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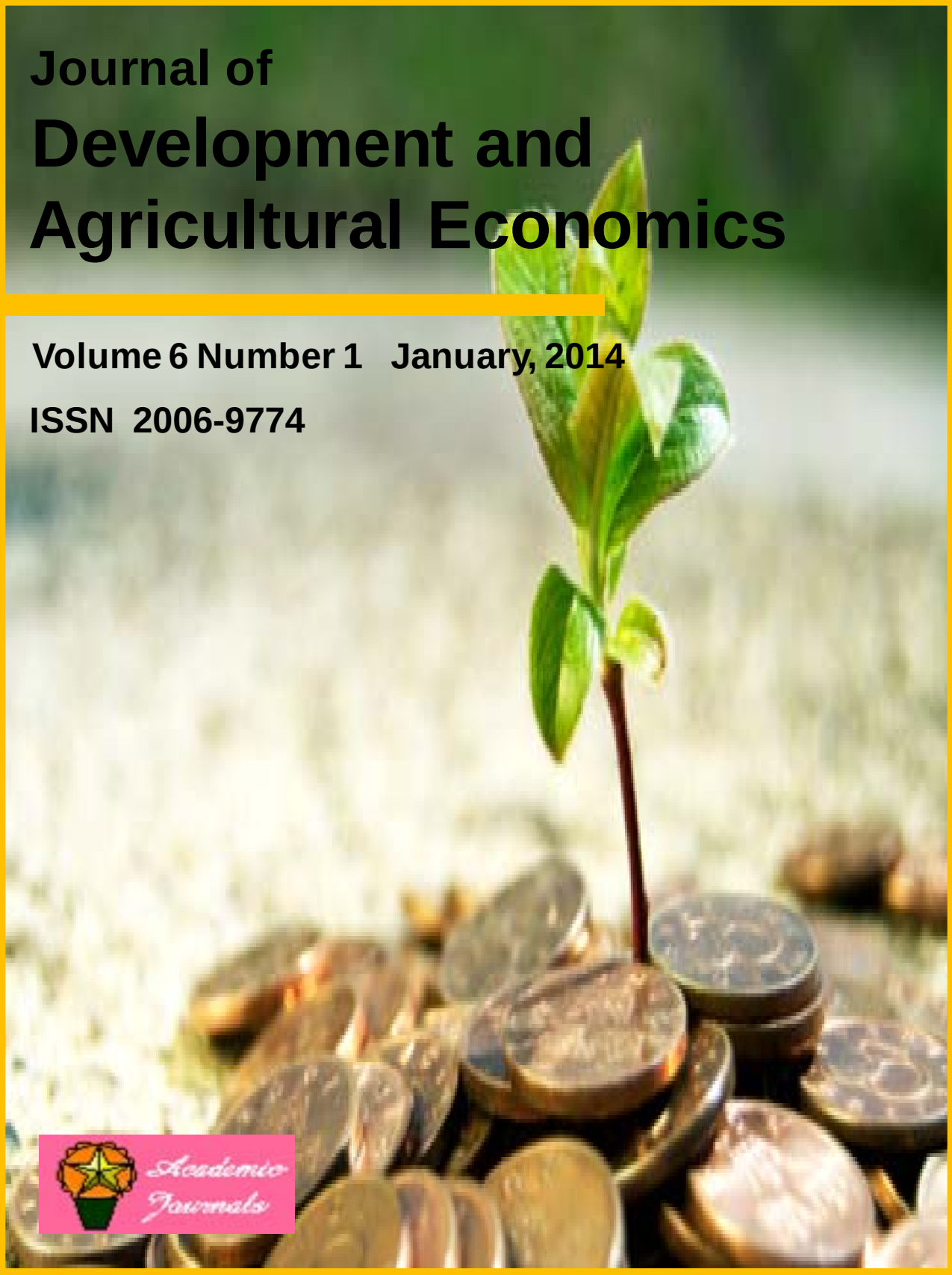

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Full Length Research Paper

Econometric analysis of the changes in food consumption expenditure patterns in Egypt

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This paper analyses the changes in food expenditure patterns over time in Egypt with special emphasis on the differences between urban and rural sectors. Engel curves for food groups are estimated by using double-log function type. The method used for estimating regression equations is the Weighted Least Squares (WLS). Data used in the study are obtained from the Household, Income, Expenditure, and Consumption Survey (HIECS) conducted by the Central Agency for Public Mobilisation and Statistics (CAPMAS) of Egypt for five survey periods from 1990/1991 to 2009/2010. Food consumption expenditure patterns have changed over the five conseculative survey periods as a result of economic changes. Estimated expenditure elasticities for food groups are positive and less than one except for fish, milk-eggs, and fruits, as they moved up to the necessity commodities in 2009/2010. The estimated expenditure elasticities for food groups have decreased significantly over the time. There are statistically significant variations between the urban and rural expenditure elasticity of most food commodities, except for cereals, milk-eggs, fruits, and beverages. Elasticities tend to be higher in rural areas than urban ones. The expenditure elasticities of food groups are lower at high-income groups than low-income ones. These results provide the guideline for future policy implication in respect of the demand management and food consumption in Egypt.

Key words: Food consumption expenditure, Engel curves, expenditure elasticity, Egypt.

INTRODUCTION

In Egypt, as in most developing countries, food dominates consumers' budgets. In 1990/1991, rural areas consumers spent almost 60%t of their incomes on food whereas urban consumers split their expenditure about evenly between food and non-food items. In 2009/2010, food expenditure share declined to over 50% in rural areas and to about 40% in urban areas (CAPMAS, 1990/1991 and 2009/2010). The food's share of total expenditure in Egypt rural areas was much higher than the urban areas. Household consumption patterns have been changing especially, after economic liberalisation programs. These changes have led to changes in real income and income distribution, affecting household expenditure behaviour.

In the economic theory, the relationship between income level and the quantity purchased is interpreted by income consumption curves. German economist Ernst Engel had established this approach firstly in the 19th century. Since then the curve that shows the influence of the changes in the consumer income on the quantity demanded is called Engel curve. The household expenditure behaviour can be analysed by using Engel curves (Sadoulet and Janury, 1995). Engel curve show how the preferences between goods change when

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there is an increase in the household income while the prices of the goods are fixed. Households primarily tend to satisfy their household's basic needs and as the level of welfare increases, the share of expenditure on necessities such as food decreases.

The relationship between demand and total expenditure can be used to derive expenditure elasticities of demand for goods. These elasticities represent the percentage of change in the quantity demanded as a response to the percentage change in the income level. According to Engel curve, the commodities are classified into two categories as necessities and luxuries. If the income elasticity of demand for certain goods is less than one, such goods are necessities and if it is larger than one, it would be luxury goods.

Engel curves were widely examined by using different econometric methods for different groups of goods. For example, Working (1943) proposed the log-linear budget share specification, which is known as the Working-Leser model, since Leser (1963) found that this functional form fit better than some alternatives. Houthakker (1957) analysed the income elasticities of 30 different countries for four different expenditure groups. Chesher and Rees (1987) estimated the income elasticity of demand for cheese, meat, and fats in Great Britain by developed Almost Ideal Demand model's Engel curve assuming that price does not change during the period of the survey. Banks et al. (1997) analysed Engel curve and consumer demands with the help of British data. You (2003) used models in the study where food, transportation, cigarette and alcohol expenditures were examined with Engel functions.

In Egypt, several studies have been conducted to estimate income elasticity using the HIECS (Shapouri and Soliman, 1984; Soliman, 1992). These studies used a consumption-income relation specified with a double log functional form. Soliman and Eid (1995) compared the changes in expenditure elasticity over a long period, including the dramatic change in the Egyptian economy from a central planned system to an open market system. Another study by Sleem and Abdul Azziz (2006) dealt with estimating the consumption function of animal products using HIECS of the year 1999/2000. It tested three functional forms: the linear, semi-log, and double-log, for fresh red meat, poultry, and fish. Atta (2006) estimated the Engel curve function for the relation between per capita annual consumption of grains as a function of annual per capita expenditure calculated from the 1999/2000 HIECS. The study tried four functional form: linear, double-log, semi-log, and quadratic forms. These functions were estimated for both major urban and rural regions of Egypt. Fabiosa and Soliman (2008) estimated a system of Engel functions for two survey periods, 1999/2000 and 2004/2005, to quantify the impact of changes of income on household expenditure behavior and to investigate how expenditure responsiveness changes with income.

Ragab et al. (2008) estimated the Engel's curve model using the double-log form. The model estimated the relation between the per capita annual expenditure on each food animal product commodity and the total per capita annual expenditure. The study compared the average estimated elasticity of the years 1999/2000 and 2004/2005.

The analysis of changing food consumption pattern over time reveals a clear picture of living standard and the economic growth of the country. This would help in designing appropriate policies related to food production and distribution. Therefore, this paper aims to analyse econometrically the changes in food expenditure patterns in Egypt over time, as the result of economic improvements, with special emphasis on the difference between urban and rural areas, as well as at different income levels.

Specifically, there are five aims for this study as follows: First; studying the changes in consumption expenditure patterns in Egypt. Second, estimating the expenditure elasticities of demand for different food groups. Third, estimating the changes in the expenditure elasticities for different food groups between the years 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. Fourth, determinating the differences in food expenditure patterns between rural and urban households (Location effect). Finally, estimating the differences between the food expenditure patterns of households at different income levels (Income level effect).

MATERIALS AND METHODS

Estimation models

The most available data of Egyptian Household Surveys are very highly aggregated household expenditure and contains no information on consumed quantities and consequent prices. Furthermore, the data provided by the surveys are completed in a short time-span, prices faced by all households can be regarded as constant. This allows focus on responses of household demand to variations in income or total expenditure. Therefore, this study used the specification of the Engel model, which uses only expenditure data.

The choice of an appropriate functional form in estimating Engel's curve gets importance. There are many functional forms that are used to estimate Engel curves. In this study, a double logarithmic functional form is used to estimate expenditure elasticities. This functional type has proven to be the most appropriate way of estimating the expenditure elasticity of demand because of its simplicity and quite easy estimation and interpretation (Ahmed et al., 2012). Also, expenditure coefficient is the coefficient of elasticity and there is no need of calculation.

In estimation of Engel curves, total expenditure is commonly used as a proxy of income for two reasons (Deaton, 1997; Tansel, 2002): First, total household expenditure tends to be more accurately reported, is easier to measure than total household income, and is measured with less error of measurement particularity in developing countries. Second; income may be subject to transitory fluctuations since savings allow smoothing of

expenditure over time. Thus, the total expenditure elasticities are calculated instead of income elasticities.

The general model for estimation defined below represents the double-log functional form and has the advantage that the estimated parameter b_i can be readily interpreted as expenditure elasticity.

$$\ln x_{ij} = a_i + b_i \ln y_j + \eta_i \quad (1)$$

Where the subscript j denotes total expenditure group and the subscript i denotes commodity group. So, x_{ij} is the mean annual per capita expenditure on a commodity group i of households from expenditure group j, a_i and b_i are the estimated coefficients, y_j is the mean annual total per capita expenditure of households from expenditure group j, and (η_i) is the disturbance term. As pointed out before, the derivation of the Engel function assumes constant prices. Equation (1) is estimated for each of the 10 food commodity groups, for each survey (1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010) in both rural and urban Egyptian areas as shown in Table 5. To find out the factors that cause the changes in expenditure patterns over time, consumption expenditure patterns of the urban and rural households, and the households at different income levels were analysed. Dummy variables are included to test these factors. The equations used for these are in the following forms.

Time effect

In order to estimate the difference in the elasticity for each commodity group over time, dummy variables are used between the years 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. There are five years of the Egyptian Household Income, Expenditure, and Consumption Surveys (EHIECS). Therefore, the number of dummies is four (Gujarati, 1995). Assuming that the five years data have a common slope but different intercepts in the regression of annual per capita expenditure share for a food group on average annual total expenditures[1]. The equation used for this is of the form:

$$\ln x_{ij} = a_{i0} + b_{i0} \ln y_j + a_{i1} D_1 + b_{i1}(\ln y_j D_1) + a_{i2} D_2 + b_{i2}(\ln y_j D_2) + a_{i3} D_3 + b_{i3}(\ln y_j D_3) + a_{i4} D_4 + b_{i4}(\ln y_j D_4) + \eta_i \quad (2)$$

Where D_1 = 1, if 1994/1995, 0 if otherwise, D_2 = 1, if 1999/2000, 0 if otherwise, D_3 = 1, if 2004/2005, 0 if otherwise, and D_4 = 1, if 2009/2010, 0 if otherwise. b_{i1}, b_{i2}, b_{i3} and b_{i4} are the estimated coefficients, In this case b_{i1} indicates how much the consumption expenditure elasticity of the 1994/1995 differs from the consumption expenditure elasticity of the otherwise. b_{i2} indicates how much the consumption expenditure elasticity of the 1999/2000 differs from the consumption expenditure elasticity of the otherwise, etc. All other variables have been as defined above. Table 6 shows the results of Model 2.

[1] The first year data (1990/1991) is treated as the base year and the intercept a_{i0} reflects the intercept of this year.

Location effect

Dummy variable was also used to see the differences in total expenditure elasticities of urban and rural households. The model is the same as Equation (2) except for the dummy variable.

$$\ln x_{ij} = a_i + b_{i0} \ln y_j + b_{i1} D + b_{i2}(\ln y_j D) + \eta_i \quad (3)$$

where D = 0 for rural data, 1 for urban data, b_{i2} is the differences in total expenditure elasticities of urban and rural households. Table 7 shows the results of model 3.

Income levels effect

In order to determine the differences between the consumption patterns of households at different income levels, the data set is divided into two subsets according to income categories. Dummy variable is used to see the differences in total expenditure elasticities of different income levels. The model is the same as Equation (2) except the dummy variable.

$$\ln x_{ij} = a_i + b_{i0} \ln y_j + b_{i1} D + b_{i2}(\ln y_j D) + \eta_i \quad (4)$$

where D = 0 for the first set (low income), and 1 for the second set (high income). b_{i2} shows how much the expenditure elasticity of low income groups differs from the expenditure elasticity of high income groups. Table 8 shows the results of model 4.

Simultaneous effect of total expenditure, time, location, and income levels

Important determinants of food expenditure patterns are the income (or expenditure) level of the household, the time, the local food habits and the income level. These determinants are analysed simultaneously by using dummy variables for each food group (Equation 5).

$$\ln x_{ij} = a_{i0} + b_{i0} \ln y_j + a_{i1} D_1 + b_{i1}(\ln y_j D_1) + a_{i2} D_2 + b_{i2}(\ln y_j D_2) + a_{i3} D_3 + b_{i3}(\ln y_j D_3) + a_{i4} D_4 + b_{i4}(\ln y_j D_4) + a_{i5} D_5 + b_{i5}(\ln y_j D_5) + a_{i6} D_6 + b_{i6}(\ln y_j D_6) + \eta_i \quad (5)$$

where: D_1 = 1, if urban, 0 if rural , D_2 = 1, if 1995, 0 if otherwise, D_3 = 1, if 2000, 0 if otherwise, D_4 = 1, if 2005, 0 if otherwise, D_5 = 1, if 2010, 0 if otherwise, and D_6 = 1, if high income level, 0 if low income level. All other variables have been as defined above.

The Central Agency for Public Mobilisation and Statistics (CAPMAS) of Statistics of Egypt publishes the data in the grouped form. For this reason, the Weighted Least Squares (WLS) regression is used to estimate the above models (1), (2), (3), (4) and (5). The weights is the proportion of population in each income class. The Weighted Least Squares (WLS) has an advantage over Ordinary Least Squares (OLS) when data used are group averages, as is the case in this study. The use of grouped data in the regression analysis causes heteroscedasticity in the disturbance terms. The WLS procedure gives more importance to observations associated with income classes with larger proportions of population, whereas OLS treats the observations as of equal importance. Expenditure elasticities are calculated as $(\varepsilon_i = b_i)$,

where b_i is the coefficient of regression.

Data

The analysis is based on secondary data of the Egyptian Household Income, Expenditure, and Consumption Surveys (EHIECS), for the years 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. These surveys were conducted by the official statistical agency of Egypt, the Central Agency for Public Mobilisation and Statistics (CAPMAS). Due to lack of access to the original data on individual household surveys we rely on the average annual data on household incomes and expenditure by income group, as taken from the official publications for the 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010 surveys. Some differences between the surveys under study can be seen. For instance, the household in the sample fall into 14 expenditure categories for 1990/1991 and 1994/1995 years, and 20 for 1999/2000, 2004/2005 and 2009/2010 years according to their average annual per capita expenditure, for urban and rural areas. Over the 5 years research period, the expenditure groups had provided 176 observations for each variable. In order to make the five survey periods comparable, expenditure data have been deflated by the consumer price index (CPI). The total annual per capita expenditure and per capita expenditure on major commodity groups were calculated in real values.

RESULTS AND DISCUSION

Descriptive analysis of consumption expenditure patterns

Here, the developments in consumption expenditure patterns in Egypt from 1990/1991 to 2009/2010 with special emphasis on the differences between urban and rural sectors is highlighted. All expenditures in this and subsequently are adjusted to 2010 market prices by the CPI. Total per capita expenditure (sum of food and non-food expenditure) is used as an approximation for per capita consumer income. The average consumption expenditure and its expenditure share is calculated for food and non-food and for each food commodity group in both rural and urban sectors over the five survey periods from 1990/1991 to 2009/2010.

Allocation of total expenditure between food and non-food

Table 1 shows per capita total expenditure and expenditure allocation between food and non-food in Egypt for the five years included in the study. At the aggregated level of analysis, differences between rural and urban expenditure patterns are noticeable. In 2009/2010, per capita expenditure in urban areas exceeded that in rural areas where average total expenditure in rural Egypt was only 59.83% of urban expenditure. This suggests a worsening of the rural-urban income differential since 1990/1991, where average rural expenditure was 85.32% of urban expenditure. In 1990, rural per capita food expenditure was the same in urban per capita food expenditure; in 2009/2010 it dropped to 75%. Thus in 2009/2010, a rural consumer spent about three quarters of what an urban consumer spent on food and about half on non-food.

In each of the five years, food's share of total expenditure in rural Egypt was much higher than the urban, as shown in Table 1. In 1990/1991, urban consumers split their expenditure evenly between food and non-food items, whereas in rural areas consumers spent almost 60% of their incomes on food. Food expenditure share declined in both rural and urban areas over the five years. It declined in rural areas from 59.35% in 1990/1991 to 50.35% in 2009/2010, a drop of 9% points. During the same period, food expenditure share in urban areas also decreased, from 49.96% in 1990/1991 to 39.97% in 2009/2010, a drop of 10% points. From 1990/1991 to 2009/2010, per capita total expenditure increased 32% in rural areas and 88% in urban areas. For non-food expenditure share, it increased over the same period from 40.65% in 1990/1991 to 49.65% in 2009/2010 in rural areas and from 50.04% in 1990/1991 to 60.03% in 2009/2010 in urban.

Table 2 shows urban and rural expenditures in various years relative to the 1990 levels. Both food and non-food expenditures increased, but non-food expenditure increased much faster. Per capita urban expenditure increased by 88% from 1990/1991 to 2009/2010 compared to only 32% in rural areas. Over the same period, both per capita non-food and food expenditures increased faster in urban than rural areas. Per capita non-food and food expenditures in urban areas increased by 126 and 50%, compared to only 61 and 12% respectively in rural areas. It is observed that per capita total expenditure and food and non-food expenditures, for rural and urban consumers decreased in 2009/2010 compared to the previous year (2004/2005). This resulted from decreasing the real individual income.

Allocation of expenditure for different food groups

According to the available data, there are ten food sub-groups including cereals, meat, fish, milk-eggs, fruits, oils-fats, vegetables, sugar, other food products, and beverages. Each food group includes commodities that have similar nutritional value and whose prices are very likely to move in tandem. The average per capita expenditure and its expenditure share is calculated for each food commodity group at the rural and urban levels and over the time from 1990/1991 to 2009/2010. All expenditures here and subsequently in this study are adjusted to 2010 market prices by the CPI.

Tables 3 and 4 show average annual per capita expenditure (LE) on different food groups and their expenditure shares in both rural and urban Egypt at 2010

Table 1. Average Annual per capita consumption expenditure (LE*) for food and non-food in urban and rural areas at 2010 market prices, 1990/1991 to 2009/2010.

Category			1990/1991	1994/1995	1999/2000	2004/2005	2009/2010
Rural	Food	Value	1226.74	1507.58	1601.73	1639.66	1372.19
		%	59.35	56.37	50.86	50.28	50.35
	Non-food	Value	840.09	1166.95	1547.51	1621.18	1353.36
		%	40.65	43.63	49.14	49.72	49.65
	Average	Value	2066.82	2674.47	3149.24	3260.84	2725.54
		%	100.00	100.00	100.00	100.00	100.00
Urban	Food	Value	1210.05	2104.88	2279.87	2222.94	1820.65
		%	49.96	46.79	38.84	40.83	39.97
	Non-food	Value	1212.13	2393.83	3589.96	3220.96	2734.73
		%	50.04	53.21	61.16	59.17	60.03
	Average	Value	2422.17	4498.71	5869.82	5443.89	4555.38
		%	100.00	100.00	100.00	100.00	100.00

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010.
LE*: Egyptian Pound.

Table 2. Change in average per capita expenditure for food and non-food in urban and rural areas since 1990/1991 to 2009/2010 (1990 = 1.00).

Category		1990/1991	1994/1995	1999/2000	2004/2005	2009/2010
Rural	Food	1.00	1.23	1.31	1.34	1.12
	Non-food	1.00	1.39	1.84	1.93	1.61
	Average	1.00	1.29	1.52	1.58	1.32
Urban	Food	1.00	1.74	1.88	1.84	1.50
	Non-food	1.00	1.97	2.96	2.66	2.26
	Average	1.00	1.86	2.42	2.25	1.88

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010.

market prices and over the time from 1990/1991 to 2009/2010.

In rural areas, the total average per capita expenditure on food group in 1990/1991 was 1226.47 LE/year (2009 prices), from which 29.83% were allocated to cereals group. However, in urban areas, it was 1210.07 LE/year (2009 prices), from which 24.28% were allocated to meat group. The average per capita expenditure on meat occupied the largest share within the structure of food expenditure, in urban areas. It is higher for urban than rural areas. The expenditure share on meat was 24.28% in 1990/1991 for urban versus 22.78% for rural areas. Over the years of the study, the meat share increased until 2004/2005. It increased to 28.48 and 27.49% of total expenditure for urban and rural areas, respectively. This means that the Egyptian consumers tended to believe in the nutritional superiority of animal products and they were ready to spend more on these products.

The second largest expenditure share went to the cereals group. The expenditures on cereal products were much higher for rural resulting from the high quantity consumed from these products. In 1990/1991 it was 29.83 and 19.33% for rural and urban areas, respectively. However, in 2009/2010, the cereals share decreased to 18.49% for rural areas versus 13.25% for urban.

Something similar took place in the case of vegetables group, its relative importance in 1990/1991 was 11.89% in both rural and urban. It increased to 14.76% of total average per capita expenditure in rural areas and to 12.84% in urban areas. With respect to Milk-Eggs and Oils–Fats, and fruits, their relative importance in rural areas increased from 8.68, 8.30 and 4.44% in 1990/1991 to 11.45, 9.12 and 6.08% in 2009/2010, respectively. However, in urban areas, their relative importance increased from 11.97, 7.51 and 6.07% in 1990/1991 to 14.80, 8.31 and 7.07% in 2009/2010, respectively. The

Table 3. Average annual per capita expenditure (LE) on different food groups in rural Egypt at 2010 market prices, 1990/1991 to 2009/2010.

Food groups	1990/1991		1994/1995		1999/2000		2004/2005		2009/2010	
	Value	%	Value	%	Value	%	Value	%	Value	%
Cereals	365.88	29.83	349.74	23.20	312.04	19.48	308.24	18.80	253.74	18.49
Meat	279.41	22.78	374.47	24.84	425.70	26.58	450.76	27.49	345.51	25.18
Fish	42.35	3.45	61.32	4.07	77.94	4.87	91.43	5.58	79.00	5.76
Milk – Eggs	106.47	8.68	130.79	8.68	147.26	9.19	170.59	10.40	157.05	11.45
Fruits	54.41	4.44	75.00	4.97	92.74	5.79	101.51	6.19	83.44	6.08
Oils – Fats	101.76	8.30	133.95	8.88	135.22	8.44	143.70	8.76	125.07	9.12
Vegetables	145.88	11.89	209.74	13.91	210.00	13.11	222.52	13.57	202.55	14.76
Sugar	53.82	4.39	71.32	4.73	78.27	4.89	81.68	4.98	62.91	4.59
Other food products	39.12	3.19	56.84	3.77	68.92	4.30	25.04	1.53	23.56	1.72
Beverages	37.06	3.02	43.95	2.91	53.63	3.35	44.20	2.70	39.26	2.86
T. food expenditure	1226.47	100.00	1507.63	100.00	1601.73	100.00	1639.66	100.00	1372.19	100.00

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010.

Table 4. Average annual per capita expenditure (LE) on different food groups in urban Egypt at 2010 market prices, 1990/1991to 2009/2010.

Food groups	1990/1991		1994/1995		1999/2000		2004/2005		2009/2010	
	Value	%	Value	%	Value	%	Value	%	Value	%
Cereals	233.87	19.33	335.99	16.0	311.35	13.66	305.61	13.75	241.20	13.25
Meat	293.82	24.28	521.08	24.7	626.40	27.48	633.00	28.48	484.97	26.64
Fish	66.59	5.50	135.48	6.4	152.58	6.69	154.46	6.95	131.02	7.20
Milk – Eggs	144.85	11.97	270.69	12.9	300.09	13.16	320.63	14.42	269.46	14.80
Fruits	73.46	6.07	156.30	7.4	183.84	8.06	170.30	7.66	128.64	7.07
Oils – Fats	90.85	7.51	164.01	7.8	154.37	6.77	167.49	7.53	151.38	8.31
Vegetables	143.94	11.89	258.61	12.3	251.83	11.05	245.87	11.06	233.87	12.84
Sugar	58.81	4.86	95.12	4.5	106.38	4.67	106.93	4.81	80.69	4.43
Other food products	59.27	4.90	98.97	4.7	109.14	4.79	39.44	1.77	35.78	1.96
Beverages	43.71	3.61	68.64	3.3	83.86	3.68	79.21	3.56	63.75	3.50
T. food expenditure	1210.07	100.00	2104.88	100.00	2279.87	100.00	2222.94	100.00	1820.65	100.00

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010.

smallest expenditure share went to the beverages in1990/1991 and to other food products in 2009/2010. It was higher for urban than rural areas. It is interesting to note that the expenditure shares of different food groups in both rural and urban Egypt decreased in 2009/2010 compared to 2004/2005. This resulted from the rising food prices in 2008, known as food crisis, faced by Egyptian households. The Egyptian government responded to this crisis by raising the food subsidy budget (Ramadan and Thomas, 2010).

Expenditure elasticities of demand for different food groups

Table 5 presents the expenditure elasticity for food group and its sub-groups. For each commodity, income elasticity is computed separately for each year. The trends of the elasticity over time are assessed. As can be expected, total expenditure (income) variable is an important determinant of food expenditure. Most of the coefficients appear to be significant at the one significance level, and expenditure elasticities have the expected positive signs. The R squares of the models indicate reasonably good fit for all equations. All models have highly significant coefficients for the intercept variable (a_j) and the slope (b_j).

Table 5 shows the expenditure elasticities for food group and its sub-groups over the five years that were estimated by model 1. Estimated expenditure elasticity for food group is positive and less than one for all the years, implying that it is normal good for Egyptian households, that is, as income increases their expenditure will increase at a lower rate. It is 0.81

Table 5. Estimated expenditure elasticities of demand for different food groups (1990/1991 - 2009/2010).

Food groups	1990/1991				1995/1996				1999/2000				2004/2005				2009/2010			
	α_j	β_j	R^2	F	α_j	β_j	R^2	F	α_j	β_j	R^2	F	α_j	β_j	R^2	F	α_j	β_j	R^2	F
Cereals	0.74 (1.54)	0.64 (7.73)**	0.69	59.74**	1.31 (4.01) **	0.57 (14.01)**	0.88	196.37**	2.36 (13.89) **	0.42 (21.63)**	0.93	467.77**	1.91 (9.29)**	0.46 (18.97)**	0.91	360.03**	2.14 (7.35)**	0.41 (11.46)**	0.78	131.33**
Meat	-1.65 (-9.28)**	0.94 (41.07)**	0.98	1687.03**	-1.81 (-7.56)**	0.96 (33.12)**	0.97	1096.73**	-0.08 (-0.52)	0.75 (38.94)**	0.97	1516.50**	0.48 (2.75)**	0.70 (33.24)**	0.97	1104.63**	0.44 (2.04)*	0.69 (26.29)**	0.90	690.97**
Fish	-4.65 (-15.21)**	1.11 (28.82)**	0.97	830.38**	-5.82 (-8.11)**	1.24 (14.43)**	0.89	208.29**	-2.96 (-7.27) **	0.90 (18.96)**	0.91	359.43**	-2.08 (-6.81)**	0.82 (22.87)**	0.93	523.25**	-2.70 (-9.03)**	0.89 (24.36)**	0.88	593.27**
Milk-Eggs	-3.02 (-20.62)**	1.04 (55.04)**	0.99	3029.88**	-4.11 (-7.23)**	1.13 (16.49)**	0.91	271.97**	-2.31 (-6.52)**	0.91 (21.84)**	0.93	477.12**	-1.84 (-4.19)**	0.87 (16.49)**	0.87	272.02**	-1.15 (-4.03)**	0.80 (22.67)**	0.87	513.89**
Oils-Fats	-1.44 (-4.43)**	0.78 (18.46)**	0.93	340.74**	-1.74 (-4.29)**	0.82 (16.78)**	0.92	281.57**	0.25 (0.92)	0.56 (17.94)**	0.90	321.78**	2.03 (7.66)**	0.37 (11.41)**	0.77	130.11**	1.83 (10.23)**	0.39 (17.65)**	0.80	311.38**
Fruits	-4.82 (-21.44)**	1.16 (40.36)**	0.98	1628.98**	-6.69 (-12.18)**	1.37 (20.66)**	0.94	426.74**	-4.00 (-13.04)**	1.06 (29.18)**	0.95	851.23**	-2.03 (-10.64)**	0.84 (37.08)**	0.97	1374.55**	-2.21 (-10.80)**	0.84 (33.69)**	0.94	1134.81**
Vegetables	-0.32 (-1.30)**	0.75 (21.43)**	0.94	459.10**	-1.49 (-3.92)**	0.81 (17.80)**	0.92	316.97**	0.65 (2.56)**	0.55 (18.33)**	0.90	335.98**	3.14 (17.00)**	0.28 (12.47)**	0.80	155.62**	3.32 (24.27)**	0.26 (15.30)**	0.75	233.94**
Sugar	-2.23 (-14.88)**	0.82 (42.11)**	0.98	1773.43**	-2.52 (-8.68)**	0.85 (24.09)**	0.96	580.21**	-1.66 (-9.84)**	0.75 (37.28)**	0.97	1389.94**	-0.40 (-1.95)*	0.60 (24.05)**	0.94	578.51**	-0.40 (-1.85)	0.58 (21.89)**	0.86	479.21**
Others	-1.08 (-3.12)**	0.62 (14.74)**	0.89	217.38**	-0.47 (-1.03)	0.58 (10.47)**	0.81	109.63**	-1.23 (-6.54)**	0.68 (30.74)**	0.96	944.95**	-1.88 (-6.61)**	0.64 (18.70)**	0.90	349.52**	-1.25 (-5.30)**	0.57 (19.72)**	0.83	388.75**
Beverages	-2.27 (-17.40)**	0.75 (44.03)**	0.98	1930.32**	-1.99 (-5.10)**	0.73 (15.49)**	0.90	239.95**	-0 .81 (-5.47)**	0.56 (32.30)**	0.97	1042.96**	-1.57 (-3.66)**	0.68 (13.04)**	0.82	170.04**	-1.52 (-4.30)**	0.66 (15.19)**	0.86	231.02**
Total Food	0.86 (3.78)**	0.81 (27.58)**	0.96	760.87**	0.77 (1.98) *	0.78 (12.75)**	0.87	162.44**	1.95 (8.46)**	0.67 (24.29)**	0.94	590.19**	2.46 (12.54)**	0.61 (25.31)**	0.94	640.75**	2.69 (17.08)**	0.57 (29.28)**	0.95	857.51**

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. ** Indicates significant at one percent level of significance; * Indicates significant at five percent level of significance. The numbers in parentheses are t-Values.

in 1990/1991 and declines over time, with estimates of 0.78, 0.67, 0.61, and 0.57 respectively. There are variations in elasticities for commodity groups that tend to indicate a difference in households' attitudes toward these groups as their income rises. The corresponding expenditure elasticities are reported for the five survey periods of 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010 in Egypt. In 1990/1991, the expenditure elasticities for food groups are positive and less than one except for fish, milk-eggs, and fruits, indicating that most of food groups are normal and necessary goods for Egyptian households. The commodities of fish, milk-eggs, and fruits are luxuries with elasticities that exceed one, while they moved up to the necessity commodities in 2009/2010 with estimates of 0.89, 0.80, and 0.94. respectively. Where an increase in total expenditure by one percent would tend to cause a 0.78% increase in fish expenditure in Egypt, it will be probably caused by a shift to higher quality fish (expensive species of fish). Increased total expenditure had a clear impact on the expenditure of milk-eggs; a one percent increase in total expenditure would tend to cause an increase in expenditure on milk and its products by 0.80. Also, fruits group has a relatively high expenditure elasticity of 0.94. For meat the expenditure elasticity was about one, identify it as near to luxury commodity. It declined to 0.69 in 2009/2010, which identifies it as necessity.

The elasticity of cereals group is relatively similar at low numbers, which means that the consumption of these commodities is relatively little affected by income changes. The cereals group has an expenditure elasticity of 0.64, which means that as total expenditure rises by one percent the expenditure on cereals would tend to

Table 6. The changes in expenditure elasticities for different food groups from 1990/1991 to 2009/2010 (Time effect).

Food groups	a_{i0}	b_{i0}	1994/1995		1999/2000		2004/2005		2009/2010		R^2	F
			a_{i1}	b_{i1}	a_{i2}	b_{i2}	a_{i3}	b_{i3}	a_{i4}	b_{i4}		
Cereals	0.39(1.24)	069(17.42)**	0.92(1.87)	-0.13(-2.14)**	2.04(5.04)**	-0.28(-5.77)**	1.52 (3.12)**	-0.23(-4.03)**	1.74 (3.50)**	-0.28 (-4.62)**	0.86	113.07**
Meat	-1.57(-10.15)**	0.94(47.52)**	-0.24(-0.84)	0.02(0.62)	1.62(6.79)**	-0.19(-6.71)**	2.05 (6.25)**	-0.24 (-5.95)**	2.39 (7.69)**	-0.29 (-7.73)**	0.97	676.09**
Fish	-4.67 (-14.29)**	1.11 (26.83)**	-1.14 (-1.86)	0.13 (1.73)	1.71 (3.40)**	-0.21 (-3.39)**	1.65 (2.38)*	-0.29 (-2.20)*	2.25 (3.43)**	-0.22 (-3.18)**	0.92	230.49**
Milk-Eggs	-3.25 (-12.09)**	1.04 (30.48)**	-0.85 (-1.68)	0.09 (1.38)	0.95 (-2.29)*	-0.13 (-2.66)**	1.42 (2.49)**	-0.17 (-2.51)**	2.67 (4.94)**	-0.22 (-4.76)**	0.94	286.75**
Oils-Fats	-1.41 (-6.31)**	0.77 (27.18)**	-0.32 (-0.77)	0.04 (0.85)	1.66 (4.81)**	-0.21 (-4.98)**	3.44 (7.25)**	-0.41 (-7.05)**	3.24 (7.19)**	-0.39 (-7.00)**	0.91	197.09**
Fruits	-4.82 (-21.21)**	1.16 (39.94)**	-1.87 (-4.37)**	0.21 (4.07)**	0.82 (-2.35)*	-0.10 (-2.39)*	2.13 (4.43)**	-0.32 (-4.25)**	3.23 (7.08)**	-0.32 (-6.93)**	0.96	531.22**
Vegetables	-0.83 (-4.24)**	0.75 (30.37)**	-0.66 (-1.81)	0.06 (1.42)	1.48 (4.94)**	-0.20 (-5.48)**	3.97 (9.64)**	-0.47 (-9.37)**	4.36 (11.15)**	-0.49 (-10.75) **	0.93	236.56**
Sugar	-2.25 (-16.28)**	0.82 (46.33)**	-0.26 (-1.01)	0.03 (0.80)	0.60 (2.80)**	-0.08 (-2.98)**	1.86 (6.34)**	-0.22 (-6.17)**	2.32 (8.34)**	-0.24 (-8.65)**	0.97	672.58**
Others	-0.86 (-3.42)**	0.62 (19.31)**	0.39 (0.82)	-0.04 (-0.65)	-0.37 (-0.95)	0.06 (1.31)	-1.02 (-1.98)*	0.02 (0.35)	0.14 (0.27)	-0.05 (-1.84)	0.94	300.59**
Beverages	-2.38 (-12.26)**	0.77 (30.95)**	0.30 (0.81)	-0.02 (-0.54)	1.67 (5.57)**	-0.20 (-5.65)**	0.81 (1.96)*	-0.09 (-1.76)	1.66 (4.26)**	-0.20 (-4.13)	0.94	284.31**
Total Food	0.58 (4.43)**	0.85 (50.48)**	-0.33 (-1.34)	0.02 (0.79)	1.19 (5.89)**	-0.15 (-6.21)**	1.75 (6.29)**	-0.22 (-6.38)**	2.24 (8.48)**	-0.24 (-8.75)**	0.97	738.48**

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. ** Indicates significant at one percent level of significance; * Indicates significant at five percent level of significance. The numbers in parentheses are t-Values.

rise by only 0.64%. It declined over time with an estimate of 0.41 in 2009/2010. This result is consistent with the fact that the consumption of cereals commodities is important for the poor and is likely to decrease with higher income. The estimated expenditure elasticity for vegetables group was 0.75 in 1990/1991 and declined to only 0.26 in 2009/2020, the lowest, compared to other food sub-groups in the same year. Similar trend is observed for the oils-fats group with an estimate of 0.78 in 1990/1991 and declines to only 0.39 in 2009/2020. This means that a one percent increase in total expenditure would tend to cause an increase in the expenditure on the oils-fats group by 0.39% in 2009/2020. With higher income perhaps the quantity of oils-fats consumed will not increase but the quality of oils-fats consumed will improve, where in Egypt, the consumption of hydrogenated oils and sunflower oil increased more with higher income than the consumption of cottonseed oil. The estimated expenditure elasticities for food group and its selected sub-groups for 1990/1991 are relatively higher than those obtained from other years. This can be explained by the economic situation in Egypt. Many households, especially the poor, face tight budgetary constraints and all of the selected food commodity groups are considered as very important groups because they fulfill fundamental needs of people.

Changes in the expenditure elasticities for different food groups over time

To examine the significance of change of commodity group elasticities over time, data groups that belong to common commodity groups from 1990/1991 to 2009/2010 were put together in one group. Regression equations were estimated by model 2 from associated group. The symbols of the dependent variables represent the related commodity groups. The estimated coefficients are indicated by how much the consumption expenditure elasticity of the 1990/1991 differs from the consumption expenditure elasticity of the otherwise. The findings can be summarised as shown in Table 6.

All food commodity groups show significant decrease in the total expenditure elasticity up to 2000 except for beverages and other food groups. While fruits, fish, and milk-eggs were luxury commodities in 1990/1991, they moved up to the necessity commodities up to 2000 except for fruits up to 2005. The expenditure elasticity of meat was near to the luxury commodities in 1990/1991, it moved up near to the necessity commodity up to

Table 7. The equations of food groups for urban and rural households.

Food groups	a_{i0}	b_{i0}	a_{i1}	b_{i1}	R^2	F
Cereals	1.67 (6.54)**	0.52 (16.64)**	0.09 (0.26)	-0.05 (-1.10)	0.78	200.52**
Meat	-1.13 (-5.74)**	0.89 (36.09)**	0.44 (1.82)	-0.06 (-2.14)*	0.95	1162.90**
Fish	-4.63 (-14.39)**	1.11 (27.52)**	1.56 (3.98)**	-0.17 (-3.47)**	0.92	691.54**
Milk-eggs	-2.41 (-8.33)**	0.93 (25.67)**	0.37 (1.03)	-0.02 (-0.52)	0.93	717.17**
Oils-fats	-1.12 (-4.48)**	0.76 (24.18)**	0.95 (3.04)**	-0.14 (-3.61)**	0.89	447.86**
Fruits	-4.53 (-15.77)**	1.12 (31.15)**	0.59 (1.70)	-0.07 (-1.52)	0.94	923.45**
Vegetables	-0.60 (-1.96)**	0.73 (19.29)**	1.59 (4.20)**	-0.21 (-4.52)**	0.81	247.84**
Sugar	-2.43 (-14.69)**	0.84 (40.77)**	0.96 (4.63)**	-0.13 (-5.05)**	0.96	1355.04**
Others	-2.07 (-4.06)**	0.72 (11.65)**	1.73 (2.52)**	-0.19 (-2.31)*	0.58	79.29**
Beverages	-2.28 (-8.64)**	0.76 (22.44)**	0.40 (1.06)	-0.05 (-1.02)	0.91	596.89**
Total food	0.86 (5.30)**	0.81 (39.69)**	0.61 (3.06)**	-0.08 (-3.41)**	0.96	1344.64**

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. ** Indicates significant at one percent level of significance; * Indicates significant at five percent level of significance. The numbers in parentheses are t-Values.

2000. The elasticities of expenditures for meat, fish, milk-eggs, and fruits are relatively high, and those of cereals, vegetables, oils-fats, and sugar are low. This suggests that the food expenditure structure in Egypt has diversified, adding meat, fish, milk-eggs, and fruits to the most dominant food groups, such as cereals, vegetables and sugar.

Differences in food expenditure elasticities of urban and rural households

Food expenditure patterns in Egypt vary substantially between urban and rural consumers, and these patterns have been changing over time. In order to determine the factors that cause changes of commodity group elasticities over the period from 1990/1991 to 2009/2010, consumption expenditure patterns of urban and rural households are analysed. Dummy variable is used to see the differences in food expenditure elasticities of urban and rural households. The regression equations were estimated with urban and rural data group. The regression Model 3 was estimated (Table 7). It is found that there is a difference between the urban and rural total expenditure elasticity for most food commodities. It is obvious the rural elasticity is higher than the corresponding urban elasticity.

Expenditure elasticities of food groups by expenditure quartile

To find out the differences between the consumption patterns of households at different income levels, model (4) was estimated using data of the period from 1990/1991 to 2009/2010. The results of regression equations can be seen at Table 8. As expenditure level becomes higher, expenditure elasticity declines for the highest quartile. This is consistent with the economic theory: at lower incomes, changes in income have a greater effect on expenditures, since spending is more constrained.

At higher incomes, changes in income have less impact on spending decisions on a commodity. The results obtained from the model (4) and Table 8 can be summarised as follows:

i) At most food commodity groups, the differences between the total expenditure elasticities for the lower and higher income groups are statistically significant,
ii) With few exceptions (other food products), the expenditure elasticities of food groups are lower at high-income groups than low-income ones,
iii) Fruits, fish, and milk-eggs, and meat were luxury commodities for low-income groups whereas they are necessity commodities for high-income groups,
iv) The elasticities of expenditures for cereals, vegetables, oils-fats, and sugar were necessity commodities for both low and high-income groups.

Simultaneous effect of total expenditure, time, location, and income levels

The determinants of food expenditure patterns are income (or expenditure) level of the household, the time, the local food habits and the income level. These determinants are analysed simultaneously by using dummy variables for each food group. The results obtained from the model (5) can be summarised as shown in Table 9. There is a marked difference between rural and urban areas in the expenditure on food group

Table 8. Equations of food groups at different expenditure quartile.

Food groups	a_{i0}	b_{i0}	a_{i1}	b_{i1}	R^2	F
Cereals	2.21(5.30)**	0.43(7.81)**	0.35(0.56)	-0.03(-0.38)	0.67	113.69**
Meat	-1.88(-7.66)**	0.99(30.06)**	-0.001(-4.74)**	-0.01(-2.55)**	0.96	1215.67**
Fish	-5.96(-19.53)**	1.29(32.92)**	4.56(10.59)**	-0.55(-10.42)**	0.94	892.58**
Milk-Eggs	-3.71(-12.51)**	1.10(28.93)**	3.12(7.45)**	-0.37(-7.25)**	0.93	718.39**
Oils-Fats	-1.46(-5.03)**	0.79(21.29)**	2.21(5.41)**	-0.27(-5.45)**	0.87	374.14**
Fruits	-5.87(-22.16)**	1.29(38.09)**	3.19(8.55)**	-0.39(-8.54)**	0.96	1290.88**
Vegetables	-1.07(-3.47)**	0.79(19.94)**	3.30(7.59)**	-0.40(-7.58)**	0.83	280.55**
Sugar	-2.22(-11.39)**	0.81(32.62)**	0.48(1.76)	-0.07(-2.03)*	0.95	1109.22**
Others	0.32(0.43)	0.43(4.42)**	-3.22(-3.29)**	0.38(3.16)**	0.58	81.26**
Beverages	-1.81(-7.53)**	0.71(22.68)**	0.92(2.60)**	-0.07(-2.49)**	0.91	558.51**
Total Food	0.57(3.27)**	0.84(37.54)**	1.35(5.47)**	-0.17(-5.57)**	0.95	1362.54**

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. ** Indicates significant at one percent level of significance; * Indicates significant at five percent level of significance. The numbers in parentheses are t-Values.

Table 9. Simultaneous effect of total expenditure, time, location, and income levels.

Food groups	a_{i0}	b_{i0}	a_{i1}	b_{i1}	a_{i2}	b_{i2}	a_{i3}	b_{i3}	a_{i4}	b_{i4}	a_{i5}	b_{i5}	a_{i6}	b_{i6}	R^2	F
Cereals	0.39 (1.37)	0.70 (19.16)**	0.24 (1.05)	-0.06 (-2.25)*	0.83 (2.38)*	-0.12 (-2.75)**	1.89 (6.01)**	-0.26 (-6.90)**	1.07 (2.90)**	-0.18 (-4.12)**	1.41 (3.63)**	-0.24 (-5.10)**	0.14 (0.40)	-0.02 (-0.38)	0.93	167.87**
Meat	-2.17 (-12.39)**	1.02 (43.18)**	-0.04 (-0.27)	-0.01 (-0.06)	-0.56 (-2.28)*	0.06 (2.02)*	0.87 (3.78)**	-0.11 (-3.67)**	1.19 (3.88)**	-0.14 (-3.63)**	1.45 (5.48)**	-0.19 (-5.65)**	-0.001 (3.95)**	-0.01 (-0.50)	0.98	916.74**
Fish	-5.98 (-23.29)**	1.17 (37.99)**	0.83 (3.46)**	-0.07 (-2.47)**	-1.90 (-5.23)**	0.23 (5.07)**	0.41 (1.27)	-0.05 (-1.21)	0.63 (1.40)	-0.06 (-1.17)	1.42 (3.49)**	-0.19 (-3.25)**	3.86 (11.12)**	-0.47 (-10.91)**	0.97	529.95**
Milk-eggs	-3.78 (-15.81)**	1.10 (35.34)**	-0.18 (-0.86)**	0.04 (1.87)	-1.34 (-4.02)**	0.15 (3.60)**	0.24 (0.81)	-0.05 (-1.32)	1.11 (2.69)**	-0.14 (-2.67)**	2.40 (6.37)**	-0.30 (-6.28)**	2.68 (8.27)**	-0.33 (-8.16)**	0.97	513.62**
Oils-fats	-2.04 (-7.52)**	0.87 (24.59)**	0.55 (2.29)*	-0.08 (-2.85)**	-0.69 (-1.81)	0.08 (1.98)*	1.03 (3.07)**	-0.14 (-3.38)**	2.21 (4.75)**	-0.27 (-4.67)**	2.31 (5.45)**	-0.28 (-5.33)**	0.70 (2.09)*	-0.09 (-1.99)*	0.93	188.81**
Fruits	-5.55 (-23.21)**	1.25 (40.07)**	-0.15 (-0.66)	0.02 (1.13)	-2.56 (-7.56)**	0.30 (7.18)**	-0.19 (-0.63)	0.02 (0.50)	1.13 (2.70)**	-0.13 (-2.64)**	2.41 (6.37)**	-0.30 (-6.39)**	2.90 (8.97)**	-0.36 (-8.93)**	0.98	654.27**
Vegetables	-2.14 (-10.01)**	0.92 (33.40)**	1.17 (6.17)**	-0.15 (-6.56)**	-1.18 (-3.92)**	0.12 (3. 38)**	0.59 (2.22)**	-0.10 (-3.02)**	2.47 (6.72)**	-0.29 (-6.62) **	3.29 (9.80)**	-0.39 (-9.48)**	1.36 (4.73)**	-0.17 (-4.91)**	0.95	264.86**
Sugar	-2.72 (-16.19)**	0.88 (40.21)**	0.78 (4.95)**	-0.11 (-5.34)**	-0.33 (-1.37)	0.03 (1.12)	0.46 (2.16)*	-0.07 (-2.51)**	1.41 (4.83)**	-0.18 (-4.71)**	2.04 (7.66)**	-0.26 (-7.99)**	-0.31 (-1.37)	0.03 (1.21)	0.97	618.65**
Others	-2.01 (-7.63)**	0.75 (21.99)**	1.74 (7.48)**	-0.19 (-6.76)**	0.57 (1.54)	-0.05 (-1.29)	-0.15 (-0.47)	0.04 (0.91)	-0.60 (-1.33)	0.02 (0.11)	0.69 (1.68)	-0.18 (-3.52)**	-0.41 (-1.14)	0.04 (0.96)	0.97	389.36**
Beverages	-2.49 (-9.24)**	0.78 (22.29)**	0.20 (0.79)	-0.03 (-0.81)	0.23 (-0.34)	-0.02 (-0.34)	1.51 (4.46)**	-0.19 (-4.54)**	0.71 (1.56)	-0.07 (-1.38)	1.65 (3.74)**	-0.20 (-3.67)**	0.34 (0.97)	-0.04 (-0.89)	0.94	194.90**
Total food	0.02 (1.34)	0.92 (41.73)**	0.35 (2.32)*	-0.04 (-2.68)**	-0.47 (-1.98)*	0.03 (1.34)	0.72 (3.41)**	-0.10 (-3.86)**	0.92 (3.15)**	-0.12 (-3.37)**	1.52 (5.68)**	-0.21 (-6.10)**	1.05 (4.58)**	-0.13 (-4.61)**	0.98	593.66**

Source: Computed based on data from HIECS, CAPMAS, 1990/1991, 1994/1995, 1999/2000, 2004/2005, and 2009/2010. ** Indicates significant at one percent level of significance; * Indicates significant at five percent level of significance. The numbers in parentheses are t-Values.

and most of its sub-groups. The rural elasticity is higher than the corresponding urban elasticity. Most of the food commodity groups show significant decrease in the total expenditure elasticity after 2000 except for beverages and other food groups. While fruits, fish, and milk-eggs were luxury commodities in 1990/1991, they moved up to the necessity commodities up to 2010 except for milk after 2005. The expenditure elasticity of meat was near to the luxury commodities in 1990/1991, but moved up near to the necessity commodity up to 2000. It is found

that the total expenditure elasticities of most food commodity groups are lower at high-income groups except for sugar and other food products.

Conclusion

Regarding the structure of food expenditure, we can conclude that the food expenditure patterns have changed over the five survey periods as a result of economic changes. This study aims to find out the changes in food expenditure elasticities of households from 1990/1991 to 2009/2010 surveys. Both food and non-food expenditures increased but non-food expenditure increased much faster. In each of the five years, food's share of total expenditure in rural Egypt was much higher than the urban, and it declined in both rural and urban areas over the time. Estimated expenditure elasticities for food group and its sub-groups are positive and less than one except for fish, milk-eggs, and fruits, indicating that they are normal and necessary goods for Egyptian households.

The estimated expenditure elasticities for food groups have decreased significantly over the time. The commodities of fish, milk-eggs, and fruits are considered as luxury goods with elasticities exceeding one in 1990/1991, while they moved up to the necessity commodities in 2009/2010. Different explanations for the changes of elasticities are discussed. Expenditure elasticity is found to be quite different between urban and rural areas for food commodities except for cereals, milk-eggs, fruits, and beverages, and these elasticities have been changing over time. Elasticities tend to be higher in rural areas than urban ones. At most food commodity groups, the differences between the total expenditure elasticities for the lower and higher income groups are statistically significant. With few exceptions, the expenditure elasticities of food groups are lower at high-income groups than low-income ones. The differences in consumption patterns between rural and urban areas, and among income groups imply that change in consumtion patterns in Egypt will be affected not only by aggregate income growth but also by changes in the distribution of that income.

RECOMMENDATIONS

Several recommendations, based on the results can be made for the future food policies. The following are some of them:

i) Rising of the nutrition and living standard level is recognized by increasing per capita real income,
ii) Increasing food production especially fruits, milk and meat and quantities of food commodities available for human consumption,
iii) Increasing animal production and fisheries, aiming at increasing the per capita consumption of animal protein,
iv) Food subsidies should be better targeted at the poor people, and more public policies favouring the poor are needed.

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The role of small scale irrigation in poverty reduction

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Poverty is of multidimensional characteristics affecting nearly a billion world population. Especially, a third of sub Saharans fall under poverty. The emergence of climate change coupled with the incidence of drought, are worsening the situation. The only option to escape this challenge is through the development of water resource projects. In attempting to do so, Ethiopia has yet developed not more than 5% of the irrigation potential. Much of this is owned and poorly managed by small holder farmers. The purpose of this study is thus to investigate whether small scale irrigation schemes contribute to poverty reduction or not. Based on 313 sample households from the Rift Valley Lake Basins, it was observed that irrigation improved household income and contributed to poverty reduction. However, the enhanced poverty impact of irrigation was constrained due to unsatisfactory performance and imperfect market. Thus, enhancing the capacity of water user associations through provision of training, market linkage and finance are a necessary step to improve irrigation performance towards poverty reduction.

Key words: Ethiopia, lake basin, rift valley, binomial logit.

INTRODUCTION

Ethiopia is predominantly an agricultural country where agriculture accounts for about 45% of the country's Gross Domestic Product (GDP), 65% of the total exports and 85% of employment (MoFA, 2007). One of the features of the Ethiopian agriculture and the national economy at large is its inability to produce sufficient food to feed the population (Samuel, 2006). In history, Ethiopia is characterized by famine as a result of high population pressure, resource base depletion and drought that affects the rain-fed agriculture significantly (Berhanu, 2001; Bruce et al., 1994). It has been documented that low farm production and productivity resulting from use of backward technology and other productivity-enhancing modern inputs are the major reasons for rampant poverty and food insecurity in rural areas (FDRE, 2010; Samuel, 2006). Poverty reduction is the first millennium development goal. Poor countries like Ethiopia were expected to halve the number of people living below one dollar by the end of 2015 (MoFED, 2010). Since 1992, the Government of Ethiopia has been carrying out measures to reduce poverty in the context of a series of reform programmes in the political, economic and social spheres (FDRE, 2003, 2010). Thus, following government efforts, poverty has declined from 45.5% in 1995/1996 to 29.6% in 2010/2011 (MoFED, 2012). Consensus has been reached by the government and donors that any solution to further reduces rural poverty must focus on increasing the production and productivity of smallholder agriculture (FDRE, 2010). Creating access to fertilizer, improved seeds, agricultural credit and thereby bringing significant growth in crop production is the major concern of national strategy (Samuel, 2006).

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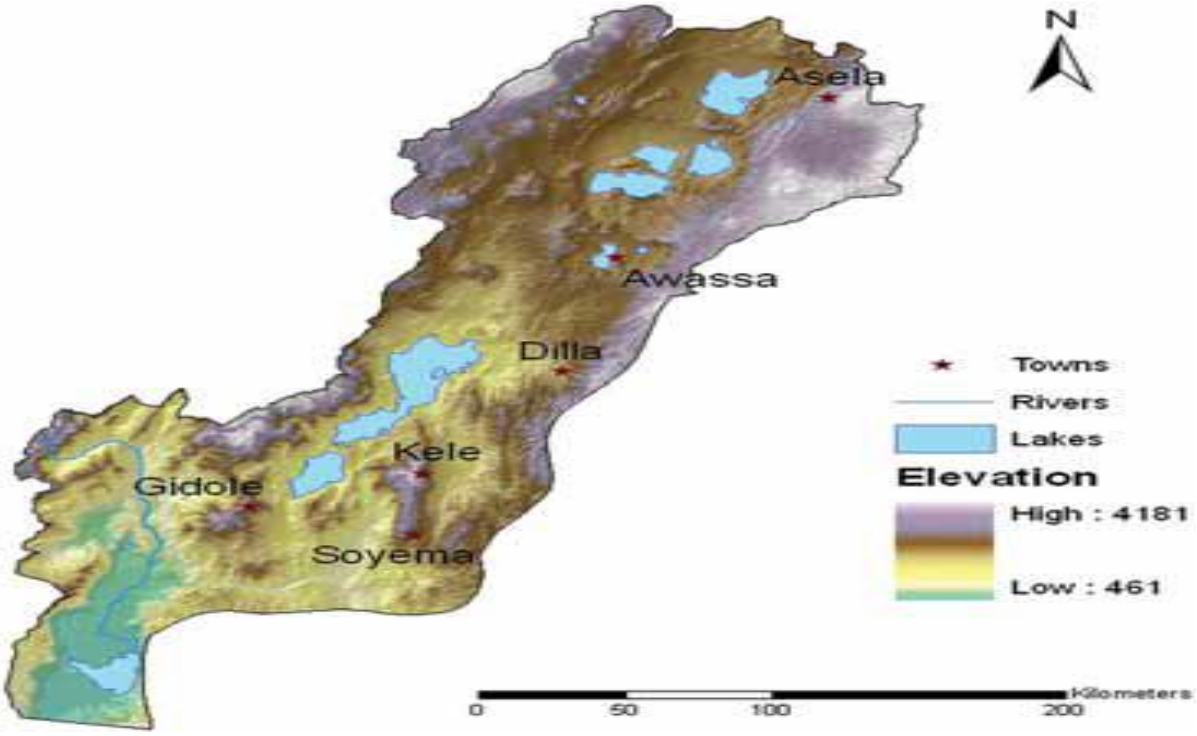

Figure 1. Ethiopian rift valley river basin (Bekele et al., 2007).

While technology is important, the issue of drought and rain fall variability is of paramount important. In order to address these challenges as a vital resource in agriculture, irrigation water contributes a lot in productive and livelihood activities of farmers.

Ethiopia is a water tower of Africa. A large number of rivers flowing on either side of the rift valley form a drainage network that covers most of the country. The government has focused to develop the sub-sector to fully tap its potentials (Mekuria, 2003; MoFED, 2006, 2010). Special attention is given to small scale irrigation development for their low capital requirement. In spite of this, the attention paid for this sector, the development of irrigation has not picked up. Even though some efforts have been underway to develop small scale irrigation (SSI) schemes; yet, Ethiopia has developed only 5% of the irrigable land (World Bank, 2006). Furthermore, it is noticed that the existing irrigation farms are operating at sub-optimal levels and many of the SSI projects have been operating below the required economic efficiency (Getaneh, 2011; Mekuria, 2003). Several studies have documented poverty-related benefits and costs of irrigation (Hussain, 2004). Most of them indicated irrigation can increase production and productivity. This, in turn, opens up new employment opportunities, both on-farm and off-farm, and can improve incomes, livelihoods and the quality of life in rural areas (Getaneh, 2011; Hussain, 2004; Oni et al., 2011). However, there are no available studies that assessed the poverty impact of SSI in the Ethiopian rift valley lake basins.

The purpose of this study is therefore to answer whether small scale irrigation schemes; while under performing, contributes to poverty reduction or not in the study sites. Since poverty reduction is the ultimate measure of development effectiveness; this study investigated the role SSI played in rural poverty reduction. The remainder of this study presents methodology, results, discussions and conclusions.

METHODOLOGY

The study site

The rift valley basin has an area of 52,739 km^2, covering parts of the Oromia, SNNPR regions. The total mean annual flow from the river basin is estimated at about 5.6 BMC. Large-scale irrigation potential is estimated at 45,700 ha with an estimated total irrigable area of 139,300 ha (Figure 1). The basin is endowed with a number of lakes of varying size with high environmental significance (Bekele et al., 2007).

Sampling and data

Multistage sampling procedure was followed to select respondents. In the first stage, four SSI schemes in the rift valley were selected purposively (Gedemso and Argeda from Oromiya; Ebala and Bedeneyalemtena from Southern Nations Nationalities and peoples

/SNNPR/ Regions). In the second stage, households from the head, middle and tail of the schemes were selected randomly, which comprises 145 users and 168 non users. Quantitative data on resource endowments and assets, average landholding size, livestock holding, incomes, expenditures and employment; demographic and social indicators like family size, dependency ratio and education level were collected from sample households through interview schedule. Qualitative data on the community perceptions about the benefit of irrigation and constraints were gathered from community representatives through focus group discussion.

Data analysis

Data was entered and analyzed using statistical package for social sciences (SPSS version 16). The descriptive analysis is based on means and standard deviations computed from the data. Independent sample t and chi square tests were used for assessing the difference between irrigation users and non-users in terms of socio-economic factors. The poverty line is measured based on cost of basic needs (CBNs) derived from the lowest income quartile and poverty indices were computed using Foster Greer and Thorbecke (FGT) formula. Foster et al. (1984) have suggested a useful general index for poverty measures. Their class of poverty indices takes the following form:

$$\rho = \frac{1}{N}\sum_{i=1}^{q}\left[\left(Z_p - Y_p\right)\right]^{\alpha}$$

Where Zp denotes the poverty line, Yi the expenditure or income of the i-th poor household (or individual), N the total number of households and q the number of households whose expenditures or incomes are below the poverty line. Thus, if α = 0, index Pα becomes: P_0 = q/N, which has been referred to as the head-count index; if α is 1, poverty gap index and if α is 2 poverty severity index.

A logistic regression model was used to analyze the impact of small scale irrigation schemes on household poverty status. Similar studies have used binomial logit model in irrigation impact analysis (Farah et al., 2001; Getaneh, 2011; Oni et al., 2011). Thus, poverty is the dependent variable, and is determined by independent variables such as irrigation use, household characteristics, asset holdings and access to services. The dependent variable is binary (1 if the household is poor and 0 if the household is non-poor). Following Gujarati (2003), the probability that the i^{th} household is poor is given by:

$$Pi = E(Y = 1/\ Xi) = \frac{1}{1 + e^{-(\beta_0 + \beta_i\ \chi_i\ )}} \quad (1)$$

For ease of exposition, the probability that a given household is poor is expressed as:

$$\rho_i = \frac{1}{1 + e^{-(Z_i)}} \quad (2)$$

Probability for not poor is $1\text{-}P_i$. Thus,

$$\frac{P_i}{1 - p_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} \quad (3)$$

is the ratio of the probability that a household was poor to the probability of that it was non-poor. The natural log of Equation 3 is:

$$L_i = \ln\left[\frac{P_i}{1 - P_i}\right] = Z_i\ = \beta_o + \beta_1\chi_1 + \beta_2\chi_2 + ... + \beta_n\chi_n. \quad (4)$$

Where Pi is a probability of being poor ranges from 0 to 1, Zi is a function of n explanatory variables (x) which is also expressed as:

$$Z_i = \beta_o + \beta_1\chi_1 + \beta_2\chi_2 + ... + \beta_n\chi_n \quad (5)$$

β_o is an intercept $\beta_1, \beta_2, ...\beta_n$ are the slopes of the equation, L_i is log of the odds ratio, which is not only linear in Xi but also linear in the parameters, X_i is vector of relevant independent variable.

If the disturbance term (Ui) is introduced, the logit model becomes:

$$Z_i = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + ...\beta_n\chi_n + \cup_i \quad (6)$$

RESULTS AND DISCUSSION

It presents respondent's demographic profile, community's perspectives, and the role of irrigation use on production, employment, income, asset endowment, consumption and poverty.

Demographic profile of respondents

In this study, 145 irrigators and 168 non irrigators were compared. Table 1 indicates that the proportion of women irrigators was 19.3%, which implies that women's access to irrigation is by far below that of men. The report of Kinfe et al. (2012) also revealed that women's access to irrigation is limited in Northern Ethiopia. The minimum and maximum age limits are 18 and 82 respectively with mean age of 40. There seems no disparity by age towards accessing irrigation and there is a tendency for young farmers to engage in irrigation farming. Education is one of the most pertinent factors that affect human behavior. About 37% of respondents are illiterate; of which 37.8 and 36.3% respectively are irrigation users and non-users. This means that 37% of the respondents cannot read and write and there is no wide variation in the education attained between irrigation and non-irrigation households. The rest 23.5, 29.3 and 10.2% completed 1 to 4, 5 to 8 and 9 to 12 grades respectively (Table 1). The average household size was 6.6 persons, with 1 and 13 being the minimum and the maximum respectively. There is also no significant variation with respect to household size and number of dependents between irrigation users and non-users.

Community perspectives on the role of irrigation

The investigated community has perceived that SSI is a

Table 1. Socio-demographic profile of respondents.

Gender	User	Non user	Total		
Female	19.3	12.5	15.7		
Male	80.7	87.5	84.3		
Age				**Minimum**	**Maximum**
Mean	40.4	39.6	39.98	18	85
Standard deviation	11.82	11.87	11.3		
Education level				**0**	**12**
Illiterate	37.8	36.3	37.0		
1-4 grade	22.4	24.4	23.5		
5-8 grade	27.3	31.0	29.3		
9-12 grade	12.6	8.3	10.2		
Household size				1	13
Mean	6.7	6.57	6.6		
Standard deviation	2.55	2.28	2.4		
Dependency ratio				**0**	**10**
Mean	1.08	1.04	1.06		
Standard deviation	1.14	0.87	1.00		

pillar to improve rural livelihoods. According to focus group participants, almost all of the irrigation users in their specific localities have improved their livelihoods as a result of irrigation. Many of irrigation users have constructed corrugated iron sheet house, been able to educate their children, become food self-sufficient either through own production or purchasing from market, started local investment like petty trading; grain mill factory, buying vehicle (*Isuzu*) for transport facility etc. According to most focus group discussants, the proportion of irrigation users with investing in local business like rural shops, petty trades; did not exceed 25% of irrigation beneficiaries. The rest majority were unsuccessful due to lack of capital, limited potential and low bargaining power. This indicate that majority of the users are not gaining the intended benefit for one or another reasons. Furthermore, lack of efficient market and frequent fall of commodity price are mentioned as the major sources of failure. In addition, during the focus group discussions, we have investigated that there are several challenges in water use administration. There are no strong and functional water user associations (WUAs) in all of the investigated schemes. The WUAs have a weak coordination skill to solve scheme related problems like water theft and conflict between users.

The role of irrigation in production, employment and poverty

Irrigation may lead to poverty reduction via increased yields, increased cropping areas and higher value crops, by these means raises employment (directly of farm workers, indirectly of other workers if wages are bid up). Increased mean yields can mean increased food supplies, higher calorie intakes and better nutrition levels. This study investigated that there were significant differences in levels of production, employment, asset endowment, consumption, and income between irrigation users and non-users as follows:

Irrigation increased production

Comparative yields analysis by crop type could not be done because of lack of uniformity in the use of inputs. However, gross yield for major crops by access to irrigation was presented in Figure 2.

As expected, irrigation use has significantly contributed towards achieving household's goal of increased production and this result is similar to other reports (Getaneh, 2011). Data analysis of major cereals and horticultural crops showed that mean crop yield per household for *teff*, maize, green pepper, potato, tomato, red onion, cabbage and barely is highest for irrigation users than non-users. This evidence has ensured that irrigation use is a guarantee for increased food supply and ensured food security. Some crops like tomato, onion, pepper and cabbage are only grown by those households with access to irrigation. This is also an indication of the fact that irrigation use increases cropping diversification and intensity.

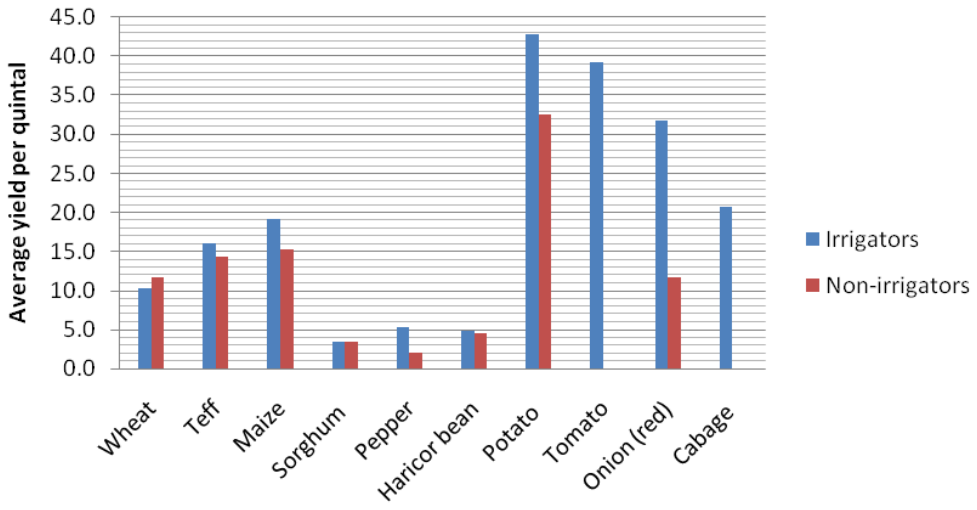

Figure 2. Average crop yields per quintal per household (1 quintal = 100 kg).

Table 2. Labor hour and cost by irrigation use.

Average labour hour	Irrigation use	Mean	Standard deviation	t/p
Plowing	User	76.90	84.38	8.464/0.000***
	Non user	21.71	25.61	
Weeding	User	90.79	116.18	7.085/0.000***
	Non user	26.51	38.11	
Harvesting	User	87.31	97.74	7.445/0.000***
	Non user	28.33	39.66	
Trashing	User	70.98	76.12	7.113/0.000***
	Non user	24.23	38.81	
Labor cost per ha in Ethiopian Birr (ETB)	User	535.94	800. 95	2.988/0.003***
	Non user	305.92	495.36	

***, Significant at less than 1% probability level, SD; standard deviation.

Irrigation enhanced employment opportunities

Conceptually, among the many benefits of irrigation, employment generation is crucial. The beneficiaries have shifted from once a year (rainy season) to two and three harvests and labor use efficiency were improved due to irrigation. Table 2 shows that mean hour invested on irrigated farm is significantly higher than the rain fed only farm for all activities from plowing to trashing. Similarly, the average labor cost (calculated only for hired labor) for irrigation user is more than double of the non-user households. This implies that, irrigation is a stimulus to increased employment opportunity. Most smallholder activities all draw from the same family labor sources, supplement for certain operations by neighbor help and casual wage labor. The development of the irrigation schemes has created job opportunities for the nearby farmers in addition to the irrigation users in the traditionally slack dry times.

Irrigation increased income

It is expected and revealed that irrigation would improve income earning (Getaneh, 2011; Hussain, 2004; Kinfe et al., 2012). Similarly, irrigation beneficiaries earned an annual mean income of 10161.5 Birr per household, which is 33.6% higher than that of non-users. Irrigation use has a positive impact on households earning from crop, and livestock, while the value of off farm income

Table 3. Income earned by households with and without irrigation.

Income source (ETB)	Irrigation use						t
	User		% share	Non user		% share	
	Mean	Standard deviation		Mean	Standard deviation		
Livestock	1451.6	2826.6	13.5	1070.2	2150.3	13.7	1.324
Crop	8138.5	6012.1	76.0	5520.9	3879.3	70.5	4.635***
Off farm	1125.2	2549.6	10.5	1234.7	2239.9	15.8	-0.0.4
Total	10161.5	5612.7	100	7606.0	4280.6	100	4.562***

***Significant at less than 1% probability level.

Table 4. Asset endowments by households with and without irrigation.

Assets owned	Irrigation use	Mean	Standard deviation	t
Total value of asset (ETB)	User	2060.16	6510.74	2.500**
	Non user	597.58	3450.67	
Total size of plots (ha)	User	1.50	1.00	3.84***
	Non user	1.12	0.76	
Total livestock (TLU)	User	5.45	3.80	2.008/**
	Non user	4.55	3.88	

***, ** Significant at less than 1 and 5% probability levels.

earning was higher for non-users. Close examination of the data exhibit that remunerative off farm income sources like cart and trade were the results of irrigated agriculture whereas inferior livelihood activities like fire wood and charcoal selling, and causal work were dominated by non irrigators. This finding is similar to the findings of Getaneh (2011) which states small-scale irrigation has a negative impact on non-farm incomes. Income share by category indicate that 76 and 70.5% of total incomes for users and non-users respectively come from crop, while the rest from livestock and off farm activities. Irrigators earned 47.4% higher than that of non-irrigators from crop alone and this difference is statistically significant (Table 3).

Irrigation improved asset endowments

Irrigation allows a greater area of land to be used for crops and asset ownership increases with access to irrigation (Hussain, 2004). This study paid attention to the basic production resources like land and livestock, as well as total value of household goods (farm tools and furniture's) estimated at purchase price. Accordingly, the value of asset owned by irrigators is three fold of non irrigators. Access to irrigation increases mean land ownership by 0.38 ha and it enhance livestock ownership by a factor of 0.91 tropical livestock unit (TLU) (Table 4).

Irrigation improved household consumption

In order to measure the impact of irrigation on household consumption, expenditure pattern was used as a proxy indicator for standard of living. This usually refers to the ability of the household to produce/purchase a basket of goods containing the minimum quantity of calories and non-food commodities. Accordingly, the average consumption expenditure per adult equivalent (AE) per annum for irrigators is more than twofold of non irrigators. Similarly, the value of home consumption, food and non food expenditures are significantly higher than that of non-users. For instance non irrigators consumption from own production is only about 51% of that of irrigation beneficiaries. This indicates that access to irrigation improves food security through home consumption by increasing the frequency of production. It also enhances the capacity to access food through purchase by 50.7%. Thus, there is a positive correlation between nutritional status and irrigation access. It has also a positive impact on non food consumption. The non food consumption value of non-users was 60.8% of that of irrigators (Table 5). Thus, this study could argue that irrigation access improves overall welfare of rural households through

Table 5. Expenditure pattern of households with and without irrigation.

Expenditure (ETB)	User		Non user		F	P
	Mean	Standard deviation	Mean	Standard deviation		
Food	3467.8	2965.2	1715.6	1813.6	40.934	0.000***
Non food	2540.6	4725.5	1546.5	2052.2	6.073	0.014**
VOC	5968.9	19828.1	3047.1	2660.7	3.57	0.060*

***, **, * Significant at less than 1, 5 and 10% probability levels; VOC, value of own consumption.

Table 6. Poverty status and indices by access to irrigation.

Irrigation use	Poverty status				X^2	P
	Non-poor		Poor			
	N	%	N	%		
User	130	89.7	15	10.3	**51.152**	**0.000*** **
Non user	88	52.3	80	47.6		
Total	218	69.6	95	30.4		

Irrigation use	Head count index (α = 0)	Poverty gap (α = 1)	Squared poverty gap (α = 2)
User	0.10	0.042	0.02
Non user	0.48	0.17	0.09

***Significant at less than 1% probability level.

improved food access, non food consumption and asset accumulation.

Irrigation contributed to poverty reduction

Local poverty line: There are many different concepts of poverty in various disciplines. It has been increasingly realized that poverty is a multidimensional concept, extending from low levels of incomes and expenditures to lack of education and poor health, and includes other social dimensions such as powerlessness, insecurity, vulnerability, isolation, social exclusion and gender disparities. This study made use of cost of basic needs to set poverty lines. The first activity in this approach is to identify a bundle of food and non food items usually consumed by the 20% lowest income quartile and estimating the cost of meeting this need (Ravallion, 1994). Accordingly, the food poverty line (FPL) for this study is 1016.49 ETB per AE per year, whereas the total non food expenditure is 310.64 birr per AE per year which covers clothing, medication, tax and social obligation costs. Adding all these expenditures from the lowest income group will make the total poverty line beyond which an individual is considered to be non-poor. Thus, the poverty line was 1016.49 birr per AE per year.

Poverty status and indices by access to irrigation: Table 6 shows from the 313 sample households, 30.4% of them are poor, which accounts for 47.6% of non-users and 10.3% of the users, which implies that poverty incidence is 37.3% higher in rain-fed only farm than irrigation. The rest 89.7% of the users and 52.3% of non-users respectively are non-poor. This confirms that irrigation development is a key for poverty reduction. The fact that 10.3% of irrigation beneficiaries being poor entails, on one hand access to irrigation is a necessary, but not a sufficient condition for poverty alleviation, and on the other hand, poverty may be adversely affected where irrigation is mismanaged leading poverty. In addition, one has to understand that poverty is a complex phenomenon. The study showed that 48 and 10% of the non user and user households respectively were living below the locally determined poverty line on the head count basis. The corresponding poverty gap by irrigation use was 0.042 and 0.17 for user and non user, respectively; whereas poverty severity index was 0.02 and 0.09 for users and non-users respectively (Table 6). Thus, poverty is more severe and widespread among non irrigators than irrigators.

Determinants of poverty: Binomial logit model was used to identify factors pushing in or pulling out households of poverty. As the major focus of this study aims to investigate the role of irrigation in poverty reduction; poverty is considered as the dependent variable of the model, while the variables are listed in

Table 7. Binomial logit model result for determinants of poverty.

Irrigation user	B	Standard error	Wald	Significant difference	Exp (B)
	-0.572	**0.289**	**3.900**	**0.048****	**0.565**
Age of head	0.045	0.014	9.845	0.002***	1.046
Household size	0.521	0.095	29.847	0.000***	1.683
Dependency ratio	0.267	0.140	3.636	0.057*	1.306
Farm size	-0.859	0.230	13.967	0.000***	0.424
Livestock holding (tlu)	-0.153	0.063	5.893	0.015**	0.858
Education of head	0.098	0.048	4.185	0.041**	1.103
Distance to market	-0.017	0.038	0.201	0.654	0.983
Constant	-3.993	0.812	24.157	0.000***	0.018
Pearson X^2	5.109***				
-2 Log likelihood	308.208				
Sample size	313				

*******, ******, ***** significant at less than 1, 5 and 10% respectively.

Table 7 including irrigation use are independent variables that determine the likelihood of being poor or not. Before running the model, the study used the variance inflation factor and contingency coefficients to check for multicollinearity among continuous and discrete variables respectively. According to the test result, multicollinearity was not a serious problem among the continuous variables. However, there is strong association between irrigation use and sex of household head. As a result, sex of head was removed from the model. The regression classification table revealed that binomial logistic model managed to predict 82.6% of the responses correctly. The model chi-square statistic for Hosmer and Lemeshow test also showed the chi-square value was found to be 5.025 and the overall model was found non-significant at 0.755 levels stating that the model adequately fits the data (Table 7).

Interpretation of significant variables

The results of binomial logit verify that most of the explanatory variables in the model have the signs that conform to our prior expectations, except education of head. Thus, irrigation use with the odds of being poor over non-poor was negatively correlated and significant. This means the probability of being poor decreases by a factor of 0.565 for those households with access to irrigation keeping other factors constant. This suggests that the probability of being poor decreases if one has access to irrigation. This finding is incongruent to the findings of Ayalneh and Korf (2009) and Getaneh (2011). Hussain (2004) also noted that irrigation contributes to poverty alleviation both directly and indirectly. It may lead to poverty reduction via increased yields, increased cropping areas and higher value crops and raising employment opportunities (FAO, 2003). Among demographic factors, age of household head was positively and significantly related to the probability of being poor; hence, old age is the cause of poverty. That means as age of the household head increases, this contributes to household poverty. The probable reason is that with age asset depletes for example land decreases upon inheritance to children. The results are consistent with the study of Gyekye and Akinboade (2001) and Sabir et al. (2006). But, it is against the findings of Ayalneh and Korf (2009); which stated that older households have greater likelihood of being non-poor. Household size positively affected the probability of a household to be poor; a unit increase in household size increased the probability of being poor by 1.683. This finding is consistent with that of Alemu et al. (2009) and Ayalneh and Korf (2009).

Similarly, dependency ratio was found to positively and significantly affect the probability of being poor by a factor of 1.3. This ratio allows one to measure the burden weighing on members of the labor force within the household. It is also in agreement with findings of Gyekye and Akinboade (2001), which stated that poverty is more likely to be associated with large households with a high dependency ratio. As expected, ownership of land and livestock showed strong negative effects on the probability of households to be poor. A unit increase in landholding and livestock holding increased the probability of a household being non-poor by 0.4 and 0.8 respectively. This finding is also similar to that of Alemu et al. (2009) and Ayalneh and Korf (2009). Contrary to expectation education of head was found to influence poverty positively and significantly at $P<0.05$. It seems illogical, but the possible reason is that the educational attainment of sample households was below the level that guarantee employment and it did not allow them to generate income as a result of their education. People who have obtained jobs in the urban areas are in general

better educated (at least completed 10th grade level), which only few of the sample households achieved. Thus, unlike some findings of Ayalneh and Korf (2009), educational level of household heads was not found to have a negative effect on poverty.

CONCLUSION AND RECOMMENDATION

This study assessed the role of small scale irrigation on poverty based on 313 households of the rift valley river basin. The roles that SSI played were seen in terms of increasing production, income, assets, and employment opportunity, as well as poverty reduction. Both the descriptive and econometric analysis showed that irrigation use has a positive effect on farm production, income, asset endowment, and employment opportunity and poverty reduction.

Thus, it is pertinent to conclude from this study that irrigation development helps to increase household income and reduces the incidence of poverty at the household level. It can benefit the poor through raising yields and production and nonfarm employment. However, the economic performances of irrigation systems in the study areas were constrained due to imperfect market structure and financial shortages.

The following recommendations were given based on the findings of the study. Water users associations should be organized and empowered in order to improve the performance of SSI schemes; simultaneously, cooperatives should be encouraged and empowered in order to solve the marketing constraints of members. In this regard, agricultural extension should be improved and include market information and business training. The most crucial ones are linking the traders and the producers to work as partners. Institutional support towards capacitating, training, and coordinating rural cooperatives would play an inevitable role in enhancing the effect of irrigation on poverty reduction.

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Tenure security and soil conservation investment decisions: Empirical evidence from East Gojam, Ethiopia

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The purpose of this study is to investigate the mutual relation between tenure security and soil conservation investment and to examine the influence of other socio-economic and institutional factors on soil conservation investment and tenure insecurity. A formal survey is conducted in two districts of East Gojam Zone of Amhara region. The Zone and the districts are selected because of their long time experience with soil conservation development activities and land re-distribution. A two-stage random sampling procedure is used to obtain sample households. Because the structural model represents a simultaneous binary choice system, the investment and insecurity equations are estimated using a two-stage probit method. The results show that tenure insecurity is an important variable that affects the probability of investing in soil conservation technologies. However, the reverse relation is insignificant. Farmers' soil conservation investment decisions are positively and significantly related to slope, age, education level and public investment, whereas, tenure insecurity and distance from the main road have a negative significant influences on soil conservation investments. The analysis of tenure insecurity reveals that expectation of redistribution and farm size has a negative influence on tenure security, whereas education level has a reverse effect.

Key words: Tenure security, soil conservation investment, simultaneous binary choice system, two-stage probit, Ethiopia.

INTRODUCTION

Land degradation is one of the major environmental problems in developing countries. Soil erosion by water is the principal cause of land degradation, and a major constraint to agricultural development in developing countries (de Graaff, 1996). Globally, the problem of soil erosion is widely recognized and millions of dollars are spent every year on soil conservation projects. But in spite of money being spent and great effort being made, the problem is gradually getting worse. An important factor in land degradation and farmers' investment in soil conservation in developing countries is the change in the socio-economic environment of farm households resulting from policy reform measures taken at higher levels (Heerink et al., 2001). As population increases and land becomes scarce, land demand by the growing number of land claimants may be met by non-market mechanisms such as state land redistribution, informal land contracts and customary inheritance. The persistence of such mechanisms and absence of an established legal rights land system has resulted in

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increasing tenure insecurity and continued land fragmentation (Amare, 1998). The absence of tenure security is highly linked to poor land use which in turn leads to environmental degradation (Otsuka and Place, 2001; Wannasai and Shrestha, 2008).

Ethiopia is one of countries that is heavily dependent on peasant agriculture and is affected by extensive degradation of agricultural land. Coupled with the poor performance of the agricultural sector, high population growth, land scarcity, technological stagnation, misguided policies and deficient institutional structure hinder sustainable utilization of agricultural land (Shiferaw, 1998).

Reducing resource degradation, increasing agricultural productivity, combating poverty, and achieving food security are major challenges of the nation. The poor agricultural practice and the country's intrinsic fragile biophysical conditions have resulted in large areas becoming severely degraded. Land degradation is most severe in highlands (over 1500 m altitude), which account for more than 43% of the country, 95% of the cultivated area, 75% of the livestock and host about 88% of the population. Hurni (1988) estimates that the annual rate of soil loss on crop land is on average 42 t/ha per year. If soil erosion continues with this rate, by the year 2010 some 60000 km^2 of agricultural land will have disappeared.

The Amhara National Regional State (ANRS) is one of the nine regional states of Ethiopia. The Region is endowed with huge potential of land and water for agriculture, but these are now under the threat of land degradation due to soilerosion. A recent study by Gete (2003) revealed that Western Amhara (Gojam) which was once known as bread basket of Ethiopia is now at severe risk due to soil degradation. The cause of soil erosion in ANRS is a combination of natural factors such as topography, erratic and erosive rainfall patterns and human actions including destruction of vegetation cover through deforestation, overgrazing, and inappropriate agricultural practices that are not in harmony with the environmental conditions. In this regard, dense population, primitive farming practices combined with intensive rains and rugged topography intensified land degradation (Betru, 2003).

To alleviate these problems, a massive conventional soil conservation program has been launched since 1975 (Shiferaw and Holden, 1998). In spite of the effort in introduction, the adoption rate has been minimal (Shiferaw and Holden, 1998, 1999).

Investment in soil and water conservation practices are influenced and constrained by socio-economical and institutional factors (de Graaff, 1993; Shiferaw et al., 2009). Soil conservation investment may be undertaken when sufficient returns are expected for a considerable period of time in comparison with the situation when such investments are not made. This is possible with a secure land tenure system.

Since the beginning of the twentieth century, Ethiopia has implemented different types of interventions in the area of land tenure. Currently, land is the state property and redistribution is the sole mechanism through which land transfer to accommodate new demands. The majority of the smallholders in Ethiopia (76%) are not sure whether their current land will belong to them in five years time (Ethiopia Economic Association, 2002 cited in Dessalegn, 2004). Benin and Pender (2001) in their study of the incidence of land redistribution in the Amhara region of Ethiopia revealed that every community has experienced at least one redistribution since 1974, and nearly half had a land redistribution since 1991, mainly in the recent redistribution since 1997. And also about four-fifths of the communities expect redistribution in the future. The stronghold of the state over rural land and subsequent action of land allocation through redistribution has given rise to tenure insecurity by rural farmers (Dessalegn, 2004). Cognizant of this problem, the government of Ethiopia has introduced land certification very recently to increase tenure security and farmers' propensity to investment.

Lack of secure rights on land decreases farmers' incentives to invest in land improvement (Besley, 1995; Otsuka and Place, 2001; Mekonnen, 2009). Moreover soil conservation investment is constrained and influenced by credit facilities, extension service, infrastructure availability, household endowment and household and farm characteristics. This implies that there are a lot of institutional and socio-economical factors that might hinder farmers to invest their own conservation measures.

In view of this, it is important to investigate the factors influencing subsistence farmers' soil conservation decisions in the context of northwestern Ethiopia. The main objectives of the study are to investigate the mutual relation between tenure security and individual soil conservation investment and to examine the influence of other socio-economic and institutional factors on individual soil conservation investment and tenure insecurity

Analytical model

Following the above description of the relationship between property rights, uncertainty and utility maximization, we use a one-period household model to assess the impact of tenure security on land related investments as the conceptual basis for our empirical investigation. There are two alternatives hypotheses related to tenure security and investment. The first one is that more secure land rights will have a positive impact on investment. In this case tenure security is exogenous. The other hypothesis is that investment is undertaken to enhance tenure security, in this case tenure security is endogenous.

In our situation, the farmer willingness to invest may be affected by the perception of risk. A farmer decides whether to invest in soil conservation technologies by considering risk of losing land, due to redistribution sometimes in the future. When the farmer feels secure about the tenure system he may decide to invest in soil conservation technologies and his production may increase as the result of the investments. Meanwhile he may lose his investment some time in future due to redistribution. If a farmer feels insecure about tenure he may decide not to invest in soil conservation technologies and his production may decrease due to soil erosion. But he will not lose any investment when redistribution is undertaken. The farmer decides whether to invest or not by considering the above scenarios.

Assuming that farmers maximize expected utility, the decision whether to invest (I_i =1) or not (I_i = 0) is based on a comparison of expected utilities of investing or not investing soil conservation technology. Using the difference in expected utilities gives the following decision rule:

$$I_i = \begin{cases} 1, if, E[U_I^I - U_I^O | z_i, \gamma_i] > 0 \\ 0, if, E[U_I^I - U_I^O | z_i, \gamma_i] < 0 \end{cases} \quad (1)$$

Where E denotes expectation of a farmer which is conditional on household and farm characteristics (z_i) and perception of risk (γ_i). U_I^I denotes utility of investing soil conservation and U_I^O is utility of not investing soil conservation. The utility level of investing or not investing depends up on the expectation of income with the presence or absence of soil conservation technologies. Considering an individual farmer with utility function $U(\omega)$, where ω is income which depends on individual and farm characteristics (z_i) and variables affecting perception of risk (γ_i). Farmer's expected utility is assumed to be increasing in income $[\omega]$, as indicated in Equation (3)

$$\max E[U(\omega) | z_i, \gamma_i] \quad (2)$$

Subject to

$$\omega = \sum_{t=1} (Y_i A_i p_i - w_I I_i - C) \quad (3)$$

$$Y_i = Y(I_i, F_i, A_i, Z_{1i}) \quad (4)$$

$$I_i = I(T_i, Z_{2i}) \quad (5)$$

$$T_i = T(I_i, Z_{3i}) \quad (6)$$

This equation defines income $[\omega]$ as annual crop revenues minus the unit cost (w_i) of conservation investments (I_i) and other variable costs (C). Crop revenue is the product of crop price (p_i), yield (Y_i) per hectare and land area (A_i). Yield, in turn, is concavely increasing with the presence of soil conservation investments $(Y'(I_i) > 0)$ and also depends on fertilize use (F_i), land area (A_i) and other factors (Z_{1i}) such as soil fertility, pest and weather condition. Soil conservation investment (I_i) depends on tenure security $(I'(T_i) > 0)$. This implies that better land security leads to more land investment. Soil conservation investment (I_i) also depends on other factors (Z_{2i}) such as slope of the plot, farm size, distance of the homestead from the main road, age of the household, extension contact, public investment, number of oxen, and education level.

On the other hand, tenure security is endogenous; security of tenure can be enhanced through investment $(T'(I_i) > 0)$. Tenure security also depends on other factors (Z_{3i}) such as farm size, expectation of re-distribution, age and education level of the household.

Hypotheses

Investment hypotheses

From the theoretical framework, several hypotheses can be derived that serve in empirical examination. Investments are measured in this study with the presence of soil conservation technologies on farmers' fields (fanya juu terrace[1], fanya juu with plantation and perennial) or not. The farmers are asked whether they invest or not individual soil conservation measures on their own plots. Investments undertaken by mass mobilization are not considered. Therefore, our dependent variable represents the presence of investment or not on farmer fields and it is a function of social, institutional, physical, and economical and attitudinal factor.

Development of the model is influenced by a number of working hypotheses. Based on the literature reviewed it is hypothesized that farmers decision to invest in conservation measures is influenced by combined effects of social, economical and institutional factors. A number of variables are expected to influence investment in soil conservation measure explained as follows:

Slope of the plot (Slope): Slope is an indicator of the probability of erosion on the land (Laper and Pandy,

[1]A fanya juu terrace is made by digging a trench and throwing the soil uphill to form an embankment. In our case farmers plant a grass strip on the fanya juu.

1999). The steeper the slope, the more likely the land will erode. Hence, it is hypothesized that investment tends to be likely on steeper slope.

Tenure insecurity (T_i): Tenure insecurity measures the perceived risk of loss of land at some time in the future. Investment is undertaken when the household is assured that he will reap the benefit for a considerable time. The household that feels insecure will not invest in soil conservation measures. So it is hypothesized to negatively influence investment.

Farm size (Farms): To invest soil conservation measure, the farm size is the crucial matter. Farmers having a large farm invest more than the others (Shiferaw and Holden, 1998). So it is hypothesized to positively associate with investment decision.

Distance to the main road (Disth): Distance to the main road is hypothesized to be negatively related to the probability of investment of soil conservation measures, since households near to main road tend to have access to information and are more likely to be visited by extension agents (Laper and Pandy, 1999).

Family size (Shh): Larger families will be able to provide the labor that is required for soil conservation investment. So it is hypothesized to be positively related to soil conservation investment.

Level of Education (Edu): Level of education is assumed to increase a farmer's ability to obtain, process, and use information relevant to the investment of soil conservation decision (Laper and Pandy, 1999). Education is therefore expected to increase the probability of investment of soil conservation.

Number of oxen (Ox): Number of oxen is hypothesized to be positively related to the probability of investment. This is because oxen are indicator of wealth and it is used in digging while soil bund is constructed.

Age of the household (Age): The age of household is hypothesized to be negatively related to the probability of investment. This is because old farmers are more suspicious about new technologies than young (Shiferaw and Holden, 1998).

Extension contact (Extc): Farmers who have frequent contact with extension agent are positively influenced to invest (Makokha et al., 1999). So it is hypothesized to be positively related to soil conservation investment.

Public investment (Pubcon): Farmers who have public investment are expected to have positive attitude towards soil conservation. This is because they perceive the benefit of the measures. Here public investment is a soil conservation investment practice which is constructed on farmers' plots by mass mobilization of the community. From Equation (5) the model of investment is specified as follows:

Investment = f(Slope, Tenure Insecurity, Farms, Disth, Shh, Edu, Ox, Age, Extc, Pubcon) (6)

Tenure insecurity hypotheses

Tenure insecurity is measured as the perceived risk of loss of land some time in future. The farmers are asked about their expectation of handling their lands at different time interval (1 year, 5 years, 10 years and throughout their life time). The response will fall in one category: Insecure land holding or secure land holding. Therefore, our dependent variable represents the feeling of tenure insecurity and it depends on a lot of factors. A number of variables are expected to influence tenure security, explained as follows.

Farm size of the household (Farms): During re-distribution, farm size was one of the yardsticks to lose land. In line of this, the household who has a large farm size fear the risk of losing his/her land. So it is hypothesized to be positively related to tenure insecurity.

Investment (I_i): Land tenure security is influenced by investment. Tenure security can be enhanced through investment. Land related investment is undertaken to enhance security of land holding (Brasselle et al., 2001). This implies that investment will be undertaken by insecure households in order to increase their security. So it is hypothesized to be positively related to tenure insecurity.

Expectation of re-distribution (Expredis): The household may expect re-distribution due to the government land re-distribution policy. So it is hypothesized to be positively related to tenure insecurity.

Education level of the household (Edu): Level of education is assumed to increase farmers' ability to obtain information about the tenure system. So it is hypothesized to positively relate to tenure insecurity.

Number of oxen (Ox): Number of oxen is the proxy variable for wealth and power. Wealthy households may f ear losing their land due to the past redistribution criteria. So number of oxen is hypothesized to be positively related to tenure insecurity.

From equation 3.6 the model of tenure insecurity is specified as follows:

Tenure insecurity = f(Age, Edu, Farms , Ox, Expredis, Investment) (7)

METHODOLOGY

Study areas, sampling procedure and data collection

The study is undertaken in two major districts (Gozamen and Awabel) of East Gojam zone, Amhara region. The Zone and the Woredas are selected purposely because of their long time experience of soil conservation development activities and their land re-distribution experiences. Rigorous SWC activities were implemented in the study areas in 1999 by the District Agriculture Office with financial support from the Swedish International Development Agency (SIDA) as part of its on-farm research program in Amhara Region.

A two stage sampling procedures is used to select farmers for the study. Kebeles (Dijil Watershed and Gudalema Watershed) are selected using a random sampling procedure. Following the selection of Kebeles, 60 farmers are randomly selected from each Kebeles (Watersheds). Data are collected from primary and secondary sources. Secondary sources include published and unpublished information about soil conservation activities, agricultural production, farming system and other socio-economic information. This information is collected from the zonal and Woreda level office of Agriculture. Primary data are collected from sample farmers using a structural questionnaire. Moreover, group discussions are undertaken with opinion leaders of respective districts.

Empirical model and estimation

Investment and tenure insecurity equation and their estimation

In this study, we empirically investigate the relations laid out in the theoretical model by a system of binary choice equations. As discussed earlier, the influence of tenure insecurity on soil conservation investment is direct. Alternatively, some factors may simultaneously affect both tenure insecurity and investment. With a simultaneous equations model two or more endogenous variables are determined jointly within the model. Both are also depend on set of exogenous variables. Simultaneity induces correlation between error terms of each equation in the system. Ordinary least squares (OLS) can not be used to estimate this model, because the relationship specified by equations violates the OLS assumption of zero covariance between the disturbance term and the independent variables. Estimation of such model through OLS will lead to biased and inconsistent estimates of the coefficients (Verbeek, 2002). As a result, the main estimating technique is two stage least squares (2SLS) for continuous variable and two stage probit estimation in the case of binary choice (Maddala, 1983).

I_i^* and T_i^* are endogenous (latent) variables and β and γ are the set of parameters and the simultaneous equations model is written the following form:

$$I_i^* = \beta_{11} T_i^* + \gamma_1 Z_{1i} + u_1 \quad (8)$$

$$T_i^* = \beta_{21} I_i^* + \gamma_2 Z_{2i} + u_2 \quad (9)$$

Where, $I_i = 1$ if $I_i^* > 0$; $I_i = 0$ otherwise; $T_i = 1$ if $T_i^* > 0$; $T_i = 0$ otherwise.

For this study, our simultaneous probit equations model is:

$$I_i = f(Z_1, X, T_i) \quad (10)$$

$$T_i = f(Z_2, X, I_i) \quad (11)$$

Where investment (I_i) and tenure insecurity (T_i) are binary [0,1] indicator variables for a given household. The Z and X are vectors of observed exogenous variables representing household and farm specific characteristics and institutional setting. And f represents the non-liner transformation of I_i^* and T_i^*

To investigate the relationship between investment and tenure insecurity, we use a simultaneous probit equation model which consists of two simultaneous binary choice equations. The estimation procedure comprises the following steps: First, the reduced form of tenure insecurity (exogenous variable) is estimated and then its predicted value obtained. Second, the predicted value of insecurity $(\hat{T_i^*})$ is used as a regressor in the investment equation. The process is repeated for insecurity equation using predicted value of investment $(\hat{I_i^*})$.

Before running the model all the hypothesized explanatory variables were checked for the existence of multi-collinearity problem. In this study, variance inflation factor (VIF) and contingency coefficients were used to test multi-collinearity problem for continuous and dummy variables, respectively.

RESULTS AND DISCUSSION

Descriptive analysis of soil conservation investment

About 44% of the households in the study invest in their own conservation technology (Table 1). Family size, age and farm size variables are assumed to influence the decision to invest in the soil conservation technology. The average family size, farm size and age of the households' head in the study area are 5.6, 1.47 and 38.6, respectively. But in this study no significant differences in these variables between investing and non-investing households are found based on univariate t-test.

The number of oxen is hypothesized to influence the decision of soil conservation investment. This is because the number of oxen indicates the wealth status of the household. The average number of oxen per household is 1.88. A t-test indicates that investing households on average have significantly more oxen (2.11) than non-investing households (1.69). Education level is also assumed to influence decision of soil conservation investment. The majority of the households who invest in soil conservation technologies (69.2%) are literate. The chi- square test shows a systematic association between the level of education and soil conservation investments.

Frequency of extension contact is also assumed to influence the decision of soil conservation investment. About 82.7% of investing households and 53% of non-investing households has high level of extension contacts. The chi-square analysis shows a systematic association between soil conservation investment and extension contact. Furthermore, the presence of public soil conservation investments on the plot of household is hypothesized to influence in decision of investments. This

Table 1. Characteristics of investing and non-investing households in the study area.

Characteristics		Investing HH (N=52)		Non-Investing HH(N=66)		t- statistic
		Mean	S.D	Mean	S.D	
Age(years)		40.59	12.01	37.06	11.95	0.11
Family size		5.94	1.77	5.48	2.00	0.19
Farm size (ha.)		1.54	0.79	1.40	0.71	0.37
Distance from main road (km)		0.95	1.09	1.32	1.0	0.05**
Number oxen		2.11	0.83	1.69	1.15	0.02**
		% of investing HH		% of non-investing HH		χ^2 statistic
Slope	Yes	86.4		50.0		0.000**
	No	15.4		50.0		
Tenure insecurity	Yes	30.8		56.1		0.006**
	No	69.2		43.9		
Level of Education	Literate	61.5		39.7		0.001**
	Illiterate	38.5		62.1		
Extension Contact	High	82.7		53.0		0.001**
	Low	17.3		47.0		
Public investment	Yes	59.6		34.8		0.007**
	No	40.4		65.2		

*Significance at the 10% level; **significance at the 5% level.

is because the households who have public investments may perceive the benefit of the technologies. About 59.6% of investing households and 34.5% of non-investing households has public soil conservation investments.

The chi-square analysis reveals a systematic association between the presence of public investments and individual soil conservation decision. In addition insecurity of tenure is hypothesized to influence soil conservation investment. This is because investment may be undertaken when the household is assured that he will reap the benefit for a considerable time. The household who feels insecurity may not invested soil conservation measures. About 56.1% of non-investing households and 30.8% of investing households feel tenure insecurity. The chi-square analysis also reveals a systematic association between tenure insecurity and soil conservation investment.

Descriptive analysis of tenure security

Around 55% of the sample households feel secure about their landholdings (Table 2). Farm size is hypothesized to influence the feeling of tenure insecurity. The households who have a larger farm size may feel insecurity of tenure because they fear some plots of their land may be taken away through redistribution. Insecure households on the average have a larger farm size (1.7 ha) than secure households (1.29 ha). The t- test shows that this difference is significant. Moreover, the number of oxen is also assumed to influence the feeling of tenure security. This is because the number of oxen indicates the wealth status of the household. Insecure households on average have significantly more oxen (1.7) than secure households (1.29).

Expectation of redistribution is assumed to influence the feeling of tenure insecurity. This is due to the prevailing land tenure policy. About 92.2% of insecure households and 75% of secure households expect re-distribution in the future. This indicates that expectation of land redistribution does not totally lead to tenure insecurity. This is because farmers expect that there will be land redistribution for landless youth from large size holders or land from dead people or from grazing areas. Chi-square analysis reveals a systematic association between tenure insecurity and expectation of re-distribution in the future. Level of education is also hypothesized to influence the feeling of tenure insecurity. However, Chi-square analysis shows no systematic association between education level and tenure insecurity.

Table 2. Descriptive statistics results of tenure security and insecure households in the study area.

Characteristics		Insecure household (N=53)		Secure household (N=65)		t- statistic
		Mean	S.D	Mean	S.D	
Age (years)		39.4	12.5	37.9	11.71	0.5
Farm size (ha.)		1.7	0 .8	1.29	0.62	0.003**
Number oxen		2.0	1.1	1.7	0 .95	0.065*
		% Land insecure HH		% Land secure HH		χ^2 statistic
Investment	Yes	24.5		55.4		0.006**
	No	75.5		44.6		
Expectation of redistribution	Yes	92.2		75.4		0.018**
	No	7.8		24.6		
Level of Education	literate	58.5		46.2		0.182
	illiterate	41.5		53.8		

*Significance at the 10% level; **significance at the 5% level.

Table 3. Two- stage probit estimation results of investment of soil conservation.

Variable	Coefficient	Standard error
Age	0.033**	0.013
Level of education	0.678**	0.299
Family size	-0.037	0.096
Distance	-0.318**	0.131
Farm size	0.267	0.262
Extension contact	0.321	0.327
Number of oxen	0.188	0.160
Public conservation	0.815**	0.303
Slope	1.048**	0.333
Insecurity(predicted value)	-0.856*	0.518
Constant	-3.171	0.776
Regression diagnostic		
Chi-square	45.79	
Probability >Chi-square	0.000	
Pseudo R-square	0 .290	
Count R^2	0.756	
Base line for count R^2	0.56	
Number of observations	115	

*Significance at the 10% level; **significance at the 5% level.

Soil conservation investment model

Using the variables described in Equation (8) is estimated using two- stage probit method. Two-stage probit estimation results (Table 3) reveal that the investment decision of soil conservation technologies is influenced by different factors at different levels of significance.

Most of the regressors used in this model have signs in line with our prior expectations. The results show that farmers' soil conservation investment decisions are positively and significantly related to slope, age, education level and public investment. Similarly, tenure insecurity and distance from the main road have negative significant influence on soil conservation investment. Some variables like farm size, extension contact and number of oxen have positive signs but are not

significant.

Consistent to our expectation, the level of the slope of plot is positively related to the decision of the soil conservation investment and statistically significant. This implies that farmers who operate on fields with steeper slope are more likely to invest in soil conservation technologies than the others. This may be explained by the positive relationships between slope and severity of soil erosion. This result is consistent with the findings of Shiferaw and Holden (1998) and Gebremedhin and Swinton (2003) in Ethiopia, and Lapar and Pandey (1999) in the Philippines. Therefore, the level of the slope of the plot is an important factor for the decision of soil conservation investment.

As expected, tenure insecurity has a significant negative influence on soil conservation investments. This suggests that tenure insecure households are less likely to invest in soil conservation technologies. It is argued that in Ethiopia, land is state property and farmers have only use and lease rights and redistribution of land is a common phenomenon.

For instance, in the Amhara region, Benin and Pender (2002) revealed that nearly half of the communities have experienced land redistribution since 1991 and about four-fifths of the communities expect redistribution in the future. This expectation of redistribution may erode tenure security and hence farmers may not undertake land improving investment because they may not be able benefit fully from the returns on their investments. This result is consistent with findings by Besley (1995) in Ghana, Hays et al. (1997) in Gambia, Gavian and Fafchamps (1996) in Nigeria, Ostuka et al. (2003) in Ghana, Winters et al. (2004) in Ecuador and Fraser (2004) in Southwest British Columbia. Moreover, a study conducted by Geberemedehin and Swinton (2003) in the Tigray region of North Ethiopia is in line with our result. Thus, tenure insecurity has a negative influence on soil conservation decision. Conversely, Benin and Pender (2001) in their study in Amhara found that land redistribution and expectation of land redistribution have a statistically insignificant effect on the influence of land investment.

Similarly, Holden and Yohannes (2002) in Southern Ethiopia revealed that tenure insecurity has no negative effect on long term investment like planting of perennials. These differences could be explained by the differences of socio-economic and land re-distribution experiences between Amhara and Southern regions, but the different results for the same region may be due to methodological difference.

As hypothesized, the presence of public soil conservation investments on a plot is positively related with individual soil conservation investments and statistically significant. This means that households who have public investments on their plots are more likely to invest in individual soil conservation technologies than others. This is because they perceive the benefits of soil conservation technologies. This result is consistent with the finding of Gebremedhen and Swinton (2003) in Ethiopia. They found that farmers, who have nearby public investment, are encouraged to invest in private soil conservation measures. Therefore, public soil conservation is stimulating individual soil conservation investment.

Consistent with our expectation, the coefficient of distance from the main road is negative and significant. It implies that farmers whose homesteads are far from the main road have a lower probability of investing in soil conservation technologies. This can be due to the fact that households near the main road tend to have access to information and are more likely to be visited by extension agents. Moreover, the transaction cost of searching for technical knowledge and information is lower for farmers living close to the road. This result is in line with the findings of Gebremedhen and Swinton (2003) in Ethiopia and Lapar and Pandy (1999) in the Cebu districts of Philippines. It can be concluded that distance from the main road is a crucial factor for the individual soil conservation decision.

Investment is found to be positively and significantly influenced by education status of the households. This suggests that literate farmers are more likely to invest in soil conservation measures than illiterate farmers. It is argued that literate farmers have the ability to obtain, process and use information related to soil conservation technologies and they are also taking more rational decisions. This result is consistent with the findings of Pender and Kerr (1999) in Aurepalle district of India and Lapar and Pandy (1999) in the Cebu district of Philippines. Thus, level of education has a positive influence on the decision of soil conservation investment.

Contrary to the hypothesis, the household age is found to have a significant and positive effect on the decision of soil conservation investment. This result implies that older farmers are more likely to invest soil conservation technologies. An explanation could be that farmers cognizant the problem of soil erosion through their life experience and hence they may take decisions of soil conservation investments. The overall model goodness of fit represents by model count R-square is satisfactory. Using the model we predict that 44 households would investing and that 71 would not investing.

In reality 50 households did invest and 65 did not. When we evaluate the predictions it is found that 33 of these 44 predictions of investing are correct and 11 not. Of the 71 predictions of non-investing 54 are correct and 17 not. So in total there are 33+54=87 correct predictions and 11+17=28 wrong predictions. Overall the predictive power of the model is 87/115=0.756. Moreover, the prediction of a model with only an intercept and no explanatory variables is 65 of the 115 observations. This gives us a baseline for predictions. So, the explanatory variables in the model give us an additional 22 correct predictions.

Table 4. Two stage probit result of determinants of tenure insecurity.

Variable	Coefficient	Standard error
Age	-0.003	0.011
Level of education	-0.511*	0.287
Farm size	0.491**	0.191
Number of oxen	0.063	0.135
Expectation of redistribution	0.609*	0.135
Investment (predicted Value)	0.262	0.367
Constant	-1.222	0.566
Regression diagnostic		
Chi-square	19.01	
Probability>Chi-square	0.0042	
Pseudo R-square	0.1203	
Count R^2	0 .678	
Base line for count R^2	0.55	

*Significance at the 10% level; **significance at the 5% level.

Tenure insecurity model

The results of two stage probit estimation for tenure insecurity are presented in Table 4. Most of the explanatory variables used in this model have signs similar with our prior hypothesis. The results indicate that tenure insecurity is positively and significantly related to farm size and expectation of redistribution. Age and number of oxen variables have negative and positive signs, respectively, but are not significant.

As expected, farm size is positively and significantly related to tenure insecurity. This result suggests that large farm size holders are more likely to feel tenure insecure. It is argued that owners of more than the average landholding may fear loss of some plots of land through redistribution. Moreover, the large farm size holders may feel tenure insecurity due to the past land redistribution policy as well as a great land holding inequality in the community. This result is also in line with the finding of Holden and Yohannes (2002) in some study sites of Southern Ethiopia.

Contrary to the hypothesis, the variable education is significant with a negative sign. This implies that literate farmers are less likely to feel tenure insecure. This may be explained by the fact that educated farmers may have alternative employment and the result they may give less attention to farm activities. Hence they may not feel tenure insecurity. However, Holden and Yohannes (2002) in their study in southern Ethiopia found that educated households (above grade 6) feel more tenure insecure. They argued that educated farmers may have better information about recent redistribution history of Amhara region.

As hypothesized, expectation of redistribution is positively and significantly related to the feeling of tenure insecurity. This result suggests that farmers who expect re-distribution are more likely to feel tenure insecurity.

It is argued that farmers may expect redistribution due to the government land policy as well as the past redistribution experience in the region and these perceptions may be a real source of tenure insecurity[2]. Therefore, expectation of redistribution due to land policy is the main source of tenure insecurity.

Age, whether investing soil conservation or not, and number of oxen do not have a significant effect on the feeling of tenure insecurity. Particularly, the finding of investment is not in line with the new finding of Brasselle et al. (2002) in Burkina Faso. They suggest that investment may be undertaken to enhance tenure security rather than as a consequence of more secure rights. The reason that our results are not in line with their findings may be that during the previous redistribution, investments did not guarantee tenure security and most farmers has lost what they invested and denied of their rights to compensation and payments for their investment. Investments may influence tenure security in flexible indigenous and customary land tenure system.

The model goodness of fit represents by model count R-square is acceptable. Using the model we predict that 40 households would feel insecurity and that 75 would secure. In reality 51 households felt insecurity and 64 secure. When we evaluate the predictions it is found that 27 of these 40 predictions of insecure are correct and 13 not. Of the 75 predictions of secure 51 are correct and 24 not. So in total there are 27+51=78 correct predictions and 13+24=37 wrong predictions. Overall the predictive power of the model is 78/115=0.678. Moreover, the

[2]Some authors use tenure insecurity and expectation of redistribution interchangeably. Here the two terms are different. Some farmers may expect re-distribution but they do not feel tenure insecurity due to their farm and personal characteristics. For instance small farm holders may expect re-distribution in the future but may not feel insecurity due to the size of their holding. This is because they are sure that they are not evicted from their small size

prediction of a model with only an intercept and no explanatory variables is 64 of the 115 observations. This gives us a baseline for predictions. So, the explanatory variables in the model give us an additional 14 correct predictions.

Conclusions

The result of the analysis indicates that tenure insecurity is an important factor that affects the probability of investing in soil conservation technologies. However, the reverse relation is insignificant. This shows that tenure insecurity has a negative impact up on the propensity to invest in soil conservation. This is because uncertainty in use rights leads to insecurity and reduced investment in land. Without clear and enforceable use rights, everyone is afraid others will reap the benefits of one's own investment. Under conditions of tenure insecurity, resource use and investment decisions regarding land cannot be made with the long term. Planning horizons will be short term, and oriented to maximizing immediate profits. In Amhara Region, tenure insecurity is the result of the past redistribution and government land policy and hence farmers do not undertake long term soil conservation investment. Therefore, the land policy should provide long-term and lasting tenure security to the peasant. Secure and stable rights to the land may possibly help in creating positive incentive to undertake long term investments by land users, stimulating the rural economy. Moreover, secure rights may increase the planning horizon of farmers. The new initiatives undertaken by the regional government to address the problem of tenure insecurity through a user right document is a promising start. But registration of land use rights without prior legal clarification of land rights may not increase tenure security[3].

The analysis of soil conservation investment equation reveals that age, education, distance from the main road, public conservation investment, slope and tenure insecurity are the main socio- economic and institutional factors that influence individual soil conservation decision. The study shows that the presence of public investments has a substantial positive impact on private soil conservation decision. This is because farmers perceive the benefit of soil conservation technologies. Thus, continuing and expanding public soil conservation measures that serve as demonstration sites with collaboration of research, extension and farmers is of paramount importance. In this study we find a negative relation between distance from the main road and decision to invest soil conservation. This results suggest that policy makers to give emphasis on expanding road facilities. Expansion of road network has facilitated access to market and as the result the improvement in communication has enabled farmers to keep better informed about outlets. This has provided farmers with strong incentives to seek ways of increasing production by better conservation technologies. The analysis also shows that literate farmers have higher probability of investing soil conservation technology compared to illiterate farmers.

The analysis of insecurity model reveals that expectation of redistribution and farm size have a positive influence on tenure insecurity, whereas education level has a reverse effect. Almost all farmers expect future redistribution and this may erode tenure insecurity. To reverse this situation, the regional government should consider a policy that may end up periodic land redistribution and there should be an awareness campaign to inform all the stakeholders about it to immune them from this problem. Additionally, improving access to land rather than redistribution through other means such as development of land rental markets and encouraging longer lease may be an alternative strategy in situation where formal land transactions are not possible. However, investment has no a significant influence on tenure insecurity.

To sum up, the implication of these findings is that tenure security should be the top priority agenda for the regional government in order to increase farmers' propensity to invest in soil conservation technologies and thereby to reduce soil erosion in particular, and to combat resource degradation in general. Finally, the study underlines the need to carry out future research to investigate the impact of land certification on tenure security.

[3]User rights documentation is being undertaken within the context of existing legislations. And these legislations are the ones that are responsible for promoting tenure insecurity.

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Consumer demand system of agri-food in Tanzania

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This paper focused on consumer demand system of agri-food in Tanzania. The study investigated on the budget share of agri-food, estimated own price and income elasticities of demand of agri-food consumed by the households in Tanzanian context. The Almost Ideal Demand System (AIDS) was employed to estimate the consumer demand system of agri-food. The empirical results revealed that households' food budget share was 60% on average per month. The own price elasticity of demand for aggregated agri-food was inelastic (0.86). Income elasticity of demand for aggregated agri-food was 0.96. Moreover, inelastic demand of own price elasticity of agri-food products informed the government intervention in terms of agri-food price stabilization policies and programmes. Furthermore, income elasticity of < 1 suggested that interventions of Tanzanian government in terms of 'income support policies' can be done by increasing the incomes of lower and middle class income earners in rural and urban areas as consumers' economic stimulus package to increase normal food consumption. In rural areas where majority of farmers dwell, this can be done by promoting the price of farm products through minimum support price so that farmers can earn much more incomes from their economic activities as a result they can use it for purchasing normal food from the business sector.

Key words: Almost ideal demand system (AIDS), agri-food, consumer demand system, income and own price elasticities.

INTRODUCTION

Consumer demand system is the aggregate desire for goods and services expressed by all consumers in the economy. The essential element to consumer demand consists of desire for consumption, with the second condition of ability to pay to such kind of consumption. The desire for consumption must contain the willingness to consume at the prices demanded for that consumption, this establishing the price schedule for goods and services. The willingness to consume diminishes as the price of such consumption increases, on the other hand, willingness to consume increases as price reduces. The consumer demand system of agri-food in Tanzania is characterized by low purchasing power, and most consumers have a strong preference for traditional foods that are suited to their diverse social and ethnic backgrounds (Makweba, 2009). Despite this, the demand for processed and quality fresh food is growing, especially due to the recent increase in the middle class across the country. Both formal and informal food markets are changing constantly, driven by lifestyle changes brought about by urbanisation, income growth and changing of family structures. However, the transformation of agri-food markets in Tanzania has been characterised by different extents of supermarketisation, especially in the urban areas.

Panagiotis et al. (2011) estimated censored linear almost

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almost ideal demand system of food in Pakistan, they revealed that all own-price elasticities but one are found to be negative and all total food expenditure elasticities are found to be positive. However, they suggested that the estimated elasticities can be used for policy analysis for international organizations and the national government to monitor the food security situation and to develop sound and proper intervention policies to mitigate the negative shock impact on food consumption and under nourishment. Taljaard et al. (2006) analysed a meat consumer demand in South Africa using Linearized Almost Ideal Demand System and Rotterdam models, they revealed that the Linearized Almost Ideal Demand System proved to fit better than Rotterdam model in South Africa meat demand market because of its flexibility to any form of utility function. Katchova and Chern (2004) examined a non-nested comparison between Quadratic Expenditure System (QES) and almost ideal demand system (AIDS) based on empirical data of food demand structure in China. They found that AIDS is the suitable model than QES for estimation of consumer demand system because of its unrestricting to any form of utility function.

The present study is focused on investigation of food budget share consumed by the households, to estimate own price and income elasticities of demand of agri-food consumed by the households in Tanzanian context.

METHODOLOGY

Types of data

Secondary data on 'agri-food consumer demand system' were collected from household budget survey (HBS) conducted in 2007 by the National Bureau of Statistics (NBS) of the United Republic of Tanzania.

Sampling technique

Households were selected from the National Master Sample (NMS) which is nation-wide covering both rural and urban areas. The sample size of 4680 households were selected by systematic sampling method, from 10466 households involved in HBS of 2007 for 21 regions included in the HBS namely; Dar-es-salaam, Arusha, Dodoma, Iringa, Mbeya, Morogoro, Kilimanjaro, Mwanza, Tabora, Tanga, Kagera, Pwani, Kigoma, Lindi, Mtwara, Mara, Shinyanga, Singida, Ruvuma, Rukwa and Manyara.

Agri-food categories

The 158 food items consumed by the households were categorized into 18 groups. Namely; cereals (paddy, rice, green maize cob, maize grain, maize flour, millet grain, millet flour, sorghum grain, sorghum flour, wheat grain, wheat flour, barley and other cereals). Cereal products (bread, biscuits, buns, cakes, chapatti, macaroni, spaghetti, cooking oats, and other cereal products). Roots and starches (cassava fresh, cassava dry, cassava flour, round potatoes, sweet potatoes, yams, cocoyam, cooking bananas / plantains and other starches). Sugar and sweets (sugar, honey, syrup, jams, ice cream, chocolate and sweets). Pulses (dry peas, green peas shelled or in pods, dry beans, green beans shelled or in pods, lentils, red grams, green grams, and other pulses). Pulse products (bagia). Nuts (groundnuts in shell, groundnuts shelled, coconuts, cashew nuts, and other nuts). Vegetables (carrots, radishes, beets, turnips, garlic, onions, spinach, lettuce, cabbage, other leafy vegetables, tomatoes, bitter tomatoes, ladies fingers / okra, cauliflower, cucumber, pumpkins, brinjals/eggplant, fresh green pepper, other cultivated vegetables, other wild vegetables, dried vegetables and canned vegetables). Fruits (bananas, oranges, limes, mangoes, avocado, pawpaw, sugar canes, apples, pears, other wild fruits). Meat and poultry products (mutton, beef, mince sausages, pork, pork sausages, goat meat, bacon, other domesticated animals, wild animals, offal (liver, kidney), dried or salted meat, canned meat, and other meat products, chicken, eggs and other poultry.

Milk and dairy products (fresh milk, yoghurt, cream, cheese, canned milk and powder milk). Fish and shellfish (fresh fish, shell fish, fresh dried fish, dried or salted fish/ shellfish fillets, and canned fish / shellfish). Oil seeds and fats (cottonseed oil, groundnuts oils, sesame oil, sunflower oil, olive oil, butter, margarines cooking fat, and other cooking oil). Spices and other foodstuffs (red / black peppers, curry powder and other spices as well as salt, yeast, baking powder, and other foodstuffs). Raw materials for drinks (tea powder, coffee powder and cocoa powder). Soft drinks (coca-cola, fanta, pepsi, mirinda, juice, mineral water), tea, coffee, cocoa and other beverages. Alcoholic drinks (Kilimanjaro beer, Safari beer, Guinness beer, Castle beer, Ndovu beer, Serengeti beer, other canned / bottled beer, chibuku and other local brews). Tobacco-cigarettes (sportsman, sweet menthol, nyota, snuff, pipe tobacco and other cigarettes). The categorizations of the food items were done to rule out the substitutability and complementary effects in the consumer demand system model.

Model specification

The almost ideal demand system (AIDS)

The almost ideal demand system (AIDS) proposed by Deaton and Muellbauer (1980), was employed to study the 'consumer demand system' of agri-food in Tanzanian context. It can be depicted as:

$$\omega_h = \alpha + \Sigma\gamma In P_h + \beta In\left(\frac{\mathrm{M}_h}{\mathrm{P}_h^*}\right). \quad (1)$$

Where: ω_h = Food budget share of the household, α = food budget shares parameter when all prices and real expenditure are equal to one (intercept), γ = price parameter, P_h = prices of food commodities consumed at the household, β = expenditure share parameter, M_h = total expenditure share of the household on all commodities (real income), I*n* = natural logarithm, P^*_h = price index. Pr ice index can be defined as:

$$In\mathrm{P}_h^* = \sum \omega_h In\mathrm{P}_h. \quad (2)$$

The α parameter is the average food budget share when all prices and real expenditure are equal to one. The β parameter measures the change in the *i* th budget share with respect to a change in real income, all else factors held constant, and indicate whether goods are necessities or luxuries. If $\beta i < 0$, ωi decreases when real income *(Mh)* increases so that good *i* is a necessity. Conversely, if $\beta i > 0$, ωi increases with real income *(Mh)* so that good *i* is a luxury. The γ parameter measures the change in the *i* th budget share for a unit change in price (*Ph)* with real income held constant. The private household was represented as a single consumer. The rational consumer always aims to maximize utility subject to budget

Table 1. Parameter estimates of food consumer demand.

Variable	Adj R^2	Parameter	Parameter estimates	Standard error	t -Value	Pr	Food budget mean
Food budget share		α	0.03	0.03	1.00	0.3179	0.60
Food price	0.39	γ	0.07*	0.003	23.45	<.0001	
Real income		β	-0.03*	0.0007	-37.43	<.0001	

* Implies significant at 5% level of significance.

constraint for given prices and initial endowments.

Estimation of price and income elasticities of demand

The own price and income elasticities of agri-foods consumer demand system were calculated as:

$$\varepsilon_{ii} = -1 + \frac{\gamma_i}{\omega_h} - \beta i \quad (3)$$

$$\eta_i = 1 + \frac{\beta_i}{\omega_h} \quad (4)$$

Where: ε_{ii} = Own price elasticity of demand, ω_h = household food budget share, γ_i = price parameter, β_i = expenditure share parameter, η_i = income elasticity of demand.

Parameterization of the almost ideal demand system (AIDS)

The demand elasticities for the linearized AIDS model were computed on the basis of estimated parameters of its demand function. A stochastic element was introduced in the demand function to obtain the following equation model:

$$\omega_h = \alpha + \sum \gamma In \mathrm{P}_h + \beta \mathrm{I}n\left(\frac{\mathrm{M}_h}{\mathrm{P}_h^*}\right) + \mu_h \quad (5)$$

Where: μ_h = Stochastic error term.

RESULTS

Estimation of almost ideal demand system (AIDS)

The empirical results for estimation of 'almost ideal demand system' are presented in Table 1. The results revealed that 39% of proportion of variation in food budget share of the household is explained by proportion of variation in food prices and real income jointly (Table 1). The empirical results for parameter estimates of the 'almost ideal demand system' of agri-food are presented in Table 1. The empirical results found that if food prices spike by 1%, the food budget share would increase by 7% under ceteris paribus assumption. On the other hand, if real income increases by one percent, the food budget share is expected to shrink by 3% (Table 1). This has been influenced by limits to the extra money people spend on food when their incomes rise. Consequently, the proportion of total spending devoted to food declines as income increases (Samuelson and Nordhaus 2008).

Food budget share

The households' food budget share for disaggregated food products are presented in Figure 1. The results revealed that cereals are the leading food budget share (26.89%), followed by vegetables (10.05%), meat and poultry products (9.69%), roots and starch (8.41%), pulses (6.99%), sugar and sweets (6.52%), fats and oil seeds (5.39%), soft drinks (5.26%), cereal products (5.04%), alcoholic drinks (3.79%), fish and shellfish (2.67%), milk and dairy products (2.31%), cigarettes (1.19%), spices and other food stuffs (0.98%), raw materials for drinks (0.78%), nuts (0.38%), fruits (0.29%) and pulse products (0.10%) (Figure 1).

Estimation of own price and income elasticities of demand for aggregated food groups

The empirical results of own price and income elasticities of demand for aggregated food groups are presented in Table 2. The own price elasticity of demand is negative 0.86 whereas income elasticity of demand is 0.96.

Estimation of own price and income elasticities of demand for disaggregated food groups

The empirical results of own price and income elasticities of demand for disaggregated food groups are presented in Table 3.

DISCUSSION

Parameter estimates

The implication of the empirical results is that 39% of

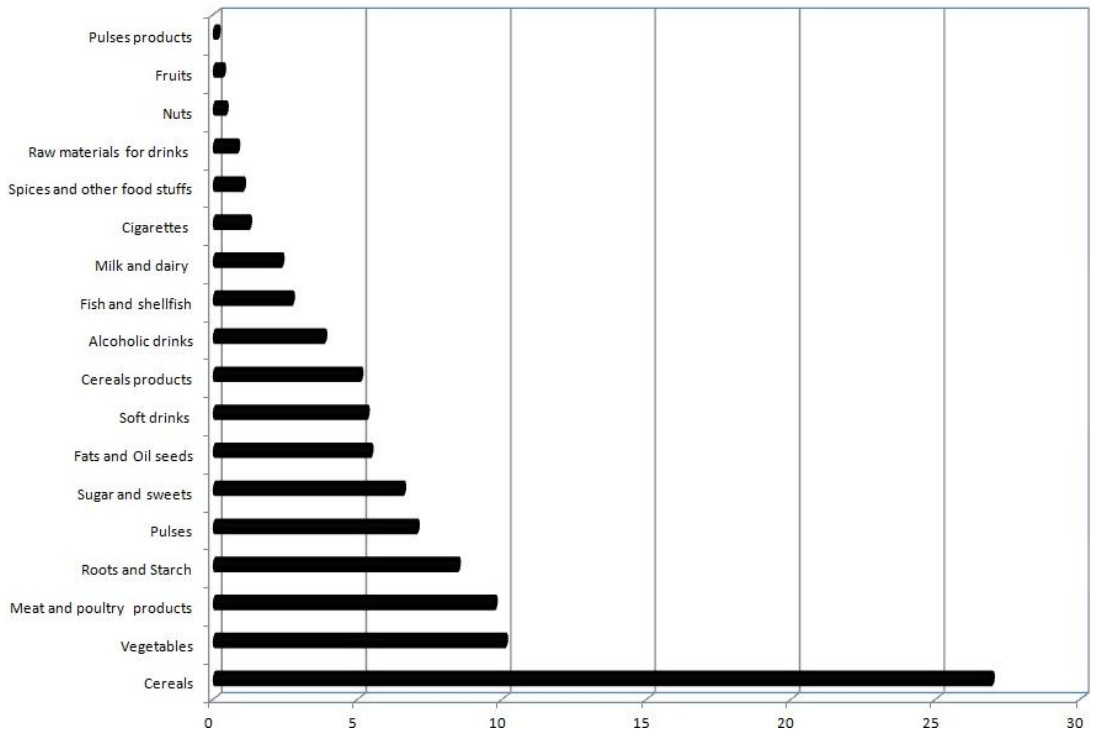

Figure 1. Tanzania Mainland: Budget share of food products for Households Budget Survey (HBS), 2007 (%).

Table 2. Own price and income elasticities of demand of aggregated food groups.

Own price elasticity	Income elasticity
- 0.86	0.96

proportion of variation in the household food budget share is driven by food prices and real income under *ceteris paribus* (Table 1). However, the adjusted R^2 is the goodness of fit of the econometric model measures the proportion of variation in the households' food budget share accounted for by the food prices and the real incomes jointly. Under *ceteris paribus*, empirical results revealed that there was a robust positive relationship between food prices and food budget share. If food prices spike by 1%, the food budget share is expected to increase by 7% because as food price spikes, consumers used to allocate much more money on food to withstand the robustness of food inflation. On the other hand, empirical findings revealed that if real income hikes by 1%, the food budget share is expected to decline by 3% because as income increases, consumers used to shift to luxurious goods consumption. Furthermore, the empirical results confirmed that food prices and real incomes are primary determinants of food budget share of the households at probability value of less than 0.0001; hence, food prices and real incomes are significant determinants of food budget share at 5% level of significance. If food prices and real incomes are minimal, the food budget share is expected to increase by 3% under ceteris assumptions (Table 1).

Food budget share

The empirical results found that households' food budget share is 60% on average for households' budget survey of 2007 (Table 1). The households' food budget share of 2007 declines by 5% from 65% of the 2000/2001 food budget share and shrink by 11% from 71% of the 1991/1992 food budget share. The implication of the findings is that household's budget devoted to food declines as the incomes of households rise. Similar findings have been reported by National Bureau of Statistics (2001) of the United Republic of Tanzania for households' budget surveys of 1991/1992 and 2000/2001. It reported that households' food budget shares for HBS 1991/1992 and 2000/2001 were 71 and 65% on average respectively which were consistent to incomes increase. However, households' budget devoted to food was expected to decline as incomes of households rose. The cereals are the leading food budget share (26.89%) because these are the main food staples consumed by the majority of food consumers in the country. The major consumed cereals include maize grain, green maize cob, maize flour, paddy, rice, sorghum grain, sorghum flour, wheat grain, wheat flour, millet grain,

Table 3. Tanzania mainland: Own price and income elasticities of demand of disaggregated food groups for households budget survey (HBS), 2007.

Food product	Own price elasticity (ε)	Income elasticity (η)
Cereals	-0.941	0.961
Cereal products	-0.786	0.946
Pulses	-0.956	0.987
Pulse products	-0.909	0.981
Fruits	-0.855	0.925
Vegetables	-0.971	0.982
Sugar and sweets	- 0.899	1.026
Roots and Starch	-0.828	0.988
Fats and oil seeds	- 0.802	0.967
Meat and poultry	- 0.990	1.070
Spices and other food stuffs	- 0.835	0.944
Milk and dairy products	- 0. 646	0.701
Tea, cocoa, coffee powders	- 0.524	0.844
Fish and shellfish	-0. 699	0.871
Soft drinks	- 0.823	1.028
Alcoholic drinks	-0.845	1.066
Cigarettes	- 0.985	1.031
Nuts	- 0.833	0.874

millet flour, barley and other cereals. The main consumed vegetables are tomatoes, other leafy vegetables, onions, pumpkin and cabbage. The major consumed meat and poultry products are beef, chicken, goat meat, pork meat, eggs, and other poultry (Figure 1).

The main consumed roots and starch are cassava flour, cooking banana / plantains, round potatoes, yam, cocoyam and sweet potatoes. The major consumed pulses are dry beans, broad beans, soya beans, peas, lentils and other pulses. The main consumed sugar and sweets are brown sugar, white sugar and sweets. The main consumed fats and oil seeds in the country are margarine, sunflower, groundnut, sesame, and other cooking oil. The major consumed soft drinks are mineral spring water, coca-cola, fanta, pepsi, tea without milk, tea with milk, fruit juice, mirinda and other soft drinks (Figure 1). Furthermore, the main consumed cereal products are bread, buns, chapatti and biscuits. The leading consumed alcoholic drinks are Safari beer, Kilimanjaro beer, Castle beer, Serengeti beer and local brew (chibuku and others). The major consumed fish and shellfish are dried sardines, fresh /chilled /frozen fish, dried / salted shellfish and dried fish. The main consumed milk and dairy products are fresh cow milk and yoghurt. The leading consumed cigarettes are sweet menthol, sportsman and nyota (Figure 1). The major consumed spices and other food stuffs are salt, other spices (masala), red and black pepper, other food stuffs, yeast and baking powder. The tea, coffee and cocoa powders are majorly consumed as raw materials for drinks. The groundnuts, cashew nuts, and coconuts are the main nuts consumed in the country. The major consumed fruits are pawpaw, orange, banana, mango and other wild fruits (Figure 1).

Estimation of own price elasticity of demand for aggregated food groups

In Table 2, empirical results revealed that the own price elasticity of demand is (-0.86), falls between negative 1 and zero ($-1 < \varepsilon p < 0$) which means that it is inelastic demand. The implication of inelastic demand is that food is a necessity good for life because as food price spikes the consumer expenditure share on food spikes as well, despite a decrease in consumers demand due to the fact that change in quantity demanded is smaller than change in price. The own price elasticity falls under demand curve which is negatively sloped (law of demand) implies that as price of food increases, consumer demand decreases due to increase in consumers expenditure share on food. The similar findings have been reported by Henderson and Quandt (2003) and Sadoulet and de Janvry (1995), they reported that as the price of a good increases, the consumer demand tend to shrink due to increase in consumers expenditure share on the particular good.

Estimation of income elasticity of demand for aggregated food groups

The empirical findings for income elasticity of demand for aggregated food groups are presented in Table 2. The

empirical results found that income elasticity of demand for aggregated food is 0.96, implies that food is a necessity good for life. Also, this result implies that as income increases consumers used to consume normal goods by shifting from inferior goods. The similar results have been reported by Annabi et al. (2006) for functional forms and parameterization of computable general equilibrium (CGE) models, they pointed out that increase in incomes of the households reduced the demand for inferior goods due to change of consumer preferences from inferior to normal and luxury goods. Samuelson and Nordhaus (2008) reported on the similar results that there are however, limits to the extra money people will spend on food when their incomes rise. Consequently, the proportional of total spending devoted to food declines as income increases.

Estimation of own price elasticities of demand for disaggregated food groups

The empirical findings revealed that own price elasticities of demand for agri-foods were inelastic ($-1 < \varepsilon p < 0$) which implies that as the agri-food price spikes, consumers expenditure share increases despite a decrease in consumer demand due to the fact that the proportionate change in quantity demanded is less than proportionate change in prices consumers are able to pay. Moreover, the own price elasticities of the agri-food is negative because the corresponding demand curve is downward sloping (law of demand curve) (Table 3).

Estimation of income elasticities of demand for disaggregated food groups

The income elasticities of demand for most of disaggregated food products were < 1, implies that food are normal goods which used to have income elasticity of < 1 meaning that as incomes of consumers increases the expenditure share devoted to food increases less than increase in incomes because foods are the necessity goods for life (Table 3). However, income elasticities of demand for sugar and sweets, meat and poultry, soft drinks, alcoholic drinks and cigarettes were > 1 attributed to increase in consumer demand more than proportionally increase in income; hence expenditure share of these foods increases higher than incomes increase (Table 3). T he similar results have been reported by Panagiotis et al. (2011) for food consumer demand system in Pakistan, Taljaard et al. (2006) for meat consumer demand system in South Africa, Sarntisart and Warr (2005) for food consumer demand system in Thailand, Katchova and Chern (2004) for food consumer demand system in China, and Ananda et al. (2003) for food consumer demand pattern in Tanzania.

They reported that food own price elasciticties of demand tend to be inelastic because as price spikes willingness to consume tend to decline due to increase in consumers expenditure share whereas income elasticities for food tend to be < 1 because as income hikes the expenditure share devoted to food used to decline despite the fact that food is a necessity good for life as compared to luxury goods which used to have elasticities of > 1.

CONCLUSION AND POLICY IMPLICATIONS

The food consumption priority is for cereals, followed by vegetables, meat and poultry products, roots and starch followed by pulses, sugar and sweets. Moreover, cereal products, fats and oils seeds, and soft drinks are the next major products consumed in the country. However, pulses products consumption is meagre, which implies that value added in pulses is less. Therefore, the priority sectors may be encouraged to have perfect market competition so that fair and free competition exist, so as consumers can get the necessity products at reasonable price.

The inelastic demand of own price elasticity for food products informs the government intervention on food price stabilization policies and programmes which can be achieved through subsidizing the prices of staple food which have higher household budget shares such as maize, rice, sorghum, cassava, pulses, sweet potatoes consumed by the majority of lower and middle class income earners in rural and urban areas in the country. The high expenditure elasticities of milk and dairy, cereals, cereal products, pulses, fish, fruits, vegetables, roots and starches, fats, and oil seeds, suggest that income support programmes are likely to be good policy tools to promote consumption of these staple food items among urban and rural household consumers. Furthermore, income support policies can be done through increasing the income of lower and middle class income earners in rural and urban areas as consumers' economic stimulus package to enable them to increase consumption of normal foods by shifting from inferior foods.

The highest expenditure elasticity also suggests that the consumer demand for meat and poultry, sugar and sweets, soft drinks, alcoholic drinks, and cigarettes, is likely to expand as the economy develops.

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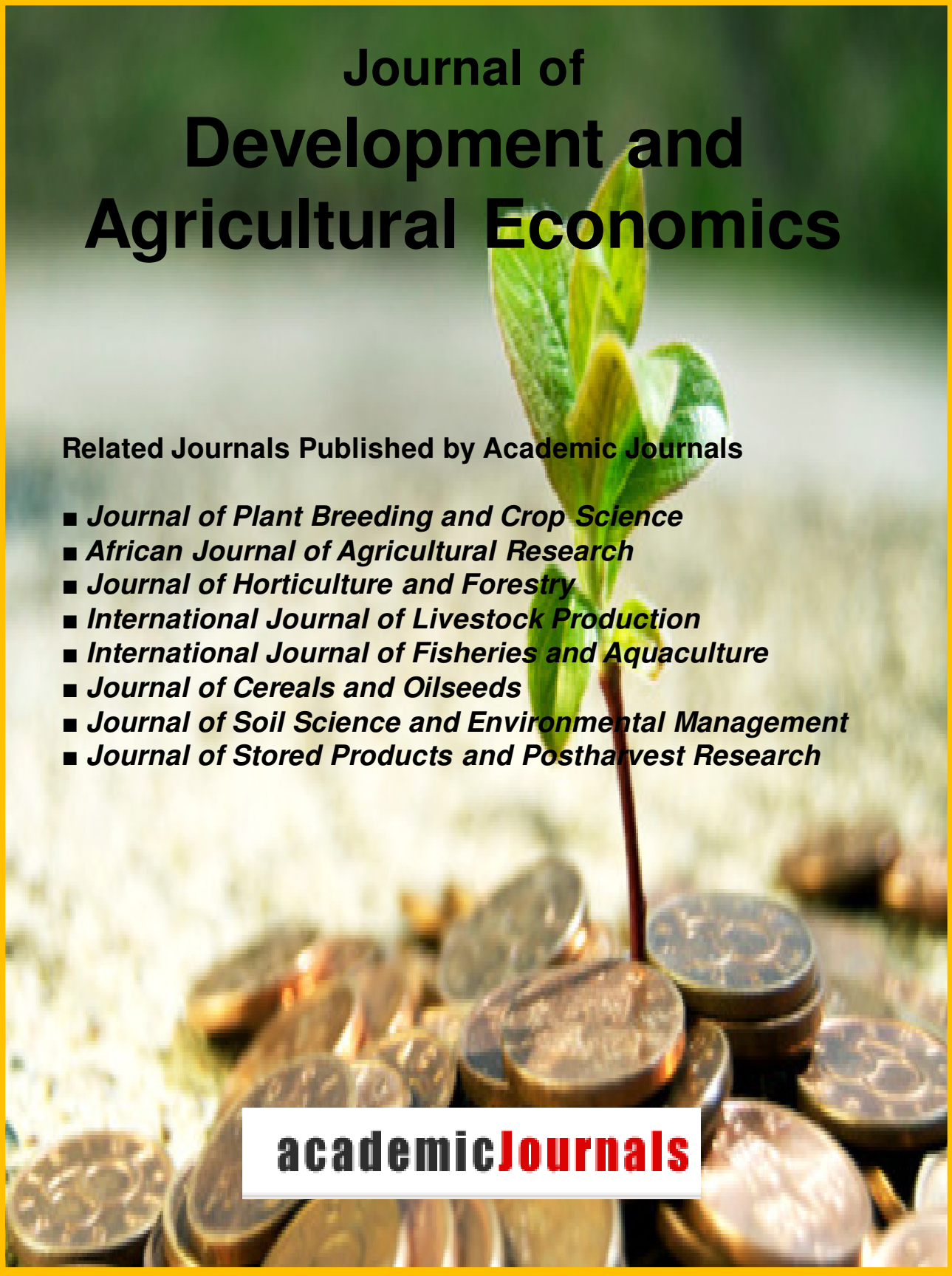

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