Factors Influencing Farm Income among Farmers in Northern Nigeria

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Abstract

The observed decline in farm income in recent times was a source of concern for farmers and other stake holders in Nigeria's agricultural sector. This could be a serious setback for Nigeria's drive to achieve self-sufficiency in food production. This paper focused on identifying the determinants of farm income in northern Nigeria. Result of the study could be beneficial to farmers and policy makers by providing insight on the factors that could raise farm income. The study was based on the hunch that certain socio economic factors and climatic elements could improve farm income. Findings of the study revealed that livestock keeping, access to credit, farm power, proximity to market, marital status, gender and climate influenced farm income. In addition variation in factors due to difference in agro ecological zones significantly affected revenue. Conclusion of the study was that farm specific factors could be used as a framework to improve farm income.

Keywords: Factors, farm income, farmers, Northern Nigeria

1. Introduction

It is evident that the economy of Nigeria is largely dependent on agriculture and serves as a means of livelihood for the larger percentage of the rural populace. Agriculture contributed about 33% to GDP in 2013 (NBS, 2014) and the smallholder farmers' account for most of the food produced in the country (Akor, 2012). However, despite the dominant role of agriculture in the country average farm yield is low; farmers are poor with low resources operate using traditional practices. The total impact of these issues culminated into low agricultural productivity; thus food production has not been keeping pace with population; this situation is inimical to food security in Nigeria. The situation is not better in northern Nigeria where most of food and other agricultural produce came from. In this area, like in other parts of the country agriculture is the main economic activity and provides the main source of income. In recent times the problem of agriculture was excercebated by the changing climate and poor resource management; this led to a serious decline in farm income. Several socioeconomic factors were identified as important determinants of farm income. Decline in farm income was not only a source of concern for the farmers, but policy makers as well who recognized the problem as major threat to the Nigeria's food security and overall economic development (Ibekwe, 2010).

A farm as a unit of production generates income through rational use of resources. Farm income refers to profits incurred as a result of the operation of the farm. For a detailed analysis of the causes of decline in farm income, the role of socioeconomic factors as determinants of farm income needs to be investigated. Findings from several studies showed that farm income is affected by farmer socio economic environment and factors such as education, credit, age, land holding, house size, livestock keeping, extension services and gender positively influence farm income (Safa, 2005; Mpawenimana, 2005; Mabe et al., 2010; Parvin and Aktezuzzaman 2013; Ibekwe 2010; Jerry and Williams 2000). In depth examination of available literature showed that although few studies considered the analysis of decline in farm income with regards to Nigeria; the issue has not received adequate attention. Ibekwe (2010); Obike et al. (2011); Malton (1977) are some of the studies that examined the role of socioeconomic factors as determinants of farm income in Nigeria.

Furthermore, although effort of these studies will no doubt be useful in guiding policy action towards the use of socioeconomic factors in raising farm income, a major issue of these studies was their inability to cover wider area; they mostly considered areas within one agro ecological zone; thus making it difficult to generalize their findings to the entire country. It could therefore be asserted with high degree of confidence that literature on the role of socio economic factors in determining farm income is lacking in Nigeria. This study was an attempt to make up for the shortcomings of previous studies. It was distinguished from other studies by being the first regional scale study to analyze the role of socioeconomic factors in determining farm income that covered 3 out of the 4 agro ecological zones found in northern Nigeria. Another exceptional contribution made by the study was to examine the role of climate in contributing to farm income by including temperature and rainfall elements in its analysis. Findings of the research may be crucial in determining the role of climate and socioeconomic factors in improving farm income in the study area. The potential of the area coupled with the problem of declining farm income provided the main motivation for the study. The main purpose of this study was to determine the relationship between farm income and the socio economic characteristics of the farmer as well as

to examine the role of climatic factors in determining farm income.

2. Methodology

2.1 Study Area

Northern Nigeria is the largest geographical region in Nigeria in terms of population and land size. Geographically the area lies between latitudes 7^0 and 14^0 North and longitudes 3^0 and 15^0 East. Out of the 36 States that make the Nigerian federation 19 are located in the north. The land mass of northern Nigeria is about 692,826 km^2 out of 923,690 km^2 of entire area of Nigeria. The climate of the area is hot almost all year round; rainfall is low to moderate with an annual mean of 500 mm. Most of the inhabitants are smallholder farmers, mainly engaged in the production of millet, sorghum, maize, rice and cowpea at subsistence scale. The area encompassed 3 major agro ecological zones (northern Guinea savanna, southern Guinea savanna and the Sudan savanna). Agricultural potential of the area is threatened by many factors mainly climate change; these resulted to decline in agricultural productivity and farm income; these problems provided the greatest motivation for the choice of the area of study.

2.2 Sampling Procedure

A sampling frame that consisted of a list of farmers obtained from the village extension workers was used to draw a sample of respondents. The populations for this study were households who engaged into agricultural production, across 3 agro ecological zones. The units of analysis were farmers who produced various kinds of crops in the area. Lack of proper record of the respondents and their farming activities compelled the use of this sampling frame as it provided the only alternative. To enable the study include respondents with the desired characteristics, multi stage sampling was used. Firstly, 8 States and the Federal Capital Territory Abuja were purposively selected; in each State two local government areas were selected. The selection of States and local government areas was done purposely to include areas with large scale agricultural production. Secondly, respondents from each local government area were randomly selected. To improve usability and lower the impact of measurement errors a total of 700 respondents were selected from the sampling frame, at the end a total of 530 surveys were finally realized out of which 483 were useable. The survey was conducted in Kaduna, Katsina, Kwara, Kebbi, Nassarawa, Niger, Sokoto, Zamfara and Abuja. Two local government areas were selected to represent each State. At district level the survey was concentrated in villages to reduce cost and save time.

2.3 Model Specification

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_nx_n + u \qquad \text{equation 1}$$

Where β_i's are Parameters to be estimated
X's =Set of socio economic and climatic variables
U = error term

2.4 Data Analysis and Variables for the Study

Data was collected at district level using a structured questionnaire. The questionnaire was made up five parts. Part 1 covered questions on agricultural/environmental problems affecting the area. Part 2 considered crop production practices and production cost, part 3 dealt with the economic characteristics of the respondents, part 4 was on the issue of climate change perception and the last section centered on the respondent's demographic variables.

Dependent Variable: The dependent variable for the analysis in this study is the net revenue/ha. It was calculated from the household survey data. It was obtained as the product of gross revenue (price multiplied by quantity in kg) minus the relevant production costs such as (seeds, fertilizer, chemicals, tillage, weeding, harvesting, transport, storage and processing) divided by the farm area in hectares.

Explanatory Variables: Climate variables, soil variables and relevant socio economic variables that were hypothesized to affect farm income were the explanatory variables used for the study.

Climatic variables: Temperature (0^c) and rainfall in (mm) are the climatic variables used for the study. Both temperature and rainfall were reported for rainy season (May to October) and dry season (November to April) in line with the climatic set up of northern Nigeria. The study identified the groups of soils found in the area based on the Nigeria reconnaissance soil survey 2009 classification. The soil classes were ranked according to their fertility status based on the classification of the reconnaissance survey.

Socio economic variables: Due to their importance the study examined the effect of relevant socio economic variables on net revenue. The variables considered were farm power, market, livestock, credit, marital status, and

gender. The effect of agro ecological zones was included in the analysis to enable the study observe the influence of variation in climate, soil and other farm characteristics on net revenue.

2.5 Estimation Procedure:

Stata statistical package was used to estimate the model for northern Nigeria. The dependent variable was regressed against independent variables. With an econometric model the impact an independent variables exerts on a dependent variable can be observed. Common problems however existed in the estimation of econometric variables such as the potential problems with estimation of the regression models which might lead to the violation of the basic assumptions of regression models these include multicollinearity, heteroscedasticity, outliers and measurement errors. To correct for these and ensure efficiency in the estimation, this study dealt with the problems which are typical to most cross sectional data as follows. White heteroscedasticity test was conducted which showed that the presence of heteroscedasticity does not exist in the dataset. The data was tested for normally using skewness and kurtosis normality test. Outliers were also identified and removed from the dataset. To improve the efficiency of estimators robust standard error estimation was used. Similarly other socio economic variables such as access to extension, education, experience and house size which do not contribute to the model and were not significant were all dropped from the model.

3. Results and Discussion

3.1 Descriptive statistics

A summary of the basic statistic of the dataset for the variable used in the study was presented in table 1 below. The result showed that the average net revenue/ ha is ₦44,891. The net revenue ranges from a minimum of ₦1760 to a maximum of ₦91,900/ ha. The mean soil fertility was 2.38 with a minimum fertility of 1.50 and a maximum of 3.50. The average number of cattle owned by the respondents was 3.0 with a minimum of 0 and a maximum of 85.Respondent's access to credit showed that the minimum amount of credit received in naira is 0 and the maximum is 2 million naira.Farm power dummy was included in the model as hand, animal or tractor; this is used as a proxy for farm technology. The average distance to input market was 10.87 kilometers, the distance varied widely between a minimum of 1.0 kilometers to a maximum distance of 50 kilometers. The mean temperature recorded in the study was 31.9^0C the minimum is 26.8^0C while maximum temperature recorded is 35^0C. Rainfall was recorded in millimeters; the maximum rainfall is 200mm while the minimum is77mm, the mean rainfall score is 144.32. Marital status, gender and agro ecological zone variables were included in the analysis as dummies.

Table 14: Descriptive statistics for variables used in the study

Variable	Minimum	Maximum	Mean	Standard deviation
Income	1760	91900	44891	20171
Soil fertility	1.50	3.50	2.38	0.671
Livestock	1.00	85.0	3.623	7.202
Credit	0.0	2000,000	11987.57	95517
Farm power	0.0	3.00	1.92	0.824
Market	1.0	50	10.877	9.265
Temperature	26.80	35.00	31.905	2.375
Precipitation	77.00	200	144.432	40.034
Marital status	0.00	1.00	0.931	0.252
Gender	0.00	1.00	0.977	0.149
Agro ecological zone	1.00	3.00	1.840	0.860

3.2 Result of the Regression for the Factors Influencings Farm income

Result of the regression for the determinant of farm income was presented in Table 2. Findings of the study showed that the coefficient for soil variable was positively signed and has a value of 7356; it was also statistically significant at 1% level. In addition, the coefficient for livestock also showed a positive relationship with net revenue and was significant at 10% level. The value of the coefficient was 316. The coefficient for credit although positively related to net revenue however, has a small impact with a value of less than 1. Similarly, the relationship between net revenue and credit was statistically significant at 5% level. Another variable that was statistically significant and exerted a positive relationship with income was farm power, the significance level was 1% and the value of the coefficient was 3,557. In contrast to the coefficients mentioned above which were positive the coefficients for market, temperature and precipitation showed a negative relationship with net revenue.

Table 15: Regression result for factors influencing farm income

Variable	Coefficient	Robust std. Error	t-value	P>|t|
Constant	127265	24372.87	5.22	0.000
Soil	7356.529***	1537.843	4.78	0.000
Livestock	316.268**	122.654	2.58	0.010
Credit	0.009*	0.004	1.93	0.054
Farm power	3557***	1093.712	3.25	0.001
Market	– 173.102**	86.364	2.00	0.046
Temperature	–3308***	614.871	5.38	0.000
Precipitation	–154.180***	39.751	3.88	0.000
1. Marital status	7414.844**	3351.731	2.21	0.027
1. Gender	10261.73*	6124.505	1.68	0.094
Agro ecological zones				
2	4994.654	3806.231	1.31	0.190
3	11841.75	4258.815*	2.78	0.006

Note: p-value ***, significant at 1%; ** significant at 5%; * significant at 10%

However, coefficient for market was significant at 5% level and the coefficients for temperature and rainfall were significant at 1% level. The values of the coefficients are 173, 3,308 and 154 respectively. Furthermore, the coefficients for marital status (1= married and 0 otherwise) and gender (1= male and 0 otherwise) dummy variables indicated a positive relationship with net revenue and were significant at 5% and 10% respectively. These variables have higher impact as indicated by the values of their coefficients which were 7,414 and 10,261 respectively. The variables for the agro ecological zones were also positive but only the coefficient for the southern guinea savanna (agro ecological zone 3) was significant at 10% level the coefficient for the northern guinea savanna (agro ecological zone 2) was not significant. The values of the coefficients however, indicated that they have higher impact on revenue than the variable for the Sudan savanna zone not included in the model. The value of the coefficient for northern Guinea savanna was 4,994 and that of southern Guinea savanna was 11,841.

Table 16: Average values of farm characteristics in hectares for States covered by the study

State	Yield(kg/ha)	Revenue(N/ha)	Farm size in ha
Abuja	2228	37,308	1.7
Kaduna	3288	53,571	7
Katsina	2989	47,446	10.3
Kebbi	3568	39,420	5.6
Kwara	3826	54,353	6.1
Nassarawa	2094	55,127	1.4
Niger	2961	51,343	1.5
Sokoto	1716	31,474	1.7
Zamfara	2874	40,511	2.5
Northern Nigeria	3081	44,891	4

3.3 Discussion

The role of socioeconomic and climatic factors was assessed in this study. Findings presented in Table 2 showed that the variable for soil exhibited a positive relationship with farm income the results of the study showed that increase in the fertility of the soil led to an increase in the amount of farm income by ₦7,356 the impact was much and the relationship was also significant. This finding showed that soil was an important determinant of farm income; this implied that increase in the fertility of soil could be used to increase farm income this agrees with the findings of (Wood and Mendelsohn 2014). Livestock keeping as a priori expectation contributed positively net revenue. The coefficient for livestock as shown in Table 2 had positive relationship with revenue. The result indicated that increase in the number of animals kept raised income by ₦316 although the impact was less, the relationship was statistically significant at 10% level; this underscored the importance of livestock in contributing to farm income. This was a priori expectation because livestock is an important part of agriculture in the area; it provided a source of farm power, manure, income, it also served as a risk aversion strategy. Finding of the study on the positive relationship between net revenue and livestock keeping is consistent with (Ajetomobi et al., 2011; Deressa and Hassan 2009; Mano and Nhemachina 2007; Sene *et al.,*2006).

Another variable tested in the study was access to credit, this variable enabled farmers to meet their farming

obligations as at when due; it is a very important factor that could lead to rise in revenue. In this study findings showed that although credit has much less impact in raising revenue the relationship was positive and significant at 10% level. The low impact of credit could be explained by the fact that not all the respondents had access to credit and for those that have access to credit the amount was usually low and hardly make any impact. Additionally, to examine the role of farm power and technology in contributing to farm income, a variable for farm power was introduced into the model to assess the contribution of farm power usage to farm income. The results indicated that for each increase in the level of farm power usage revenue increased by ₦3,557 the impact was much and significant at 1% level. The levels of farm power usage were hand, animals and tractor. Findings of the study indicated that farm power was also an important determinant of farm income.

The variable for market distance showed that farms located farther away from market loose revenue. The results suggested that farms that were closer to market stand to benefit more than farms that were farther away. The coefficient for market was statistically significant at 5% level. Ater and Aye (2012) and Fonta *et al.* (2011) in a Ricardian analysis of farms in Nigeria made similar observations. This finding showed the importance of market distance in determining revenue. Climate is one of the most important determinants of success in agriculture; growth and development of both crop and livestock are largely controlled by climate. Indirectly climate affects farm income by determining agricultural output. In this study temperature and precipitation as elements of climate were introduced into the analysis to capture the relationship between climate and revenue. Results of the study presented in Table 2 revealed that both temperature and precipitation showed negative signs and were statistically significant at 1% level. This showed that increase in both temperature and precipitation will be detrimental to revenue. This finding may be as a result of the fact that temperature in northern Nigeria was high and any further increase in temperature will affect revenue negatively. Similar findings were made in related studies Ouedraogo *et al.* (2006); Fonta *et al.* (2011); Ajetomobi *et al.* (2011); Ater and Aye (2012).

Until now only temperature was considered, although the climate of the area is dry, recent changes in climate led to increase in the frequency and intensity of rainfall resulting into flooding, crop lodging and high incidence of pest and diseases. This implied that increase in rainfall could results to decline in revenue. However, the impact due to rise in temperature by far outweighed the impact due to increase in rainfall; this indicated that temperature played a more important role in determining revenue than rainfall. The impact due to 1^0C was a decline in revenue of up to ₦3,304 while impact due to 1mm increase in rainfall led to ₦154 decline in revenue. In a similar study, Ajetomobi *et al.* (2011); Fonta *et al.* (2011) made same observations. Rainfall may not be a limiting factor for agricultural production because the area in recent years received adequate amount of rainfall and any further increase could lead to a decline in income.

Marital status and gender were other socio economic variables that could explain variation in income which were included in the analysis. Results from the study showed that the coefficients for both marital status and gender were positive and significant at 5% and 10% respectively. Findings of the study showed that marital status and gender have huge impact on revenue respondents that were married have ₦7,414 more revenue than single respondents while male respondents have ₦10,261 more revenue than female respondents. Married respondents could have higher revenue due to their effort in meeting social responsibilities. Women could be associated with low revenue because they lacked control over resources, cultivated smaller farms and in addition were subjected to various kinds of discrimination which affected their ability to achieve higher farm income. Al-Hassan (2012); Khai and Yabe (2011); Kuwornu et al., (2013); Ogunniyi (2012) made the same observations and concluded that Men achieve higher revenue over Women due to their physical stamina, scale of operation and control of resources.

To capture variation in revenue due to differences in socio economic and climatic factors of the respondents from various agro ecological zones a dummy for agro ecological zones was included in the analysis. Findings of the study revealed that in using various socio economic and climatic factors, respondents from southern Guinea savanna zone have ₦11,841 more revenue than respondents from the Sudan savanna and respondents from the northern Guinea savanna have ₦4,994 more revenue than respondents from Sudan savanna zone not included in the model. However, coefficient for the southern Guinea savanna was significant at 10% level. This result showed that respondents from the Sudan savanna have a better chance of improving their revenue by properly using their socio economic and climatic factors.

The debate on the declining farm income due to climate change has attracted the attention of researchers to agriculture, specifically food crops sector. This study investigated the role of socio economic and climatic factors on farm income in northern Nigeria. The study contributed to literature by being the first study that examined the role of socioeconomic and climatic factors on revenue across different agro ecological zones in northern Nigeria.

The analysis of the study comprised of farmers who makes a larger percentage of the populace in northern Nigeria. Analysis of the study revealed that socioeconomic and climatic factors can contribute to more revenue among farmers in northern Nigeria. All the variables tested except market distance, temperature and rainfall showed a significant positive relationship with net revenue. Another important conclusion of the study was that respondents from the southern Guinea savanna agro ecological zone were found to have the highest net revenue due to their socio economic characteristics implying that respondents from the northern Guinea savanna and the Sudan savannah have more to benefit by exploring their socio economic factors. This was consistent with the findings of previous studies that postulated that socio economic factors affected crop yield and consequently farm income (Ibekwe 2010; Williams and Jerry 2000; Mabe et al., 2010; Mpawemina 2005; Parvin and Akteruzzaman 2013; Safa 2005).

4. Conclusion and Recommendations
The study provided a sound empirical evidence of the impact of socio economic and climatic factors on farm income in northern Nigeria. Relying on survey of farms, the study revealed that farm specific and climatic factors might be one of the most important determinants of net revenue for farms in northern Nigeria. The model tested predicted that increase in temperature, rainfall and market distance will be harmful to net revenue, while all the socioeconomic factors were positively related to net revenue. This study was distinguished from previous studies that assessed the determinants of farm income in Nigeria in 3 significant ways. First, the analysis covered most of the entire northern Nigeria which produced most of the food consumed in Nigeria. Second, climatic factors were included in the analysis; lastly, variation in revenue due to differences in agro ecological zones was observed. Researchers and government should devote more resources focus attention in sensitizing farmers to use their socio economic characteristics in improving farm income. The current analysis was limited to certain farm specific factors and only two climatic elements, prospective researchers should include other factors that could affect farm income and ensure wider coverage in their future analyses.

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