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Full Length Research Paper

Food inflation and households' welfare: The case of Ethiopia

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Abstract

Food inflation has been shown to have an adverse impact on the welfare of households, especially net-buyers of food commodities in developing countries. This study investigates the effects of households' socioeconomic and demographic characteristics on households' welfare after food inflation. Welfare is the monetary compensation needed to restore a household to its pre-food inflation level of utility. A quadratic almost ideal demand system (QUAIDS) is estimated using five food groups; then the compensated price elasticities derived are used to compute the welfare values for each household. The study uses the Ethiopian household survey data collected jointly by International Maize and Wheat Improvement Center (CIMMYT), Mexico and Ethiopian Institute of Agricultural Research (EIAR) in 2009/2010. The study shows that low dependency ratio and increases in land holdings significantly improves households' welfare after food inflation.

Keywords: Welfare, Dependency Ratio, Landholding, QUAIDS, Ethiopia.

INTRODUCTION

The issue of food inflation and its impact on the welfare of consumers, especially in developing countries, has received a lot of policy and research attention in recent decades (Wodon & Zaman, 2008; Zezza et al. 2008; Shimeles and Delelegn (2013)). In developing countries, food inflation is essential because households spend a significant share of their incomes on food commodities (Wodon & Zaman, 2008; Matz et al. 2015). For instance, food inflation could significantly reduce household consumption, especially among uneducated urban and vulnerable rural households in Ethiopia (Ticci, 2011; Hill and Porter, 2017). Also, Shimeles and Delelegn (2013) have shown that food inflation could hurt households' welfare. Could policymakers help vulnerable households mitigate against the potential adverse effect of food inflation?

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It is possible if policymakers and other stakeholders understand households, in particular, their socioeconomic and demographic characteristics and how they worsen or improve their welfare after food inflation. However, empirical research on this issue, especially for Sub-Saharan Africa, is limited. This study contributes to bridging this gap in knowledge.

The study hypothesizes that low dependency-ratio and increased land holdings could improve on households' welfare after food inflation. The dependency ratio is the number of household members that are less than or equal to 15 years or above 65 years divided by the number of household members within the working age range of 15-64 years (Harwood, Sayer, & Hirschfeld, 2004). A low dependency ratio could mean households would have more members working, and possibly more income to withstand food inflation. Also, households with better access to agricultural lands might be able to

produce more agricultural commodities. Shimeles and Delelegn (2013) show that households in rural areas with better access to agricultural land tend to benefit from food inflation.

From the preceding, the study addresses the following questions: a) Could low dependency-ratio mitigate against the negative impact of food inflation on households' welfare? b) Could land holdings mitigate against the potential negative impact of food inflation on households' welfare? Therefore, the general objective of the study is to identify the important demographic and socioeconomic variables that could affect households' welfare after food inflation. In particular, it would achieve the following objectives: a) to estimate the size of the effect of dependency ratio on households' welfare after food inflation, b) to estimate the size of the effect of households' land holdings on their welfare, after food inflation.

The study uses Ethiopia as a case study because it is very susceptible to the possible negative impact of food inflation on household's welfare. Ethiopia is one of the poorest countries in Sub-Saharan Africa. Also, famine is frequent in the country, which is caused by drought and pest infestation, declines in soil fertility and land size holdings, poor crop performance, effects of climate change and climate change, among other factors (Kaluski, Ophir, & Amede, 2002). Climate change is one of the most significant threat to food security in the 21st century, and the future (Devereux & Edwards, 2004; Hanna & Oliva, 2016). Moreover, the country is one of the worst affected by food insecurity and malnutrition in the world (De Onis, Monteiro, Akré, & Clugston, 1993). Food insecurity, mainly from food supply shortages, could be a significant precursor of food inflation in developing countries.

CONCEPTUAL FRAMEWORK

To achieve the research objectives of this study, it is critical to understand the effect of food inflation on households' welfare. A starting point would be to understand the behavior of households' food choice. It would be the theme of this section.

To analyze the behavior of households' food choice, a weakly separable preference structure is assumed. For a weakly separable preference structure, households' overall utility is sub-divided into separate utilities obtained by consuming separate food groups (Deaton & Muellbauer, 1980). The utility is the satisfaction derived from consuming food item (q) in a food group (Q). Also, it is expected that households' demographic and socioeconomic characteristics could affect the utility function. It would allow for the analysis of the effect of low dependency ratio and increased land holdings on households' welfare after food inflation.

Following a two-stage budgeting framework, households' are assumed to be endowed with a fixed income from which to spend on consumption goods and other goods (collected called a numeraire good). The two-stage budgeting occurs when households/consumers allocate food budget (expenditure) to major food groups (first stage) and then allocate the group food expenditures to individual commodities in the group (Deaton & Muellbauer, 1980). In this paper, the food groups from which a consuming household must choose from staple foods (Q1), vegetables (Q2), meat and other animal products (Q3), beverages and drinks (Q4) and fats, including oil sweeteners and snacks (Q5). The commodities that make up these food groups are provided in Table 1.

The utility maximization problem for a consuming household, given a certain level of income M, is expressed as follows:

$$\text{Max } U\{u_1(Q_1), \dots, u_5(Q_5); \omega\},\ j = 1, \dots, 5 \quad (1)$$

$$such that: \sum_{j=1}^{5} V_j * Q_j = M$$

where, $Q_j = \sum_{(i \epsilon y)} q_i$: is the aggregate commodity of the jth food group (and q_i is the ith commodity within food group Q_j); $V_j = Y_j/Q_j$:is the unit value of the aggregate commodity Q_j (and $Y_j = \sum_{(i \epsilon y)} p_i q_i$: is the expenditure on aggregate commodity Q_j); p_i: is the price for the ith commodity within food group Q_j); $u_1(Q_1)$: is utility obtained from consuming from the stable foodsub-group;$u_2(Q_2)$:is the utility obtained from consuming from the vegetables sub-group; $u_3(Q_3)$:is the utility obtained from consuming from animal product sub-group; $u_4(Q_4)$:is the utility obtained from consuming from the beverage sub-group; $u_5(Q_5)$:is the utility obtained from consuming from the edible oil sub-group; and M is the income (total budget for food) available to the household, ω: is a vector of household's demographic and socioeconomic characteristics.

Assuming U (.) is twice differentiable and strictly convex, the solution to the households' maximization problem (1) results in optimal demand functions for aggregate commodity j. Moreover, according to Deaton and Muellbauer (1980), this demand function satisfies the characteristic properties of demand functions, because they are derived from standard utility maximization problem. These properties are the homogeneity of degree zero in prices and total expenditure, and symmetric and negative definite Slutsky substitution matrix (Deaton & Muellbauer, 1980). The optimal demand function for aggregate commodity j ($Q_j{}^*$) is expressed as:

$$Q_j{}^* = f(M, V_j, V_i;\ \omega) i \neq j \quad (2)$$

Substituting equation (2) back to the households' utility function produces an indirect utility function. The inverse of the indirect utility function produces the expenditure function (E). This function is expressed as:

Table 1. The composition of food groups.

Staple foods	Vegetables	Meat &Other Animal Prod.	Beverages	Fats, oil, snacks
Maize (dry)	Tomatoes	Beef	Tea (leaves)	Cooking Oil
Maize (green)	Onions	Goat meat	Tea (liquid)	Margarine
Teff	Cabbage	Sheep meat	Coffee (powder)	Groundnut oil
Wheat	Spinach	Pig meat	Coffee (liquid)	Coconut oil
Barley	Kale	Chicken	Soft drinks	Bread
Rice	Carrot	Turkey	Juices	Biscuits
Sorghum	Okra	Ducks	Local beer	Popcorn
F/millet	Pumpkin	Bush meat	Bottled Beer	Cashew nuts
P/millet	Eggplant	Fish	Wine	Sugar
Cassava	Cucumber	Eggs	Drinking water	Salt
Potatoes	Pepper	Milk	Coffee beans	Chocolate
Beans dry	Garlic	Cheese/Ghee	Water for livestock	Curry
Beans fresh		Butter	Water for other uses	
Cowpea fresh grain		Yoghurt		
Cowpea dry grain		Honey		
Cowpea leaves				
Groundnut fresh				
Groundnut dry				
Soybean				
Pigeonpea fresh				
Pigeonpea dry				
Greengram				
Bananas				

$$E = \emptyset^{-1}(V_j, U(\omega)) \quad (3)$$

Assuming a compensating variation measure of welfare (CV), the welfare loss/gain to the household after changes in the unit values of the food groups (food inflation) is:

$$CV = \Delta E(.) = E\left(V_j^1, U^0(\omega)\right) - E\left(V_j^0, U^0(\omega)\right) \quad (4)$$

For a price increase, the lower the CV, the higher the resulting welfare. It is because the household would require less monetary compensation to return it to the initial level of utility. A first ($\Delta E_{fo}(.)$) and second order (($\Delta E_{so}(.)$) Taylor's series expansions of the equation (3) give approximations to the CV. The second order Taylor's series expansion allows for the possibility of substitution among food groups (Friedman & Levinsohn, 2002; Vu & Glewwe, 2011). The expressions for the first and second order approximations, for changes in the unit values of food groups, are given in equations (5) and (6), respectively. The second order approximation allows for households' farm production activities (Vu and Glewwe, 2011).

$$\Delta E_{fo}(.) = \sum_{j=1}^{5} w_j * \Delta \ln(V_j) - \left(\frac{V_j * y_j}{X}\right) * \Delta \ln(V_j) \quad (5)$$

$$\Delta E_{so}(.) = \Delta E_{fo}(.) + 0.5 * \sum_{j=1}^{5}\sum_{i=1}^{5} w_j * s_{ji} * \Delta \ln(V_j) * \Delta \ln(V_i) \quad (6)$$

where, w_j: is the expenditure share of the jth food group, y_j: is the farm output of food group j where applicable (it is the sum of all the elements of the food group), V_j: is the unit price of food group j (assumed to be the same as the unit value of farm outputs of group j), X: is the total household food expenditure, $\Delta \ln(V_j)\ and \Delta \ln(V_i)$: is the log difference of unit value of food groups $j\&i, i \neq j$ (that is the percentage change in unit value of food groups), s_{ji}: is the compensated price elasticity of food group j with respect to food group i.

Deaton and Muellbauer (1980) note that the second term in $\Delta E_{so}(.)$ is either 0 or negative, since the compensated derivative of demand with respect to price is at most zero. Therefore, this study expects that for price changes the welfare loss to households will be lower when they have increased possibility for substitution (for instance away from expensive food groups to less costly options). Also,

from equations (5-6), it is expected that farm production could be an insurance strategy against food inflation.

MATERIAL AND METHODS

Econometric Model

Demand System

The goal of this section is to describe the procedure for estimating welfare after food inflation (equation 6). To do so, the compensated food price elasticities (s_{ji}in equation 6) would have to be extracted from an estimated food demand system. Many approaches have been developed to estimate food demand systems. The Quadratic Almost Ideal Demand System (QUAIDS) is used to estimate the demand system in this study using the QUAIDS package in STATA 14 (Poi, 2012). Also, households' socioeconomic and demographic variables are added to the model through the scaling technique (Poi, 2012).

Apart from the QUAIDS model being consistent with demand theory assumptions, it can also allow for non-linear Engel relationships between food group expenditure shares and food expenditure (Banks, Blundell, & Lewbel, 1997). Ignoring such nonlinear relationships could cause parameter estimates to be inconsistent (Banks et al. 1997). The appropriateness of this model versus the Almost Ideal Demand Systems Model (nested within the QUAIDS) is tested in this study. The QUAIDS model will be appropriate when the joint significance of the parameter capturing the quadratic term of income on food group share, for all the food group equations is significantly different from zero.

The study has five food groups. To avoid singularity (because of the adding up assumption) which prevents the demand system to be estimated, four equations would be estimated by maximum likelihood (Poi, 2012). The parameters of the last food group are recovered using the restrictions of adding up, homogeneity of degree zero in unit prices and income, and Slutsky's symmetry which is imposed on the model before estimation. The specification for the QUAIDS, including the model restrictions, are provided in (Poi, 2012).

Determinants of Households' Welfare

The compensated price elasticities extracted from the estimated QUAIDS model is used to compute the first and second order Taylor's series approximations of welfare, assuming a 10 percent food inflation across all food groups. The second order Taylor's series approximation of welfare is used as a dependent variable in a simultaneous quantile regression model, because it allows for the possibility of substitution among food groups. The simultaneous quantile regression model is estimated over the 25th, 50th and 75th quantiles of the distribution of welfare, using the SQREQ routine in STATA 14. The regression procedure is used to determine the effects of households' socioeconomic and demographic characteristics on welfare after food inflation. Also, it allows the impact of the household characteristics to vary over the quantiles of the distribution of welfare across households. Moreover, according to Barrett and Dorosh (1996), this model can be consistent with weaker model assumptions than least squares estimation. It makes it more robust to model misspecification.

The standard errors of the estimated model coefficients would be determined using bootstrap with 100 repetitions. This procedure would produce the appropriate standard errors and allow for reliable inferences from the model (Cameron & Trivedi, 2005). Assuming the second order welfare function (with production effects) is continuous and has a cumulative distribution represented by $F_y(.)$, the qth quantile of the cumulative distribution, and the corresponding conditional quantile regression are given as equations 7 and 8, respectively:

$$y_q = F^{-1}(q), \quad q \in (0,1) \tag{7}$$

$$y_q = \alpha_q + x\beta_q + \varepsilon \tag{8}$$

where, y_q: is the qth quantile of welfare distribution, α_q: is the constant term for the qth quantile, β_q: is the slope parameters for the qth quantile corresponding to a vector of socio-demographic variables, x, of which dependency ratio and land holdings are elements, ε: is a stochastic error term assumed to be normal with an expected value of 0 and a constant variance.

Data Collection

This study uses a survey of Ethiopian rural households conducted during 2009-2010, in four Ethiopian regions, namely Tigray, Amhara, Oromia, and Southern Nations, Nationalities, and People's Region (SNNPR). The survey was conducted jointly by International Maize and Wheat Improvement Center (CIMMYT), Mexico and Ethiopian Institute of Agricultural Research (EIAR). A stratified random sampling strategy is used, where strata are randomly selected woredas (districts) of high, medium and low maize yield potential. The resulting data are nationally representative. A total of 1,396 farm households from 30 woredas were surveyed, of these, 1,359 grow maize on 2,496 plots (46.4% households own only a single maize plot).

Apart from crop production information, information on household assets and food consumption were also collected. The final sample is 441, which is 32 percent of the original sample size of 1396. Sixty-eight percent of the sample had missing information on some of the food items and were deleted. Moreover, the sampling weights used for the stratified sampling were not available for this study. Therefore, the results from this study cannot be generalized to the entire Ethiopian population. Nevertheless, the results of this study could inform policy

Table 2. Variable Definitions and Summary Statistics.

Variable	Definition	Mean
Employed as Farmer	1 if farmer; 0 otherwise	0.217(0.413)
Illiteracy	1ifhave had least basic education; 0 otherwise	0.472(0.500)
Married and Living with Spouse	1 if true; 0 otherwise	0.939(0.240)
Dependency Ratio	Ratio of members<15 years &>65 years to those of working age (>15 years &<65 years)	1.19(0.80)
Working Age	Proportion of members >15 years &<65 years	0.52(0.18)
Sex	1 if male; 0 if female	0.938(0.240)
Land holdings	land holdings in Kert (4 Kerts= 1 Hectare)	9.619(8.476)
Remittances	1 if true; 0 otherwise	0.027(0.162)
Walking Distance to Market	Km	83.04(58.06)
Food Shortage Last Year	1 if true; 0 otherwise	0.005(0.067)
Occasional Food Shortage Last Year	1 if true; 0 otherwise	0.136(0.343)
No Food Shortage/Surplus Last Year	1 if true; 0 otherwise	0.662(0.47)
Food Surplus Last Year	1 if true; 0 otherwise	0.193(0.39)

Values in parentheses are standard errors.

makers and future research on the determinants of households' welfare after food inflation. Summary statistic results show that the average dependency ratio is 1.19. It means that on average, households in the study have more members who might not be working (dependents) than those working. Also, the average land holding is 9.7 Kerts, which is about 38 hectares. The summary statistics for the rest of the variables, including their definitions, are shown in Table 2.

RESULTS AND DISCUSSION

QUAIDS Results

This study used the Quadratic Aids Ideal Demand System model to estimate the system of demand equations (QUAIDS). A test of the null hypothesis that the joint significance of the parameters capturing the quadratic term of income, for all the food group equations is significantly not different from zero, is rejected at the 1 percent level, with a Chi-Square value of 106 (Table 3). It means that the QUAIDS model is appropriate for this study.

The food expenditure elasticities show that the staple food group is a luxury (Table 4). It is contrary to the expectation of this study because in most cases staple foods are normal commodities. However, due to the aggregate nature of this food group, it is possible that some food goods that are mostly consumed by the rich might produce such a result. However, vegetables, meat, and oil are all normal goods according to the results of the study. The beverage is an inferior good since it has a negative food expenditure elasticity. Moreover, all the own price compensated elasticities of all the food groups have negative signs as expected, and inelastic (Table 4). Similarly, all the own price uncompensated elasticities are negative as expected, and inelastic (Table 4).

QUANTILE REGRESSION RESULTS

Table 5 reports the quantile regression model results. A test of the null hypothesis that the effects of the variables (significant at 1%, 5%, and 10% levels) are the same across the different quantiles of the distribution of welfare, especially for dependency ratio and land holdings, is not rejected, all at the 1 percent significance level. Therefore, the results of ordinary least squares regression are discussed.

The OLS model results show that dependency ratio is expected to reduce welfare at the 5 percent significance level. A unit increase in the dependency ratio is expected to reduce households' welfare by 0.7 units. The higher the proportion of household members below 15 years and above 65 years, the higher the burden on the household, including the consumption of food commodities. Such households would have to buy more food commodities to satisfy their nutritional demands. At the same time, the dependents are likely not able to work and earn income to support the household to buy food commodities. The opposite effect is likely to happen to households with lower dependency ratios. However, a unit increase in land holding is expected to improve on welfare after food inflation by 0.1 units, at the 1 percent

Table 3. QUAIDS Model Results.

	Staple	Vegetable	Meat	Beverage	Oil
Constants	0.281***	0.212***	0.294***	0.084***	0.129***
	(0.106)	(0.021)	(0.058)	(0.020)	(0.024)
Food Expenditure	-0.178***	-0.018	0.097***	0.075***	0.024*
	(0.020)	(0.017)	(0.020)	(0.010)	(0.013)
Unit Price of Stable	0.076***	-0.034***	-0.019	-0.009*	-0.014*
	(0.022)	(0.008)	(0.013)	(0.005)	(0.007)
Unit Price of Vegetable		0.094***	-0.032***	-0.008***	-0.019***
		(0.007)	(0.006)	(0.003)	(0.005)
Unit Price of Meat			0.071***	-0.008**	-0.012**
			(0.011)	(0.004)	(0.006)
Unit Price of Beverage				0.023***	0.002
				(0.003)	(0.003)
Unit price of Oil					0.043***
					(0.007)
lambda_1(Engel Coefficient)	-0.023***	-0.003	0.010***	0.012***	0.005***
	(0.004)	(0.002)	(0.003)	(0.001)	(0.002)
Married Living with Spouse	0.336***	-0.021	-0.152***	-0.097***	-0.066***
	(0.038)	(0.024)	(0.031)	(0.017)	(0.019)
Sex (male)	-0.004	0.018**	-0.024**	0.007	0.004
	(0.012)	(0.009)	(0.012)	(0.006)	(0.007)
Dependency Ratio	0.067***	-0.008	-0.036	-0.030***	0.007
	(0.026)	(0.018)	(0.024)	(0.012)	(0.014)
Number of Observations	448				
Log-likelihood	1158				
Joint Test (all Lambdas =0)	Chi-Square	=106***			

***, **,* denote significance at 1, 5 and 10 percent, respectively; values in parenthesis are standard errors.

significant level. Households with higher land holdings are expected to be wealthy (Headey, Dereje, &Taffesse, 2014). Moreover, it was found out in Kenya that households with land holdings are able to withstand the adverse effect of food inflation than those without access to land (Levin and Vimefall, 2015). Also, such households would have access to an essential agricultural input, which they could use to expand their farm acreage and as collateral to access credit (Musabanganji, Antoine, & Lebailly, 2015). Therefore, it is expected that, through an income effect or production effect, such households would fare better in the event of food inflation.

For the control variables, food surplus last year, and no food surplus or shortage previous year are expected to improve on welfare after food inflation, at the 5 percent, and 1 percent significance levels, respectively. Ethiopia is a drought-prone country, with frequent famine occurrences. Food shortages are more likely to cause famine. Food inflation, in such case, would worsen household's welfare. On the contrary, households that experienced food surplus or did not experience food shortage or surprise would be expected to do better (regarding welfare) after food inflation. Again, household's size has a positive effect on welfare, at the 1 percent significance level. The summary statistic results (Table 2) show that households in this study on the average have about 52 percent of their members within the working age. These people would be able to work off-farm and/on-farm to support their household. Also, the higher the walking distance to the market, the higher the likelihood that household's welfare would decrease, at the 5 percent significance level. It is not surprising because such households would have to pay more for transportation to get to the market, and also spend more time going to the markets. The model explained about 7 percent of the variation in welfare. Moreover, overall, the model is significant at the 1 percent level with a Wald Chi-Square value of 78.

Table 3. Estimated Price Elasticities and Expenditure Elasticities.

	Compensated Price Elasticities					**Expenditure Elasticities**
	Staple	Vegetable	Meat	Beverage	Oil	
Staple	-0.111	0.001	0.115	0.000	-0.004	2.23
Vegetable	0.163	-0.293	0.146	0.005	-0.021	1.04
eat	0.123	0.107	-0.374	0.055	0.089	0.52
Beverage	-0.534	0.159	0.600	-0.486	0.262	-1.04
Oil	-0.040	0.019	0.349	0.110	-0.438	0.26
	Uncompensated Price Elasticities					
Staple	-0.786	-0.384	-0.684	-0.145	-0.229	
Vegetable	-0.151	-0.472	-0.226	-0.062	-0.126	
Meat	-0.034	0.017	-0.560	0.021	0.037	
Beverage	-0.220	0.337	0.972	-0.419	0.367	
Oil	-0.120	-0.027	0.254	0.093	-0.464	

Table 5. Quantile Regression and OLS Results.

	OLS	25th Quantile	50th Quantile	75th Quantile
Employed as farmer	0.343	-0.614	0.554	0.273
	(0.607)	(1.222)	(0.651)	(0.270)
Illiteracy	-0.833	-0.282	0.041	-0.113
	(0.571)	(0.892)	(0.416)	(0.273)
Married and living with spouse	-0.399	2.452	0.241	0.272
	(2.671)	(3.398)	(1.589)	(0.802)
dependency ratio	0.691**	1.278**	0.518**	0.380***
	(0.358)	(0.549)	(0.262)	(0.136)
Sex	0.491	-1.623	-0.478	-0.968
	(2.977)	(3.020)	(1.588)	(0.809)
Land holdings	-0.102***	-0.123**	-0.114***	-0.055***
	(0.035)	(0.057)	(0.033)	(0.021)
Remittances	1.521	2.379	0.509	0.118
	(1.678)	(2.196)	(0.700)	(0.970)
Walking distance to market	0.010**	0.012*	0.008	0.004
	(0.005)	(0.008)	(0.003)	(0.003)

***, **,* denote significance at 1, 5 and 10 percent, respectively; values in parenthesis under the slope coefficients and constants are bootstrap.

CONCLUSION

This study investigated the impacts of Ethiopian households' characteristics, in particular, dependency ratio and land holdings, on welfare after food inflation. Welfare is defined as compensation variation and derived from a second order Taylor's series approximation of the expenditure function. Compensated price elasticities, derived from an estimated QUAIDS model, served as the main variable in computing households' welfare.

This study has shown that low dependency ratio and access to land holdings are expected to have significant positive impacts on households' welfare after food inflation. It means that policies targeted at reducing fertility, and subsequently dependency ratio, could serve as a mitigating strategy against the effects of food inflation on household's welfare. Moreover, this study encourages governments in Africa, and in particular, Ethiopia, to design laws and programs to liberalize land markets, and support households to access agricultural

Table 5. Continued. Quantile Regression and OLS Results.

	OLS	25th	50th	75th
household size	-0.284**	-0.326	-0.127	-0.083
	(0.120)	(0.262)	(0.092)	(0.062)
Food shortage last year	2.653**	1.120	2.063*	2.961***
	(1.135)	(2.210)	(1.075)	(1.153)
Occasional food shortage	-0.228	-1.228	0.885	1.295
	(0.630)	(1.824)	(0.817)	(1.056)
No food shortage&surplus	-1.916***	-2.909**	0.111	0.730
	(0.647)	(1.263)	(0.705)	(1.012)
Food surplus last year	-1.773***	-4.522***	-0.240	0.767
	(0.729)	(1.684)	(0.919)	(1.062)
Constant	-2.191	-3.433	-2.785**	-1.710
	(1.734)	(2.301)	(1.253)	(1.164)
R-square	0.07	0.07	0.06	0.05
Model Sig. (Wald-Chi Square)	78***			
Number of Observations	441	441		

Null Hypothesis (Slope parameters equal across quantiles)	Conclusion
Dependency ratio	Fail to reject (F-value = 1.38)
Land holdings	Fail to rejected (F-value = 1.87)
Food shortage last year	Fail to rejected (F-value = 0.44)
Walking distance to market	Fail to rejected (F-value = 1.37)
Food no surplus/shortage last year	Rejected (F-value = 4.16***)
Food surplus last year	Rejected (F-value = 4.59***)

***, **,* denote significance at 1, 5 and 10 percent, respectively; values in parenthesis under the slope coefficients and constants are bootstrap.

land. It could be an effective strategy to improve households' welfare after food inflation, through increased agricultural productions all things remaining the same.

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