (FAOSTAT, 2021).
- In the context of developing countries where resources are scanty, improving efficiency using the existing technologies is more important (Bedasa and Krishnamoorthy, 1997).
- Therefore, the measurement of efficiency has remained an important area of research, especially in developing countries like Ethiopia.
  - Hence, there is a large pool of studies done on efficiency of agricultural production in Ethiopia
- Previous studies:
  - Lack consistency in their results
  - Widely limited to technical efficiency
  - The literature on efficiency of onion production is scanty
- Therefore, this study aims to analyze the level of and determinants for technical and economic efficiency of onion producers in Ethiopia.

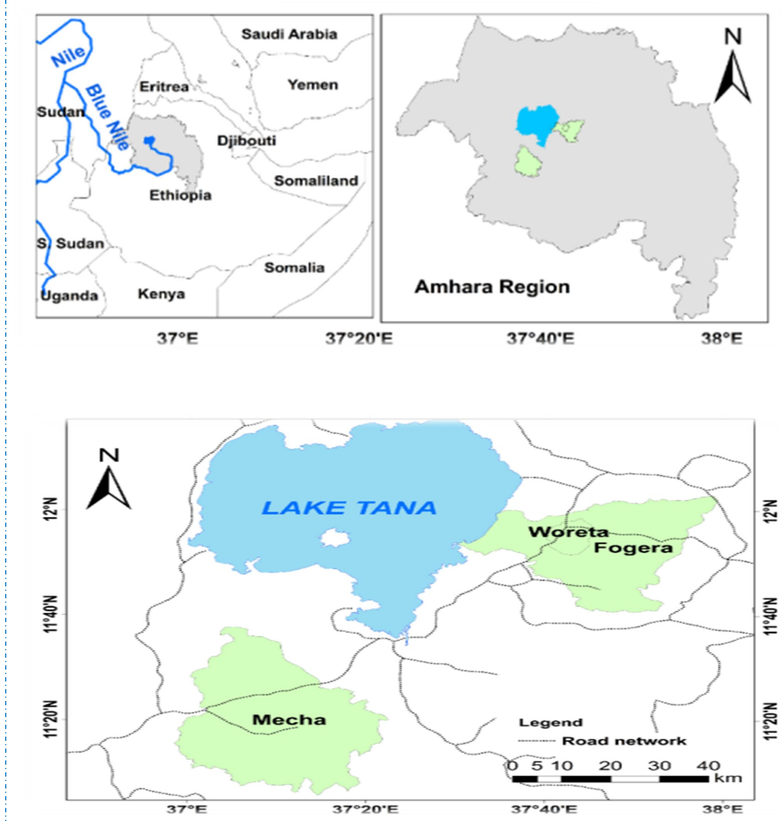


Fig. Study Area

2. Estimation Strategy

- Sampling: Combination of Purposive and Multistage systematic random sampling procedure was employed
  - Fogera and Mecha districts selected for their high potential
  - Three kebeles were selected randomly from each district
  - Likewise, households were randomly selected from each kebele
  - Total of 380 households, proportional to the population in the kebeles
- This study employes a stochastic frontier model that separately account for factors beyond and under the control of firms (Aigner et al., 1977).
- More formally, the production technology of a farm is represented by a stochastic production frontier as:

$$Y_i = f(X_i;\beta) + v_i - u_i$$

- Assuming a self-dual Cobb-Douglas production function in equation (1), the dual cost frontier can be derived algebraically and written in a general form as follows:

$$C_i = h(W_i, Y^*; \alpha)$$

where is the minimum cost of the farm associated with adjusted output of is a vector of input prices for the farm, and is a vector of parameters to be estimated

- AE = ratio of min cost/actual cost; and EE = TE*AE

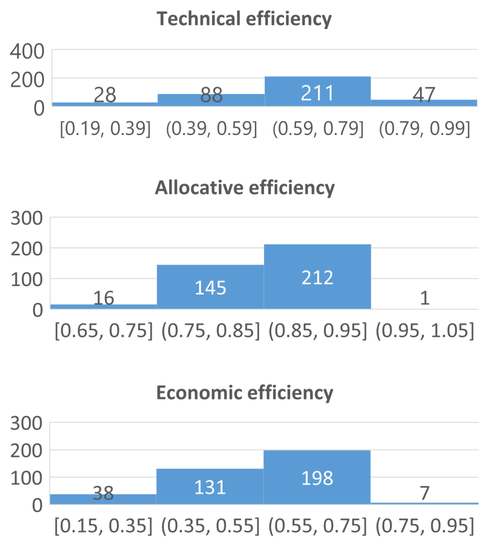
3. Result

Table 1. OLS and Maximum Likelihood estimates of onion production function

VARIABLES	OLS	Frontier
ln_Land_total	0.429***	0.416***
	(0.0359)	(0.0350)
ln_Labor_total	0.652***	0.662***
	(0.0758)	(0.0747)
ln_urea_onion	0.0164***	0.0153***
	(0.00510)	(0.00507)
ln_NPS_onion	0.00980*	0.0116**
	(0.00561)	(0.00562)
ln_insecticide_onion	0.0773***	0.0774***
	(0.0204)	(0.0189)
ln_herbicide_onion	0.0182**	0.0175**
	(0.00714)	(0.00697)
ln_fungicide_onion	0.00436	0.00396
	(0.00741)	(0.00718)
F Statistics	112.1***	
Chi_square (X2)		785.5***
R2	0.68	
λ		1.19 (0.16)
σ^2		0.44 (0.09)
Log likelihood		-290.4
Ho: sigma_u = 0		2.18*

Notes: ***, **, and * refer to 1%, 5%, and 10% significance level; Figures in parenthesis represents standard errors.

- Results of OLS and ML estimation consistently show that all inputs (Land, Labor, Urea, NPS, insecticides, herbicides, and fungicides) are positive and significant.
- The null hypothesis for testing the existence of 'inefficiency' shows that there is considerable level of technical inefficiency, at 10% sig, level.
- As demonstrated below, the mean technical, allocative and economic efficiency is 69%, 76%, and 52% respectively.



Description	Values
Mean (Std. Dev)	0.69 (0.11)
Minimum	0.30
Maximum	0.88

Description	Values
Mean (Std. Dev)	0.76 (0.10)
Minimum	0.38
Maximum	1.00

Description	Values
Mean (Std. Dev)	0.52 (0.12)
Minimum	0.05
Maximum	0.77

Table 2. Factors driving efficiency of smallholder onion producers (N = 374)

VARIABLES	te	ae	ee
Age (Years)	-0.000900	-0.000462	**-0.000959***
	(0.000550)	(0.000506)	(0.000575)
Formal education (=1 if yes)	0.0125	-0.00574	0.00737
	(0.0131)	(0.0120)	(0.0137)
TLU (tropical livestock unit)	**0.00474****	7.24e-05	0.00383
	(0.00233)	(0.00215)	(0.00244)
Family size (Active labor)	-0.00686	0.00304	-0.00315
	(0.00439)	(0.00404)	(0.00460)
Credit access (=1 if yes)	0.0224	0.00130	0.0139
	(0.0153)	(0.0140)	(0.0159)
Use pump (=1 if yes)	**0.0648*****	**0.0907*****	**0.116*****
	(0.0126)	(0.0116)	(0.0132)
Improved seed (=1 if yes)	**0.0327****	0.00278	**0.0280***
	(0.0138)	(0.0127)	(0.0145)
Extension service on seed (=1 if yes)	0.00376	**-0.0415*****	-0.0201
	(0.0127)	(0.0117)	(0.0133)
Extension service_fertilizer (=1 if yes)	-3.70e-05	0.0185	0.00501
	(0.0124)	(0.0113)	(0.0129)
Extension service_harvest (=1 if yes)	0.000231	**0.0441*****	**0.0369****
	(0.0146)	(0.0135)	(0.0153)
Manure_use (=1 if yes)	-0.0120	0.0103	-0.0102
	(0.0126)	(0.0115)	(0.0131)
Training (=1 if yes)	-0.0137	-0.00685	-0.00963
	(0.0123)	(0.0113)	(0.0128)

Notes: ***, **, and * refer to 1%, 5%, and 10% significance level; Figures in parenthesis represents standard errors.

- We found that use of improved irrigation technology (pump) has a positive and significant effect on production efficiency (i.e., technical, allocative and economic efficiency).
  - Increased technical efficiency can be because of the possible improvement in productivity, while the increased the allocative and economic efficiency can be associated with educed cost of production
- Likewise, adoption of improved seed has a positive and significant impact on efficiency of smallholder onion producers.
- The result also shows that extension service about onion harvesting has significant contribution to improve efficiency.
- However, contrary to our expectation, extension service on seed has impacted allocative efficiency negatively, this calls for revisiting the level of knowledge of extension workers regarding onion seed/seedling.
- Asset ownership (measured by TLU) has a positive and significant impact on technical efficiency. This can be partly because:
  - Oxen is main source of draft power and
  - Richer households are more likely to be able to make all the required investment for their onion farm.

Source: From internet

4. Conclusion

- There is high potential to increase productivity by improving efficiency of smallholder onion producers. Specifically, technical, allocative and economic efficiencies can be improved by 31%, 24% and 48% respectively.
- Improving the existing efficiency can be possible by promotion and adoption of improved technologies (i.e., irrigation pump and improved seeds) available in the area.
- Access to and improvement in extension service can also help to improve efficiency of smallholder onion producers.
- Hence, efforts in promoting technologies and the extension service should be reinforced.

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