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1 Exploring the Long-run Dynamic Links between Access to Land 2 and Food Security: Evidence from Ethiopia

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5

6 **Abstract**

7 Scan to know paper details and author's profile

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9 *Index terms—*

10 **1 INTRODUCTION**

11 Ethiopia is the second-most populated country in Africa after Nigeria, with about 113.5 million people living there
12 as of 2022, making it the 13th most populous nation in the world. [1] . Ethiopia's economy is based primarily
13 on agriculture, which is approximately employing 85% of the country's population [2] . Ethiopia had nearly 38.5
14 million hectares of agricultural land in 2020, corresponding to over 34 percent of the country's total land area
15 [3] . Ethiopia is one of the most food-insecure countries in Sub-Saharan Africa. Since 1980, the government had
16 a persistent food shortage. And, it is ranked 104 th out of the 121 nations having enough data to compute the
17 2022 Global Hunger Index rankings. Ethiopia has a deep sever level of hunger, with a score of 27.6 [4] .

18 In Ethiopia, 22.6 million people are food insecure due to drought, conflict, and increased in food prices [5] .
19 Bodurtha et al. (2011) [6] report that 60% of Ethiopia's rural residents do not have enough acreage to provide
20 enough food for their own families, and 43% of them live in a landless household. The farm size of Ethiopian
21 households ranges from 0 ha to 10 ha. According to Headley (2014) [7] , Ethiopia has an average cropland size
22 of 0.96 hectares per household, with regional variances. The Southern Peoples Regions and Tigray both have
23 0.49 hectares. The region with the greatest land per family is Oromia (1.15 ha), followed by Amhara (1.09 ha).
24 The country has gone through three main types of land tenure systems. The current system of land tenure was
25 implemented in 1991, the Derg military regime London Journal of Research in Humanities and Social Sciences
26 was in place from 1974 to 1991, and the Imperial government functioned until 1974. Currently, the system of
27 land tenure treats land as a public good. And, the Land policy has not brought the anticipated results and is
28 also not participatory.

29 As a result, providing households with land and a guarantee of food security will be one of Ethiopia's most
30 significant challenges in the coming decades.

31 The ability of a family to feed itself depends on having access to farmland, which is the bedrock of the
32 livelihoods of many smallholders [8] . Most research in Ethiopia didn't explore the long-run dynamic linkages of
33 food security and farm size, and it includes the works of Diriba, 2020 [9] ; Gebissa, 2021 [10] ; Frankenberger and
34 Coyle, 1993 [11] ; IFPRI, 2020 [12] ; Mengistu, 2014 [13] ; Teshome, Arega, Mehrete, 2021 [14] ; Bodurtha et al.,
35 2011 [6] ; Paul and G?th?nji, 2017 [15] . Therefore, it is crucial to evaluate the dynamic linkages of food security
36 and access to land in rural households in Ethiopia over time using the system GMM approach.

37 **2 II. METHODS AND MATERIAL**

38 **3 Data Source**

39 The ESS survey, which collected information from 3288 households, provided the household parcel-level data
40 used in our study. Ethiopian Socioeconomic Survey (ESS), the first-panel survey with a household questionnaire
41 and comprehensive agricultural data, was conducted by the World Bank [16] Living Standards Measurement
42 Study, Integrated Surveys of Agriculture (LSMS-ISA) group, and Ethiopian Central Statistical Agency (CSA)
43 [17] . ESS1 stands for the first wave of the ESS, which took place between 2011-2012; the second wave, which

44 took place in 2013-2014; the third wave, which took place in 2015-2016; and the fourth wave, which took place in
45 2018-2019. Since ESS4 for 2018-19 is a new panel and not a continuation of the ESS3 wave, we did not include
46 it in the study. Finally, the data is organized, coded and estimated using STATA 17.

47 4 Estimation Approach

48 We used the system GMM method as an estimation strategy for the study because it accounts for time-invariant
49 household-specific effects, addresses the endogeneity issue of the lagged dependent variable, permits some degree
50 of endogeneity in the other regressors, and optimally combines information on cross-individual variation in levels
51 with that on within-household variation in changes [18,19] . Two-step system GMM estimates were also chosen
52 over the one-step estimation because they are robust to heteroskedasticity and panel-specific autocorrelation with
53 Windmeijer correction for limited samples, which helps to remove standard-error biases. Some prerequisites are
54 dealing with data before estimating the long-run GMM coefficients. First, the short-run system GMM has to be
55 calculated along with post-diagnosis tests (instrument validity test, serial correlation tests, and robustness check).
56 The GMM estimate, a new estimator that combines the regression-in-differences with the regression-in-levels in
57 a system, has obtained considerable traction in the empirical literature employed for this study. The two models
58 (at "level", "first-difference") are specified as follows in light of this introspection:

59 5 Log-ann-food-cons-peraeq ilt =? ? +?log-food-cons-ann- 60 peraeq il, t-1 +?log-Farmsize

61 ??? + + ? ?t ; ?=1 ? ? μ ????? j=1??k; i=1?n; t=1?, T + ? ?t ; i=1?, n; t=1?, T $\hat{=}$?log-ann-food-cons-peraeq
62 ilt =? $\hat{=}$?log-food-cons-ann-peraeq il,t-1 +? $\hat{=}$?log-Farmsize ??? + + $\hat{=}$? u it ?=1 ? ? μ ? $\hat{=}$?????(2)

63 Where log-ann-food-cons-peraeq ilt denotes food security and for household i for location 1 over period t;
64 log_food_cons_ann_peraeq il,t-1 entails the lagged dependent variable's value for household i in location 1 over
65 period t; log-Farmsize ??? denotes logarithm of HHs total London Journal of Research in Humanities and Social
66 Sciences 48© 2023 Great] Britain Journals Press | 8 | Volume 23 Issue ??? Compilation 1.0

67 Exploring the Long-run Dynamic Links between Access to Land and Food Security: Evidence from Ethiopia (1
68) farm size (acre) a proxy to access to land for household i in location 1 over period t; is ??? other predictors in the
69 model for family i over period t and j is the number of included control variables (It has log-TLU ??? ; log-adulteq
70 ilt ; log-Number-of-Parcel ilt ; log-HH-dist-road-Kms ilt ; log-HH-dist-market-Kms ilt ; log-Heads-age ilt ; dummy
71 variables (Head completed primary school (=1), and Female-headed households (=1)) and time dummies); ? ??t
72 =the error term. For the disturbance-term, the following household-specific fixed effect is assumed:??? t = ??+
73 u it .

74 Secondly, the long-run effect for the k th parameter is computed as follows: $k / [1-?]$ (3)

75 Where ? k represents the short-run coefficients of the independent variables and ? represents the coefficient
76 of one period-lagged value of the dependent variable.

77 Finally, year dummies control for time variations of the dependent variable across the panels is also estimated.
78 Therefore, the year dummies are computed as: $[e ? -1] X 100$ (4)

79 Where ? represents the year dummies coefficients, and e represents the exponent (i.e., the base or the anti-log)
80 of the natural-logs. This is always used when the dependent variable is expressed in natural logarithms, and the
81 explanatory variable is a dummy (1/0) measure.

82 6 III. RESULT AND DISCUSSION

83 7 'Generating' Long Run GMM Coefficients

84 This section briefly discusses the long-run estimates. The results of system GMM estimates (Annex-I) are
85 Computed. The results are further validated using different diagnostic tests, which include serial correlation
86 and "Sargan / Hansen" tests (Annex-II). the result further confirmed the authenticity of the estimated model
87 and the instrumental variables, respectively. Robustness of the GMM results was checked from the pooled OLS
88 (Anex-III), the fixed effect (Annex-IV), and the difference GMM (Annex-V) model results.

89 Hence, the findings are robust when applied to too many different model specifications and instrument sets.
90 Given the usual ceteris paribus assumption, the system-GMM coefficients are short-run coefficients. If the System-
91 GMM result is significant it is also possible to compute the long-run GMM coefficients. The system GMM test
92 in Annex-I shows that, all the coefficients at 5 % were found significant. The long-run GMM coefficients could
93 be generated only for the significant short-run coefficients. Thus, Table ?? below gives the long-run effect for the
94 k th parameter.

95 Table ??: Long-run GMM coefficients of the significant system GMM coefficients We were looking closely
96 the STATA outputs of the long-run coefficients. First, we observed that, we had found Z-statistics instead of
97 t statistic but it doesn't loss the interpretation. The estimated long-run coefficients or the test output of the
98 long-run GMM model in Table ?? simply shows that, a percentage change in adult equivalence, one year-lagged
99 of annual food consumption per adult equivalence, number of household parcel, households distance to main
100 road (Kms), heads age, households distance from the market center (Kms) and female-headed households leads
101 to about 1.315%, 0.576%, 0.144%, 0.032%, 0.131%, 0.123%, 0.377% decrease in annual food consumption per

102 adult equivalence or food security level of household in the long run at 1% significance level, respectively. It
103 also shows that, a percentage change in total farm size of families (acre), tropical livestock units, and heads
104 completed primary education leads to about 0.076%, 0.521%, 0.177% increase in annual food consumption per
105 adult equivalence (food security level of a household) in the long-run, at 1% significance level. Adult equivalence
106 and annual food consumption per adult equivalence exhibit an elastic relationship, and the other independent
107 variables were found to have an inelastic relationship with the dependent variable. Household's Farm size (acre),
108 tropical livestock unit, and household head completed primary education has a more significant positive effect on
109 annual food consumption per adult equivalence in the short-run (0.179%, 1.23%, 0.419%) than in the long-run
110 (0.076%, 0.521%, 0.177%) respectively.

111 **8 "Plotting" Year Dummies in System GMM**

112 Year dummies control for time variations of the dependent variable across the panels is also computed using the
113 general formula. This is used when the dependent variable is expressed in natural logarithms, and the explanatory
114 variable is a dummy (1/0) measure. Therefore, the 2016 (y_{-3}) from the system GMM output is computed as
115 follows:

$$116 [e^{0.2613757} - 1] \times 100 = 29.87\%$$

117 As a result, in Ethiopia's rural and small-town areas, the average yearly food intake per adult equivalence in
118 2016 was 29.87% greater than the average in 2014, *ceteris paribus*. The 'computation result' that was previously
119 displayed is supported by Figure ?? which also depicts the trend of food consumption over time.

120 **9 London**

121 **10 IV. CONCLUSION**

122 We concluded that farm size, measured in acres, had a significant and favorable impact on food security both
123 in the short-run and long-run. And, there is an inelastic relationship between farmland availability and long-
124 term food security level of families. Since there is an inelastic relationship between farmland and food security,
125 the data strengthens the argument that farmers' productivity is harmed by public land ownership. As farmers
126 seek to raise food for their families, this causes serious issues. To grant farmers their land rights, land policy
127 should be centered on households' access to land. The government should also take steps to increase agricultural
128 productivity, promote education, prioritize women in policy, and close long-term infrastructural gaps that affect
rural households. ^{1 2 3}



8

Figure 1: 8 |

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Figure 2: 8 |Figure 1 :

Figure 3:

10 IV. CONCLUSION

8. log-Heads-age		0.083	0.054	1.54	0
9. Head	completely	0.071	0.076	0.93	0
Education (=1)					*
10. Female-headed (=1)	-	0.039		-2.03	0
	0.08				
	y-	-	0.014	-7.72	0
	1	0.11			
				*	
	y-	-	0.013	-7.52	0
	2	0.099			
	O	0.000	.	.	.
	Constant	0.926	.281	38.87	0
Mean dependent var	8.14	SD dependent var			0
R-squared	0.17	Number of obs			9
F-test	117.872	b > F			0
	10052.4				1
Akaike crit. (AIC)		Bayesian crit. (BIC)			0
	61				
	*** p<.01, ** p<.05, * p<.1				
Londb359 0.179 1.23 -3.101 -0.34 -0.07 6 -0.291 -0.308 0.419 -0.89 Akaike crit. (AIC) 2. log-Farmsize acre 3.					
Jour-					
nal					
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search					
in					
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man-					
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ties					
and					
So-					
cial					
Sci-					
ences					
y-1 1. log-food-cons-ann-peraeq-L 0.038		0.037	0.011	1.02	307 -30
	-				
	0.32				
y-3 2. log-Farmsize acre	0.26	0.048	5.45 0.007	1.62	0.000
		0.011			
Constant	24.6	2.517		9.81	0.000
3. log-TLU	0.09	0.016		5.75	0
Mean dependent var	8.145			SD depen	*
Number of obs 4. log-Number of Parcel	9855	0.022		-2.12	H
	-				t
	0.047				0
5. log-adulteq	6	-	0.024	-17.64	0
		0.43			
6. log-HH-dist-road Kms		-0.005	0.002	-2.29	0

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132 .2 Declaration of competing interest

133 The author(s) declared that they have no known competing financial interests or personal relationships that
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135 .3 Annex-II: Test of validity of instruments

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