Journal of Agricultural Science and Engineering
Vol. 1, No. 3, 2015, pp. 114-119
http://www.aiscience.org/journal/jase

Economic Analysis of Factors Affecting the Farmer Income Under Traditional Farming System in South Darfur State – Sudan

Thabit Ahmed Hassan*

Department of Agricultural Economics, Faculty of Agriculture, University of Zalingei, Zalingei, Central Darfur State, Sudan

Abstract

Agriculture is the viable leading sector and main vehicle for growth and development in the Sudanese economy and is certain to remain so far several decade's. The rainfed sub-sector is accounts for 85 to 90 percent of agriculture area in Sudan. Whereas; more than 75 percent of the population in South Darfur State, in western Sudan, are depending on agriculture as their main source of food and income. Millet is the main staple food cultivated in the northern and eastern parts of the region while sorghum is cultivated in the south and in the lowlands (w*adi*). Some people practiced other economic activities in the dry season. These activities are trade, government jobs, handicraft production and forestry related ventures. *The* sample was two stages stratified random sample representing the five localities of Nyala government. *The* farm household head age has got a coefficient of 4.586. This coefficient is significant at 1% level of significance. The value of farm assets had got a coefficient of 1.285, which is highly significant at 1% level of significance with the expected sign.

Keywords

Darfur, Traditional, Farm Income, Lowlands, Significant, Value of Assets, Rainfed

Received: April 27, 2015 / Accepted: May 21, 2015 / Published online: June 28, 2015

1. Introduction

Agriculture is the viable leading sector and main vehicle for growth and development in the Sudanese economy and is certain to remain so far several decade's. The rainfed sub-sector, which, accounts for 85 to 90 percent of agriculture area in Sudan depending on the season, is based on a *low-input: low-output* premise conditioned by the unreliable nature of the rains Alemu (2012).

It provides employment for about 68% of agricultural labour force (6.9 millions) and livelihood of over two thirds of the inhabitants. It contributes to about 50 % of Gross National Product (GNP) Hassan (2001). FAO, (2004) stated that, about 80 % of Sudan's working population in rainfed sub-sector is engaged primarily in either crop production or livestock rearing.

More than 75 percent of the population in South Darfur State, in western Sudan, depends on agriculture as their main source of food and income. The farming systems in the study area are predominantly rainfed, traditional, and operate with limited resources. Abdelrahman (2007) mentioned that they are characterized by the small size of holdings, being dependent on manual family labour, and using few or no external inputs such as fertilizers, chemicals or seeds. Farmers have poor access to information and relevant research results, and yields obtained are very low.

2. Economic Activities in South Darfur State

Darfur is a region in western Sudan which is comprised of five states with total population of about 8.1 million persons.

* Corresponding author
E-mail address: erthahmed@Gmail.com

Most households in the Darfur region depend on agriculture and livestock for their livelihoods.

Traditional rain-fed agriculture is the dominant seasonal farming activity across the region. (Abdur, 2000) stated that the traditional sector is made up of small family units of 2 ha (Darfur) to 50 ha, farming for both income and subsistence.

Millet is the main staple food cultivated in the northern and eastern parts of the region while sorghum is cultivated in the south and in the lowlands (w*adi*). Nearly all households attempt to diversify their incomes by engaging in petty trade, firewood and grass collection and sale, domestic labour, long-distance labour migration as well as to augment through remittances, gathering and consumption of wild foods (WFP 2011).

The economy of the area under study is dependent on traditional rainfed crop production and animal rising (Abdur, 2000). The farm cultivation is practiced on the sandy soils for production of staple food grains, mainly millet and cash crops, such as groundnuts and sesame, Hassan (2001). They also produced sorghum on the alluvial deposits around the valleys in small holdings plus some vegetables such as okra, tomatoes etc. The introduction of tractor is very rare, except in some pockets on the clay soils around Nyala town. Some producers used animal tractions for seedbed preparation and first weeding simultaneously, after the first showers and emergency of weeds.

Some people practiced other economic activities in the dry season. These activities are trade, government jobs, handicraft production and forestry related ventures, e.g. Gum – Arabic and charcoal production. Due to the rural area suffering from lack of work opportunities during the dry season, some people have migrated to look for work in nearby cities.

Millet and sorghum are main food grain produced in Darfur for home consumption. Their productivity is very low compared to the national level. This has resulted from natural resources degradation, non-commercialization attitude prevailing among farmers coupled with the lack of government economic policies to hedge against years of bad harvest, in addition to the low income from agricultural production due to low crop yields and low crop prices. Felix (2013), stated that often because of poor harvests due to erratic rains and dry spells, and limited alternative income sources.

However, most of millet grown in Western Sudan (Darfur and Kordofan) is used for home consumption by farmers, though; surplus is sold to the other farmers or to local middlemen, Thabit (2015). Farmers usually sell their crops at very low prices during or after harvest to meet their high need for cash and to repay the loans for formal institutions or informal system *(sheil*) the lack of active marketing and storage facilities also caused the low prices.

Abuel Gassim (1999) reported that, for millet improvement in Western Sudan the main constraints, facing millet production are:-

1-Low of rainfall and its erratic distribution,

2-Low yields of landrace, and varieties that are cultivated in the area.

3-Millet affected by pests, such as *Heliocheclus ablipumetella* (raghuva), *Rhinyptia infuscta,* locust, stem borers, rates and birds and Downy mildew and smuts are the main diseases.

4-Poor cultural practices and decrease of soil fertility,

5- Socio-economic factors such as, weakness of purchasing power among farmers and the high costs of inputs, e.g. fertilizer, pesticides…. etc. for development of crop productivity.

3. Farm Incomes

As mentioned before the farm household objectives are primarily to produce for home consumption and income generation is the second. On the average a farm household has three to four income resources, crop and livestock account for the bulk of total income, the rest is distributed between non-farm and transfer incomes. Cash is needed for household needs, farm managements, taxes, school fees and other expenses. It has been found that by (Tesfaye, 1992), income generated from the above sources is used for consumption needs which is accounted on average of 70 percent of total household budget in normal year and assets accumulation to supplement crop production.

The study found that in the study area, farm household income is characterized by large variation among them. Data displayed in Table (1) showed that the average farmer's annual income in the study area about SdG9493.0 in 2013/14 season, which is less than the national per capita income (SdG74538.7) in 2013/14. This characterizes these farmers as poor. Eberhard et al., (1999) defined that anyone whose income is less than half the average income of the total population of the respective country is considered as poor. This is not surprising in the State where the percentage of poverty conditions exceeded 95%. However, the only strategy is to augment their incomes through off farm opportunities works and intervention to develop agricultural innovations, which are suitable for farming system in the area and also acceptable to producers.

However, about 22 percent of the respondents did not report

any crop sale during the survey time. They also delay selling their product until the prices rise at the end of the season. Data also revealed that about 46 percent of respondents are of low income having less than SdG5000.0, which is less than the average income. Simon (1990) suggested that, farm incomes are not only low, but also highly variable during the season. This was emphasized by (Tesfaye, 1993) who reported that, household income is characterized by seasonal variations and the annual flow of income normally rises and reaches the peak during harvest season when farm production is at highest compared to the end of season. Also the data in Table (1) revealed that 3.3 percent of respondents have income more than SdG35000.0. Those are affluent farmers, who usually received credit from the Agricultural Bank of Sudan (ABS).

However, the high proportion of low income among farm households generally prevails throughout traditional agricultural system of Darfur. Farm household of low rate income could not purchases technological innovations which led to the use of the backwards tools in the cultivation processes and consequently reduced crop productivity. Joske (1991) said that since small-scale farmers usually produce only a small surplus for the market, they cannot earn enough money to buy capital intensive inputs. On the other side productivity also results in low income and cash liquidity constraints. Therefore, the low productivity has prevented accumulation of funds for reinvestment and purchase of improved inputs.

Table (1). Frequency Distribution of Respondents According to Farm Income in the Study Area.

Income(SdG000)	Respondents	%of Total
5000 ≤	69	46
5100 -10000	37	24.7
10100 -15000	13	8.7
15100 -20000	12	8
20100 -25000	8	5.3
25100 -30000	2	1.3
31000-35000	4	2.7
≥ 35000	5	3.3
Total	150	100

Source: -Field Survey 2013.
Ÿ = SdG9493.0

Also the problem of cash scarcity forces farm households to sell their crops during harvest time at lowest prices, (Elnoush, 1999). He added that, this again causes low income and forces them to work for the others to earn cash for the consumption needs rather than working on their own land which in turn results in low productivity.

4. Off-Farm Income

In the wet season when the agricultural operations are in their peak, farm households need extra income to meet their consumption needs as well as to finance their farm activities. During this period the poor farm households try to sell their labour to affluent farmers in the area to earn cash income. This kind of off-farm income is of very little significance because most of the demand for hired labour during the peak season is supplied through mutual assistance "*Nafir*".

On the other hands farm households have practiced a number of other activities in the dry season to supplement their farm income. These activities include regular off-farm occupations as well as income generating capital investment. For instance the study found that in the study area some of farm households are employed by the government as school teachers, guards, policemen, medical assistants, mill operators and others are operating in animal carts, handicrafts, charcoal-------etc. The income acquired from the above opportunity activities has participated in the total farm household income by about 38 percent, which is less, compared to that found by (Lynn et al., 1996) in his study of sub-Sahara Africa. He reported that, non-farm sources have been found to provide an average of 58 percent of total income in rural households.

5. Objective

To investigate the farm income with which the farm household must decide how much capital to spend.

6. Hypotheses

The farmers have limited income to use and must decide how much capital they want to spend.

7. Research Methodology

7.1. Sample Technique

The sample was two stages stratified random sample representing the five localities of Nyala government namely, Nyala, Darelslam, Beleil, kass and Shataya. First,three villages were selected from each localities at random. This was done in a way that each village should be located at a direction different from the others and to represent the whole geographical area of the government. In the second stage, from each village ten respondents were selected randomly, (150) farm households from the list of Cooperative Organizations of farm households in the villages

7.2. Data Collection

The study depended mainly on primary data which were collected using structured questionnaire through direct

interviewing of small farmers who grew millet during the season 2013 – 2014. The data collected are: Farm household head age, household size, total labour, value of assets, market distance, operational area and weather conditions as dummy variable. The survey was carried out during, March and April of the year 2014. This period coincided with the end of the harvesting season. The respondents at this time were expected to recall all the relevant information thoroughly.

7.3. The Theoretical Aspect of Models Specification

$$Y = f\ (X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + e)$$

The Ordinary Least Square (OLS) method was adopted with classical normal assumptions N $(0, \sigma^2)$ to estimate the model. In this model income was calculated from two resources, agriculture and animal holdings and was regressed on variables.

Symbolic names of variables and definitions are presented in Table (2).

Table (2). Definitions of Variables.

Symbols	Definitions
Y	Farm Income
X1	H. H. age
X2	H. size
X3	Labour (man days)
X4	Value of assets
X5	Market distance
X6	Operational area
X7	Dummy for weather condition

The concepts and definition of variables used in this study are discussed as follows:

7.3.1. Farm Income

Farm income used in this study is limited to the value of all surplus products that could be sold, whether they are cash or non-cash crops. Household's surplus would be evaluated by farm-gate prices. The income that household gain from the farm will cover the consumption expenses and other household necessities and the surplus will be invested in the farm for the next season as factor input. The researcher expected that farm income have a positive relationship to farm output.

7.3.2. Farm Household Head Age

The average of all respondents age was 43 years ranging from 26 to 76 years. The elder farmer has more experience in farm operations which will help to increase his output, but he lacks the capacities or aspiration of younger farmer and that is expected to lower his MPP and the area cultivated. Although his household members would grow up and participate in the field operations, yet we expected that farm household head age will have a negative relationship to farm output.

7.3.3. Farm Household Size

The average member of the household in the study area was seven persons, ranging between 2 to 19 members. However, the large household size should be cautiously looked into. A large household size can have two opposing effects on the head of household:

a) a large household represents an increase in labour force for households and can be expected to have positive relationship with agricultural output,

b) on the other side a larger household means more mouths to feed which might well increase a risk.

7.3.4 Value of Assets

The main sources of income for household were agricultural production (crop production and animal production). On the other hands farm households have practiced a number of other activities in the dry season to supplement their farm income. These activities include regular off-farm occupations as well as income generating capital investment, in addition to other income resources like transfer incomes, gift……etc.

7.3.5. Total Labour

Labour is the main input in the traditional rainfed agricultural production in Darfur as in some other parts of the country. With regards to labour no distinction can be made between household members as gender issue, even between hired labour. The labour variable should be measured in terms of standardized units with no changes in skill, composition or intensity. Labour force was measured using standard man-day. A standard man-day was taken as the effort excreted by healthy adult in the age (15-65 year) in a working day. However, a one-day labour input in the traditional production areas was assumed to be one standard man-day for each adult man and women separately, while for children and old men it was 0.5 as index. However, the researcher expected that the labour input have positive relationship with the two main food grains production.

7.3.6. Market Distance

It is the distance between market place in the towns and villages in Kilometres.

7.3.7. Operational Area

The data collected regarding the unit of operational area was initially recorded in local unit, i.e. *Mukhammas* (1 *Mukh* = 1.73 feds.) and then converted into feddans for millet and sorghum land. However, it was difficult to determine land quality variability in the surveyed area. So we expected that the marginal physical product of land to be

7.3.8. Dummy Variable, D_1

Weather conditions are used as a dummy variable. It includes rainfall, humidity, temperature, erosion and vegetation. These factors are location specific and they are important factors influencing the agricultural production. It was reported that in most socio-economic surveys, these factors are represented by ordinal scales, such as good/bad, high/medium/low…etc (Adedapo et al 1996). This ordinal scale factor was given the value of one if the answer of question is yes and zero otherwise. The researcher assumed that the bad weather conditions will have a negative relationship with the farm output.

8. Result and Discussion

One of the hypotheses that were stated in this study was that, the farmers have limited income to use and must decide how much capital they want to spend. To test the hypothesis that the farmers have inadequate income to purchase farm inputs to produce the main food grain in Darfur State. Statistical regression model was formulated in which the effect of the inputs on farm income was investigated.

Estimated values of the regression coefficients were tested for statistical significance, using student's t test, and the overall regression equation by F-ratio test. The results of multiple linear regression equation are postulated in the Table (3).

The multiple coefficient of determination, R^2, was above the moderated level of fitness, which showed that 63% of the variation in the farm income could be explained by the specified independent variables in the model.

The F-ratio as an overall measure of significance was 45, which is significant at all levels of significance, compared to the tabulated F-value of 2.64 at 1% level of significance with 7 and 184 degrees of freedom. However, it is confirming the goodness of fit of the model and indicating the hypothesis is rejected.

The intercept value was 3.653, which was not significant at any reasonable level of significance.

The farm household head age has got a coefficient of 4.586. This coefficient is significant at 1% level of significance, with positive sign. It showed that as the age of farm household head increases by 1% the farm income would increase by 4.586%. The farm income coefficient with the respect to farm household head is very high relative to the expected one. On the other hand it also implies that the elder the head of farm household, the more likely to generate higher income. This is because old people are highly experienced and have a wide scope investment mind and have the ability to utilize their resources efficiently in order to protect their families from unexpected disasters.

Table (3). Result of Income Regression Equation

Variables	Coefficients	Standard error	t-value
Intercept	3.653	179.635	0.02
H. H. age	4.5861*	1.175	3.902
H. size	3.2999	3.798	0.869
Labour (man days)	0.081	0.542	0.150
Value of assets	1.295*	0.007	185.00
Market distance	-5.238	3.654	-1.433
Operational area	17.110*	1.032	16.579
Dummy for weather condition	-3.653**	1.794	2.036
$R^2 = 0.63$	$R^{2Adjusted} = 62$		F-ratio = 45

** Significant at 1% level
* Significant ant 5% level

The data also revealed that the household size had a coefficient, with a positive sign. These indicates that large size of household is more productive in term of labour force and has a better chance and opportunities to diversity work in order to get higher income from farm and off-farm activities to invest in the agricultural process and animal raising.

The total labour used has got a coefficient of 0.081, which is not significant at any level of significance, with a positive sign as expected. This showed that an increase of labour force by 1% would cause the farm income to increase by 0.081%. It implies that the household with more labour or those who are affluent to put more land under cultivation using family labour or/and hired labour are better off.

The data furnished in Table (3) showed that the value of farm assets had got a coefficient of 1.285, which is highly significant at 1% level of significance with the expected sign. This showed that an increase of the expenditure to purchase farm implements, (tools etc., which are used in field cultivation) by 1%, would increase the farm income by 1.285%. It indicated that households having more implements and tools for agricultural production are more likely to utilize them more efficiently to obtain higher output and consequently higher income.

Market distance from villages has got a coefficient of –5.238, which is not significant at any level of significance, with the expected negative sign. This indicated that increasing market distance by 1% from villages or residing sites would decrease the farm income by 5.238%. This means that the long distance of markets from residing areas of farm households would make them avoid the high transportation costs to the marketplace and they would be selling their surplus products at farm or village level to the middlemen at low prices after harvest.

Also the data revealed that the operational area has got a coefficient of 17.11 which is highly significant at 1% level of

significance, with a positive sign implying that as the farm household increases the operational area by 1%, the farm household income increase by 17.11%. This indicated that the land size is a major determinant in the traditional agricultural production areas for farm income, because, the effects of other variables on output could appear through the land variable coefficient as a media on which all other inputs act.

Weather conditions as the dummy variable has got a coefficient of –3.653 which is significant at 5% level of significance. Its presence in the model had affected the significance level of some other independent variables. However, the negative coefficient indicated that as the weather conditions become unfavourable the farm income would decrease.

Recommendation

1. To develop the traditional rainfed production with especial attention given on the valley's deposits and clay soils which are about 20% of the total arable land of the State.
2. To develop an effective linkages between agricultural education, research and extension through an institutional framework this enables a better flow of information and coordination between different agencies.
3. To introduce new varieties of crops in the State and give more attention to high-value products such as groundnuts and sesame to augment the farmer's income.
4. To establish institutions, that will import improved seeds and/or develop research farms for producing certified and hybrid seeds in the State.

References

[1] Abdelrahman Khidir Osman (2007), Community based seed supply in Sudan2007 LEISA Magazine 23.2 June 2007,p18

[2] Abdur Rashid M. Aranda da Silva (2000) FAO/WFP Crop and Food Supply Assessment Mission to Sudan.

[3] Adedapo, Odulaja and Fassil, G. Kiros (1996). Modeling Agricultural Production of small-scale Farmers in Sub-Saharan Africa: A Case Study in Western Keneya. Journal of Agricultural Economic, vol. 14, No. 2 pp. 85-91.

[4] Alemu Asfaw (2012), CTA, FAO-SIFSIA-N FAO-Sudan, Quasi Cropand Food Supplya Assessment Mission to Sudan, P 11-12

[5] Eberhard H. and Klaus, P. (1999). Agriculture and poverty Reduction, the Benin Example, in Agriculture + Rural Development vol. 6 No. 2 pp. 57-60.

[6] Elnoush, H. (1999). Micro-Finance and poverty Alleviation, the potential of Groups Lending: A Case Study of UNDP Project: Area Development Scheme Elobied Western Sudan.

[7] Felix Sichali, Sherry McLean, Blessings Botha (2013), Seeds for change: a certified seed project in Malawi is boosting local incomes and supporting emerging national agricultural policy.

[8] FAO and ICRISAT (2004). The World Sorghum and Millet Economics Facts, Trends and Outlook. FAO, Rome

[9] Hassan, T.A. (1987). Economics of Millet Production under Subsistence Farming System in Darfur Region. A case Study of Central District Council of Southern Darfur Province. Unpublished M.Sc. Faculty of Agriculture, U. of K.

[10] Joske, F.G. and Jacqueline, E.W.B. (1991). Appropriate Biotechnology in Small-scale Agriculture: How to Reorient Research and Development. P. 2, C.A.B. International Redwood Press Ltd. Melksham.

[11] Simon, C. (1990). Report on Animal Traction Survey, Kebkabya Small-holder Project. ITDG Serise.

[12] Swamy, P.A. and Mehta, J.S. (1979). Estimation of Common Coefficients in Two Regression Equations. In, Journal of Econometrics vol. 10 No. 1 pp. 1-14.

[13] Tesfaye, T. (1993). Experimenting with a Cooperative – Based Credit approach in Western Sudan. Saving and Development vol XVII No. 3. IFPRI Washington DC. USA.

[14] Thabit Ahmed Hassan, Elamin Ibrahim Hessein (2015). Economics of Resource Use in Millet Production under Subsistence Farming System of South Darfur State of the Sudan VOL. 5, NO. 1, January 2015 ARPN, P 27-31

[15] WFP (2011). Comprehensive Food Security Assessment in Darfur UN World Food Programme, State Ministry of Agriculture and State Ministry of Health North Darfur.