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**MITIGATION OF FOOD INSECURITY IN ETHIOPIA:  
PERSONAL, HOUSEHOLD, AND REGIONAL  
DETERMINANTS**

Key words: survey, logit, agricultural asset sale, work for food, ecozone, education

**ABSTRACT.** Food insecurity has plagued Ethiopia for decades. The objective of this study is determining which personal attributes, household features, income-generating undertakings, and regional location change the food insecurity of Ethiopian households updating past studies. Furthermore, the study quantifies the probability changes in a household being food insecure in response to changes in personal attributes, household features, income-generating undertakings, and regional location. The data from the 2021/2022 Ethiopian Rural Socioeconomic Survey have been applied to estimate coefficients using the logit technique and calculate the effects of explanatory variables. Results show that being a male household head, education, having non-farm enterprise, and access to electricity lower the likelihood of a household being food insecure. In contrast, the likelihood of being food insecure has been associated with the region where a household was located, or dependence on raising livestock. The regional discrepancies have been substantial. Broadening access to education, stimulating non-farm enterprise, and promoting economic development while accounting for regional differences will reduce the risk of household food insecurity.

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## INTRODUCTION

Among the African nations, Ethiopia is the second most populous country after Nigeria [WB 2024]. Despite impressive GDP growth in recent years, surpassing the GDP growth of other countries in east Africa, the country faces development challenges. Many residents experience poverty and about 61% live on USD 3.65 a day [Statista 2024]. In 2024, numerous communities in northern, southern, and southeastern regions of the country are expected to experience food shortages [Rescue 2024]. Besides the drought, internal conflict exacerbates food insecurity and disrupts agricultural production. Climate related crises have involved prolong droughts followed by floods in Ethiopia in recent years [Rescue 2024]. The existing challenges force the population to continually adapt and cope with the risk of food insecurity. The objective of this study is determining which personal attributes, household features, income-generating undertakings, and regional location change the food insecurity of Ethiopian households. For this purpose, the study applies World Bank data from the most recent household survey in the empirical analysis quantifying the changes in the probability of a household classified as food insecure in response to a change of each considered factor. The study uses the logit technique to generate knowledge that updates past studies of food security in Ethiopia and enables the verification and possible modification of the existing programs aimed at reduction of hunger and malnutrition.

## BACKGROUND

Food insecurity has plagued Ethiopia for decades [Ocho et al. 2017] and the review of trends, challenges, and prospects of 66 studies suggested access to agricultural technology and employment opportunities as well as government policies to stabilize prices and implement programs to protect the poor. Another review of 35 studies focused on specific household level factors including the personal attributes, farm characteristics, assets, and external features such as interaction with extension personnel and market access [Abebaw and Betru 2019]. The review of past studies on food insecurity in Ethiopia revealed that the northern regions of Tigray, Amhara, and Afar, southern Oromiya and SNNPR, and eastern regions of Somali most often suffered from food insecurity. The northern, eastern, and southern regions were named as the frequent focus of food insecurity studies by Setiye Abebaw and Teshome Betru [2019].

Several recent studies further explored food insecurity in Ethiopia. The studies focus on rural [for example, Sani and Kemsu 2019, Abebe 2021] and urban populations [for example, Biadgilin 2023] but it is the rural residents that are more often exposed to food

insecurity. Most Ethiopians live in rural areas and agriculture is the primary employment of about 60% of the total country's population [Trading Economics 2024]. Another feature of many studies is the regional focus due to inherent heterogeneity of rural areas scattered across several ecological zones characterized by varying climatic conditions and the different mix of agricultural enterprises. Seid Sani and Biruk Kemsu [2019] used the 7-day consumption data to examine food insecurity and coping mechanisms in the Assosa zone in western Ethiopia after randomly selecting 276 households. Betemariam Gebre et al. [2021] studied the southeastern region of the country affected by the protracted drought and analyzed the coping strategies to manage the risk of food insecurity after surveying 1,402 rural households. Gezahegn Abebe [2021] investigated farmers' food insecurity in the Sidama region of southern Ethiopia applying a sample of 376 households surveyed at two locations. Million Sileshi et al. [2023] used information from 408 households to identify drivers of rural household food insecurity in the East Hararghe Zone. Recognizing major implications of household food insecurity for public health, Mohammed Temesgen Toma et al. [2023] assessed food insecurity in the South Ari district in the southern part of the country using a sample of 717 households. Factors influencing household food insecurity in the Offa district in southern Ethiopia were examined by Mamush Masha et al. [2023] using survey data collected from 144 households, while Betemariam Gebre et al. [2024] analyzed food insecurity in the Tigray region using a sample of 363 households.

## ESTIMATION APPROACH TO ASCERTAIN FOOD INSECURITY DETERMINANTS

The dependent variable in this study is a dichotomous variable, a 0/1 measure of food security, based on the response to the question on whether the household worried about having adequate amounts of food over the 12 months prior to the survey. The response for the variable is binary and equals 1 if the response was affirmative, 0 otherwise. Logit and probit statistical techniques are appropriate for estimation in case of a dichotomous dependent variable and ensure that the estimated response probabilities are strictly between 0 and 1 [Wooldridge 1996]. The choice of logit or probit estimation technique is not justified on theoretical grounds [Greene 2008]. The ultimate choice of the logit technique to estimate the empirical relationships in the current study follows the results of testing the Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC). The difference in the values of the AIC and BIC for logit and probit model was negligible. Therefore, the current study applied the logit method in estimation.

According to Jeffrey M. Wooldridge [1996], the functional form of the logit model is:

$$G(z) = \frac{e^z}{1+e^z}, \quad -\infty < z < \infty = x_i\beta \quad (1)$$

where  $G(z)$  is the cumulative distribution function and  $G(\cdot)$  is the logistic function.

The dependent variable,  $y = 1$ , indicates households which were not food secure. Then, the probability of a household facing food insecurity is:

$$P[y = 1 | X] = \frac{e^z}{1 + e^z} \quad (2)$$

while the probability that the household is food secure is given by:

$$1 - P[y = 1 | X] = 1 - \frac{e^z}{1+e^z} \quad (3)$$

Using the above relationships, the odds ratio is obtained by:

$$\text{Odds ratio} = \frac{P[y=1|X]}{1-P[y=1|X]} = e^z$$

Taking log of both sides, yields:

$$\log\left(\frac{P[y=1|X]}{1-P[y=1|X]}\right) = z = \alpha + \beta X_i + \mu$$

where  $\alpha$  is a constant,  $\beta$  is the set of coefficients of the exogenous variables,  $X_i$  is the set of exogenous variables, and  $\mu$  is the error term with the 0 mean and constant variance.

## DATA AND VARIABLE SELECTION

Data used in the study was collected through 2021/2022 Ethiopian Rural Socioeconomic Survey (ERSS) by Ethiopian Statistical Service (ESS). The extensive survey was conducted through face-to-face interviews and funded with assistance from the World Bank, the Foreign Commonwealth and Development Office, and the Bill and Melinda Gates Foundation. The survey is part of periodic household surveys organized by the ESS and the most recent publicly available for Ethiopia. Several applied questionnaires focused on various areas of community, household, and farming issues used in various parts of the agricultural production cycle. The questionnaire used in this study consisted of 16 sections and includes data about the socio-demographic information of the respondent and household members, health care, employment type and duration, income, savings,

Table 1. Selected descriptive statistics of the sample and units of measurements

Variable	Units	Mean	Standard dev.	Min.	Max
Household food insecure	1 = food insecure	0.416937	0.493102	0	1
Age_head	Years	45.09322	14.25245	18	90
Male_head	1 = male	0.68875	0.463052	0	1
Married	1 = married	0.735811	0.440945	0	1
Household_size	Number of persons	4.598263	2.348606	1	17
Basic_education	1 = person can read/write in any language	0.612604	0.487205	0	1
Temporary_labour	Number of days household members have temporary work for food or money	3.72955	25.37746	0	657
Agriculture_asset_sale	1 = agriculture asset sold	0.042214	0.201097	0	1
Non_farm_enterprise	1 = owns non-farm enterprise	0.129267	0.335529	0	1
Payment_work	1 = worked for payment in the last 12 months	0.226015	0.418291	0	1
Livestock_only	1 = livestock only enterprise	0.044637	0.206527	0	1
Access_elctricity	1 = electricity access	0.435468	0.495868	0	1
Amhara	1 = resides in region	0.132499	0.339066	0	1
Harar	1 = resides in region	0.089561	0.285581	0	1
Oromia	1 = resides in region	0.128661	0.334858	0	1
Somali	1 = resides in region	0.104625	0.306101	0	1
Benishangul	1 = resides in region	0.041608	0.199711	0	1
SNNP	1 = resides in region	0.132499	0.339066	0	1
Gambela	1 = resides in region	0.085235	0.27926	0	1
Afar	1 = resides in region	0.050495	0.218986	0	1
Dire Dawa	1 = resides in region	0.105029	0.306622	0	1
Addis Ababa	1 = resides in region	0.129873	0.336197	0	1

Source: own calculation

non-food expenditures, and housing, among others. Of particular interest to the current study was the section about food security.

The survey was integrated with the Annual Agricultural Sample Surveys (AgSS) and the ERSS surveyed rural households were a subsample of the latter. The sample is a two-stage stratified probability sample, where the first stage sampling chose households from the enumeration areas in urban areas in each region using the probability proportional to size. The second stage applied systematic random sampling to select ten agricultural households from the AgSS panel. A weighting scheme was applied to assure representativeness of the sample [WB 2023]. The survey was conducted in two waves to account for the agricultural seasons from September 16, 2022 to January 31, 2023 and April 1 to June 30, 2023. The survey compiled responses from 4,999 households, except for the Tigray region due to the local conflict. The estimation uses 4,924 observations after omitting a few outliers.

Table 1 presents a summary of descriptive statistics of the sample. Two out of five households (41.7%) have been classified as food insecure. The average respondent is 45 years old and almost 69% of the interviewed respondents were males. Nearly 74% of respondents were married and the average household included 4.6 persons. About 61% could read and write in at least one of the languages spoken in the country. Household members were temporarily employed for wages or food for 3.75 days per year and many households did not perform such work at all. Almost 23% were employed full-time or part-time and worked for wages or in-kind payment in the 12 months prior to survey. Just over 4% sold agricultural assets in the year before the survey was taken, presumably to obtain revenues used to support the household, possibly by buying food. A similar percent (4.5%) reported livestock as their only livelihood. Nearly 44% of the surveyed households had access to electricity [Macrotrends 2024], a key measure of the area's economic development. A total of ten regions were identified in the sample, including the capital Addis-Ababa. Since the regions vary in size and population, and are scattered across several ecozones, the share of respondents varied in each area. The smallest numbers of households in the sample were located in Benishangul (4.2%), Gambela (8.6%), and Harar (9%). The three areas with the largest shares of households in the sample were Oromia (12.9%), Addis-Ababa (13%), and Amhara (13.2%).

The personal, household, and regional characteristics listed in Table 1 have been included as explanatory variables in the statistical analysis. The selection followed the previous household studies of food insecurity in Ethiopia that repeatedly included those factors. Among the personal attributes are age, sex, marital status, and education [Abebaw and Betru 2019, Mengistu and Kassie 2022]. Pertinent household characteristics are household size, income, its forms and sources, especially off-farm income or employment [Abebaw and Betru 2019, Mengistu and Kassie 2022]. Farm features include raising livestock [Abebaw and Betru 2019, Mengistu and Kassie 2022]. The surrounding factors include access to electricity.

## LOGIT ESTIMATION RESULTS: FACTORS EFFECTING FOOD INSECURITY

Estimation results show estimated coefficients (Table 2). However, the coefficients need to be converted to marginal effects measuring changes in the probability of households being food insecure to serve practical purposes. Therefore, the discussion focuses on the statistically significant marginal effects. Households of male respondents were 3.4% less likely to be food insecure than those of women. Also, ability to read or write lowered the probability of food insecurity by 8.4%. As the household size increased above the average 4.6 persons, its probability of being food insecure increased by 6.5%.

Table 2. Logit estimation results of the relationship between n = 4,924

Variable name	Coefficient estimate		Marginal effect estimate	
	coefficient	std. error	marginal effect	std. error
Age_head	-0.00293	0.00226	-0.000650	0.000501
Male_head	-0.151*	0.0834	-0.0335*	0.0185
Married	0.00880	0.0886	0.00195	0.0197
Household_size	0.0292**	0.0148	0.00649**	0.00328
Basic_education	-0.379***	0.0753	-0.0842***	0.0166
Temporary_labour	0.00330**	0.00131	0.000734**	0.00029
Agriculture_asset_sale	-0.197	0.151	-0.0437	0.0336
Non_farm_enterprise	-0.185*	0.0954	-0.0412*	0.0212
Payment_work	0.0797	0.0812	0.0177	0.0180
Livestock_only	0.327**	0.156	0.0726**	0.0346
Access_elctricity	-0.774***	0.0813	-0.172***	0.0174
Amhara	0.788***	0.150	0.175***	0.0331
Oromia	1.303***	0.150	0.289***	0.0323
Somali	0.854***	0.161	0.190***	0.0355
Benishangul	0.685***	0.195	0.152***	0.0431
SNNP	1.268***	0.150	0.282***	0.0325
Gambela	0.339**	0.167	0.0753**	0.0371
Afar	0.724***	0.187	0.161***	0.0413
Dire Dawa	1.227***	0.155	0.272***	0.0337
Addis_Ababa	1.371***	0.153	0.305***	0.0331

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Source: own calculation

The increasing number of days of temporary work was associated with a negligible increase in the household being food insecure and may reflect inadequate food as a motive of such employment. However, having a non-farm enterprise lowered the probability of food insecurity by 4.1%, stressing the importance of off-farm earning opportunities. Respondents whose main livelihood was raising livestock could be expected to be more susceptible as this type of enterprise was associated with a 7.3% higher probability of being classified as food insecure. Livestock grazing is affected by access and condition of pastures, which in turn are dependent on precipitation. Having access to electricity lowered the probability of being food insecure by a whopping 17.2% and, as a proxy for economic development, suggests the importance of policies stimulating growth.

The effects of regional residency on the probability of a household being classified as food insecure show that all regions included in the empirical relationship have a higher chance of such classification as compared to the benchmark region of Harar. Harar has the lowest share of food insecure households, 7.1% [Chow and Lin 2019]. Respondents from households in Addis-Ababa had the highest probability, 30.5%. It has to be noted that those households are urban households and, in absolute numbers, rural households are more likely to be food insecure. The probability of being food insecure as compared to the benchmark region of Harar is 28.9%, 28.2%, and 27.2% higher, respectively, for households in regions of Oromia, SNNP, and Dire Dawa. The probability of Gambela's households being food insecure was 7.5%, the smallest among all regions.

## CONCLUSIONS

This study applied the latest publicly available data from the national household survey in Ethiopia to empirically determine factors increasing the probability of a household to be classified as food insecure. Among personal characteristics, age of the household head, education, and having a non-farm enterprise lowered the household likelihood of being food insecure. A narrow focus on livestock enterprise increased the probability of being food insecure in contrast to crop enterprises. Livestock enterprises can involve a semi-nomadic existence involving frequent relocation of herds and grazing conditions are affected by droughts and floods. The desire to have a large number of animals could lead to overgrazing over time. The largest decrease in risking food insecurity is associated with access to electricity, stressing the overall benefits of economic development. As in many sub-Saharan economies, the electricity grid does not cover the whole country and limits economic opportunities in some areas. The utilization of renewable energy sources could eliminate this constraint but requires investment and know-how. Specific solutions that are necessary for this aspect are outside the consideration of this study focused on micro-level analysis. However, the current study confirmed large differences of households



risking food insecurity with regard to their regional location. Clearly, those differences have to be recognized by a region-specific focus of efforts to alleviate food insecurity and accommodate the varied eco-zone conditions. The food insecurity phenomenon has been a social and economic issue in Ethiopia for decades. Earlier studies suggest that the causes of regional differences include ethnic, social, and environmental conditions that appear separately or in combination and complicate the search for sustained solutions.

Food insecurity is associated with poverty and addressing poverty as the underlying cause requires stable policies and sustained implementation of support measures focused on growth, job creation, and broadening access to education. Basic education reduced food insecurity as evidenced in this study and teaching basic reading and writing skills could involve not only children but also adult population offering opportunities for the NGO involvement. A future study can overcome limitations of this study by expanding the set of explanatory variables that will reduce the effects of omitted factors, including household composition, detailed measures of income from farming and off-farm employment, and shocks induced by internal conflicts in addition to catastrophic weather events brought about by climate change.

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## ŁAGODZENIE NIEDOBORU ŻYWNOŚCI W ETIOPII: DETERMINANTY OSOBOWE I REGIONALNE

Słowa kluczowe: badania ankietowe, regresja logitowa, sprzedaż aktywów rolnych, wykształcenie, ekostrefa, praca za żywność

**ABSTRAKT.** Etiopię od wielu lat dotyka brak bezpieczeństwa żywnościowego. Celem artykułu jest określenie, które cechy osobowe i cechy gospodarstwa domowego, a także przedsięwzięcia generujące dochód i położenie regionalne wpływają na niepewność żywnościową gospodarstw domowych w Etiopii. Określono prawdopodobieństwo wystąpienia niedoboru żywnościowego w gospodarstwach domowych w odpowiedzi na zmiany społeczne, a także w zależności od regionu zamieszkiwania. Na podstawie danych z Ethiopian Rural Socioeconomic Survey 2021/2022 obliczono współczynniki regresji logitowej i efektu zmiennych objaśniających. Wyniki wskazują, że prawdopodobieństwo ryzyka niedoboru żywności w gospodarstwie domowym występowało rzadziej, gdy głową rodziny był mężczyzna, respondent posiadał wykształcenie podstawowe, miał dodatkowe dochody z pracy poza gospodarstwem rolnym, a także wtedy, gdy gospodarstwo domowe miało dostęp do elektryczności. Badania potwierdziły także duże zróżnicowanie regionalne pod względem możliwości wystąpienia zagrożenia niedoboru żywności w gospodarstwach domowych, w zależności od ich lokalizacji regionalnej. Ryzyko niedoboru żywności występowało częściej w gospodarstwach położonych poza regionem Harar lub w regionach, w których respondenci zajmowali się wyłącznie produkcją zwierzęcą (wypasem). Do zmniejszenia ryzyka niedoboru żywności może przyczynić się m.in. ułatwienie dostępu do wykształcenia, możliwość zarobku w przedsięwzięciach pozarolniczych oraz stymulowanie rozwoju ekonomicznego, z uwzględnieniem różnic regionalnych.

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