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MARGINAL EFFECTS OF FARMERS' AGE ON THEIR IRRIGATION TECHNOLOGY ADOPTION IN POVERTY REDUCTION IN KWARA STATE

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Abstract

This study evaluated the marginal effects of farmers' age on their irrigation technology adoption in poverty reduction in Kwara State, Nigeria. Farm-level and household-level primary data were obtained with the use of well-structured questionnaire and interview schedule from 348 respondents, from villages and communities covering a total of five (5) Local Government Areas. Data were subjected to descriptive statistics and instrumental variable of two-stage least square regression model. The household heads who were in their productive age (18-59 years) increased their annual per capita income by 62.5 per cent by their adoption of the irrigation technology. An additional year of schooling increased annual per capita income of household heads in their productive age (18-59 years) by 2.3 per cent. It was concluded that, education is vital to the adoption of irrigation technology, young farmers are more productive than their older counterparts.

Keywords: Irrigation, adoption, marginal effect.

Introduction

Adequate and efficient irrigation provides a reliable employment, increase cropping intensity, increase yield per hectare and eventually generate more income, hence, high standard of living for the farmer (Jamala, Shehu & Garba, 2011). Therefore, it reduces poverty by ensuring food security and by stabilizing (or lowering) food prices both in the rural and urban markets (Lipton *et al.*, 2003). Irrigation increases agricultural production by providing all year round farming opportunities through the artificial supply of water to crops. It has the ability to regulate water supply to crops especially at times when the crops need water most and provides drainage facilities for the disposal of excess water, which is impossible with rain-fed agriculture (Simeon, 2010).

Irrigation farming is one of the most important rural development investments that can have both direct and indirect impacts on poverty and food security in semi-arid tropical countries (IFPRI 2002; Bhattarai & Narayanamoorthy 2004). Empirical evidence from Australia shows that a dollar worth of output generated in irrigated agriculture generates more than five dollars worth of value to the regional economy, which suggested irrigation development has a strong multiplier effect on other sectors of the economy (ali & Pernia, 2003). Moreover, Hussain & Hanjra (2004), also found that the productivity of irrigated lands were twice that of non-irrigated reference areas, the net productivity benefits defined as the difference in net output values between irrigated and non-irrigated lands varied widely across settings from US$23 to US$600 per hectare.

Irrigation in Nigeria has become an issue of vital importance considering present population growth rate (Jamala, Shehu & Garba, 2011). Recent report shows that population is increasing by 3.5% annually, while food production is increasing by only 2.5% the food and Agricultural Organization for instance, has warned that by the year 2025, Nigeria will no longer produce enough food to feed her self, solely from rain fed agriculture. One of the complimentary measures that could be taken is to intensify irrigated agriculture (Jamala, Shehu & Garba, 2011).

The objectives are to;

- examine the socio-economic characteristics of respondents in the study area,
- evaluate marginal effects of farmers' age on their irrigation technology adoption in the study area

Methodology

The study was conducted in Kwara State, Nigeria. Specifically, the study covered Oke-Oyi and Songa scheme of the Lower Niger River Basin Development Authority. Kwara State consists of sixteen (16) Local Government Areas. The State is located in the middle belt (North Central) of the country within latitude $7^0$45'N and $9^0$30'N and longitude $2^0$30'E-$6^0$25'E. The State is bounded in the north by Niger State, in the South by Osun and Ondo States, in the East by Kogi State and in the West by Oyo State. Kwara State shares an international boundary with the Republic of Benin (Taiwo, 2005). The population of the state is put at 2,371,089 which is made up of 1,220,581 males and 1,150,508 females. It covers an estimated land area of 32,500km^2 out of which 75.3% is cultivable and found suitable for almost all forms of food crops (Federal Office of Statistics, 1996; Saraki, 2008). The State has two main climatic seasons, the dry and wet season. Annual rainfall ranges between 1000 to 1500mm while the average temperature lies between 30ºC and 35ºC (KWADP, 1996). The State is divided into four zones by the Kwara State Agricultural Development Project (KWADP) in consonance with ecological characteristics, cultural practices and project's administrative convenience. These are: Baruteen and Kaima Local Government Areas (Zone A); Edu and Pategi Local Government Areas(B); Asa, Ilorin East, Ilorin South, Ilorin West and Moro Local Government Areas (Zone C); and Ekiti, Ifelodun, Irepodun, Offa, Oyun, Isin and Oke-Ero Local Government Areas (Zone D).

Population of the study was made up of all farmers in the rural areas of Lower Niger River Basin Development Authority in Kwara State, Nigeria. A multistage sampling procedure was employed for the selection of respondents for the study. The first stage involved the purposive sampling of Oke-Oyi and Songa irrigation scheme. The second stage involved random sampling of villages and communities where farmers that were involved in the irrigation scheme are located. The third stage involved the random and representative selection of irrigation farmers (treatment) and non-irrigation farmers (control). Farm-level and household-level primary data were obtained with the use of well-structured questionnaire and interview schedule from 348 respondents, from villages and communities covering a total of five (5) Local Government Areas.

The data were mainly primary: these were obtained through the use of a well-structured questionnaire and interview schedule. This was employed to make enquiries on socio-economic, household and farm characteristics, adoption of irrigating activities of the respondents. The crops considered were okra, pepper, maize and sorghum.

The tools and procedure that were employed elucidated the objectives of the study: this includes the following.

Descriptive statistics were employed. They are the mean, percentages and frequency distribution. These were used as tools to describe the socioeconomic information of the individual farmers that were selected for the survey.

One of the common approaches to address these problems is the use of instrumental variables (IV) regression or two–stage least squares (2SLS) estimation. In order to investigate the impact of irrigation technology adoption on poverty of farmers, an instrumental variable in a two-stage least squares regression was done. This is to isolate the impact of technology adoption from other intervening factors. The establishment of a counterfactual outcome is required, as is the ability to overcome selection bias.

It is estimated as:

$$Y_i = \alpha + \beta p_i + \gamma X_i + \xi_i \qquad (1)$$

Where;

$E(\xi_i) = 0$

Y_i = Poverty indicator (Logarithm of annual income)

P_i is the adoption indicator (dummy variable: yes = 1, no = 0)

X_i is the vector of explanatory variables $expected\ to\ influence\ Y_i$

$\gamma = a\ vector\ representing\ the\ marginal\ impacts\ of\ each\ component$

X_i is the vector of explanatory variables $(X_1, X_2, \ldots X_i)$

$X_1 =$ Adoption of irrigation

$X_2 =$ Years of schooling

$X_3 =$ Dependency ratio

$X_4 =$ Household size

$X_5 = Okra\ farm\ size$

$X_6 =$ Pepper farm size

$X_7 =$ Maize farm size

$X_8 =$ Sorghum farm size

$X_9 =$ Ease of land acquisition

$X_{10} =$ Number of extension visit

$X_{11} =$ Frequency of irrigation

$X_{12} =$ Access to credit

Variables that influence adoption of irrigation were awareness, credibility of irrigation scheme, years of schooling, dependency ratio, household size, okra farm size, maize farm size, sorghum farm size, pepper farm size, ease of land acquisition, number of extension visit, frequency of irrigation and membership of cooperative society.

Analysis of Results of Data and Discussion

Over 83 percent of the household heads were within the range of age 21 – 50 (years): while the minority were older household heads and they accounted for about 16 percent of the respondents. The mean age of household heads was 42 years. This implies that the household heads in the study were young and agile: who can still contribute immensely to the economy.

Household heads that had no formal education were 36.5 percent of the respondents: while those that had formal education were 63.5 percent of the respondents. Amidst this: 36.2 percent 18.39 percent and 8.91 percent had primary, secondary and tertiary education respectively. Therefore, the literacy level was above average. This could encourage the acceptability of innovation and help in the adoption of irrigation technology (Dauda *et al*, 2009).

The household heads with a monthly income of less or equal ₦ 60,000 were over 50 percent of the respondents. The mean monthly income of the household heads in this study was ₦ 69,610.These result suggested that, the respondents were majorly low income earners. Income plays a vital role in the expenditure level of an individual. The income of an individual tends to dictate his level of taste for alternative choices (Amao *et al*, 2009). Therefore, majority of the household may not be able to adopt irrigation technology, because they were low income earners. The mean household size was 7 individual. This result is consistent with the result of Yusuf (2008) that, the average household size in Kwara State is 7 individual. The large size of the household could enhance agricultural production if the members serve as farm labour.

Table 1: Socio economic characteristics of household

Socio Economic Characteristics	Frequency	Percentage
Age (years)		
≤ 20	1	0.29
21 – 30	63	18.28
31 – 40	131	37.59
41 – 50	94	27.26
51 – 60	34	9.46
61 – 70	17	4.80
> 70	8	2.32
Mean = 42 years		
Educational status		
No Formal Education	118	33.91
Primary	126	36.21
Secondary	64	18.38
Tertiary	31	8.91
Adult Education	9	2.59
Mean = 6 years		
Monthly income (₦)		
≤ 20000	32	9.20
20001 – 60000	151	43.39
60001 – 100000	104	29.88
100001 – 140000	38	10.92
140001 – 180000	12	3.45
>180000	11	3.16
Mean = 69610.94, Minimum = 2000, Maximum = 420000		
Household size		
1 – 3	41	11.78
4 – 6	115	33.05
7 – 9	104	29.88
10 – 12	63	18.11
13 – 15	16	4.59
> 15	9	2.59
Mean = 7, Maximum = 24		

Source: Field survey, 2013.

Marginal Effects of Age of the Household Heads

Marginal effects of age of the household heads were stated in Table 2. The household heads who were in their productive age (18-59 years) increased their annual income by 62.5 per cent by their adoption of the irrigation technology. However household heads of less productive age (not 18-59 years) reduced their annual income by 34.9 per cent. Thus, the adoption of irrigation technology has high propensity to liberate household heads of productive age from poverty. Household heads within the less productive age have the propensity to increase their poverty status.

An additional year of schooling increased annual income of household heads in their productive age (18-59 years) by 2.3 per cent. However, household heads of less productive age (not 18-59 years) reduced their annual income by 0.1 per cent. Thus, education has high propensity to reduce poverty status of household heads that were in their productive age. Household heads within the less productive age have the propensity to increase their poverty profile even with an additional year of schooling.

Household heads in their productive age will increase their annual income with a unit increase in farm size okra and maize by 13.4% and 5.9% respectively. However, household heads in the less productive age reduced their annual income by 22.8% and 3.9% per an hectare increase in farm size of okra and maize respectively. Therefore, household heads in their productive age have the propensity to adopt innovative technology that can effectively lead to poverty reduction. All things been equal, labour productivity is a function of age (Oladimeji *et al*, 2013). It is believed that old people tends to adhere strictly to traditional methods of production while young people tends to be more willing to adopt new technology in order to increase their productivity (Oladimeji *et al*, 2013).

An additional household member will reduce the annual income of the productive household heads by 5.6 per cent. But the less productive household heads income will increase their annual income per an increase in the membership of the household.

Table 2: Marginal effects of age of the household heads

Variables	Coefficients: Productive age (18-59 years)	Coefficients: Less productive age (Not 18-59 years)
DEPENDENT VARIABLE (Log of annual income)		
Adoption of irrigation	0.625***	-0.349
Years of schooling	0.023**	-0.001
Dependency ratio	0.113*	-0.061
Household size	-0.056***	0.014
Okra farm size	0.134	-0.228
Maize farm size	0.059	-0.039
Sorghum farm size	0.295***	0.595
Pepper farm size	-0.118	0.506*
Ease of land acquisition	0.150*	0.605**
Number of extension visit	-0.036	-0.043
Access to credit	1.069	.
Frequency of irrigation	0.193**	-0.147
Membership of cooperative society	0.388***	.
R^2	0.145	0.561
Probability X^2	0.000	0.0001

*** 1% level of significance, ** 5% level of significance, * 10% level of significance
Source: Field survey, 2013.

Conclusions and Recommendations

Education was vital to the adoption of irrigation technology. Government should therefore, adequately increase annual budgetary allocations to educational sector in other to make basic education (i.e primary up to junior secondary school) compulsory, and education at all levels should be made free. Young farmers are more productive than their older counterparts. Therefore, government and non governmental organizations (NGO's) should provide credit and input incentives to serve as bate that could attract and encourage farmers, most specifically the young and highly educated individuals to adopt irrigation farming. This in effect will reduce irrigation adopter poverty.

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