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Determinants of Productivity in the presence of Risk encountered by Arable Crop Farmers in Umuahia South LGA, Abia State, Nigeria

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Abstract
The study estimated the determinants of productivity in the presence of risk encountered by arable crop farmers in the study area. A multistage sampling technique was used for this study. Primary data were obtained with a well-structured questionnaire. Results show that the coefficients of education, labour and income were significant at 1% level and had a direct relationship with productivity as well as cost of planting materials, capital and age at 5% level each, and farming experience at 10% level. The coefficients sex and number of risks encountered had an indirect relationship with productivity and significant at 10% and 5% level respectively. Risk attitude largely depends on their socioeconomic characteristics. This implies that a good proportion of the farmers in the study area preferred taking risk by venturing into risky opportunities, followed by risk averse behaviour (42.5%) by adopting mitigating strategies to avert risk in farming. The result revealed that on average, the arable crop farmers realized N101, 200.03 from cassava enterprise, while N64,402.66, N 46,568.31, N 31,245.36, and N 28,401.20 were realized from fluted pumpkin yam, maize, rice and melon respectively, giving a total of N271, 817.56 from the combination of the crop enterprises under study. The results therefore call for policies aimed at provision of affordable education, especially targeted at women farmers to enable them access and process information that will enhance productivity and mitigate risk.

Keywords: ***Risk, Behaviour, Productivity, Arable, Crop, Farmers***

Introduction

Agriculture is exposed to a wide variety of risks and uncertainties ranging from input supply and prices, agricultural yield, post-harvest losses and product prices to the vagaries of nature such as bad weather conditions, pests and diseases (Nmadu *et al.,* 2012). Other natural hazards such as floods and fire outbreaks are equally important with regards to their impact on the success or failure of an agricultural enterprise. In order to boost agricultural production considerably, it is imperative to reduce the impact of these risks and uncertainties to the barest acceptable minimum (Aina and Omonona, 2012). Agricultural production is highly characterized by risk. Particularly, production decisions are generally made under the environment of risk and uncertainties. Yield, product prices, and to a more limited extent, input prices and quantities are usually not known with certainty when investment decisions are being made. In many cases, farmers are confronted with risk of pests and diseases, which may cause product prices to decline. Such characteristics result in returns displaying high variability. Returns vary with the farming system, climate, policy, institutional setting, amongst others; these in turn affect production decisions.

However, Agriculture has contributed immensely to the nation's development. According to the Central Bank of Nigeria (CBN), (1995), the contribution of agriculture to the nation's gross domestic product in 1985 was 54.4%. Its role in food production, provision of raw materials for industries, as a major source of employment and income to a great number of the citizens of the country cannot be overemphasized. In recognition of this crucial role of agriculture in economic development, past governments have sought ways to increase domestic food production to alleviate food shortage and excessive high cost of food items, which have been a prevalent feature of many developing countries. Agricultural sector in developing countries is characterized by the existence of both large scale and smallholder farmers. The smallholder farmers are mainly subsistence, in which food crops are grown together with cash crops. The smallholder farmers face challenges that include; high cost of inputs (especially the price of fertilizer and seeds), poor livestock husbandry, limited extension services, over-dependence on rain-fed agriculture, lack of markets, and limited

application of agricultural technology and innovation (GoK, 2007). More so, the economic performance of the agricultural sector is usually uncertain due to its biological nature in addition to relying mainly on rain fed agriculture and livestock rearing under natural conditions. This type of production is inherently risky because of variability of rainfall, animal mortality due to livestock diseases and fluctuations in output prices. The environment in most of low income countries is characterized by crop diseases, flooding, illness of household members and crime. All these create uncertainty (Capitanio, 2008).

As a result of a combination of many factors, many people in low income countries including Nigeria live in poverty and food insecurity. They face many risks and uncertainties which arise from natural, economic and socio-political environments. These risks and uncertainties easily trigger food shortages, deterioration in nutritional status and destitution (Pinstrup-Anderson *et al,* 2001). A number of studies show that farmers are risk averse. They manage risk by preferring enterprises that provide satisfactory levels of security even if at the expense of higher income. They also prefer to use established techniques of production, and to be self sufficient in food requirement through increased food production (Nyikal and Kosura, 2005). Risk plays an important role in farmer decision making and therefore affects agricultural productivity and thus growth and development. Lack of institutional innovations like crop insurance and affordable credit in developing countries to shift part of the risks from the private to the public sector makes risk management an important part of smallholder production decisions (Besley, 1995). Private sector provided insurance products have not developed due to problems of moral hazard and adverse selection.

Smallholder farmers in Abia State of Nigeria face many risks in their farming activities. For example, in the past, the country has recorded drought, crop and animal diseases and pests as well as fluctuations in prices of both farm produce and inputs. As a result, there has been variability in household income. Risk hinders farmers from pursuing their farming as a business. The risk situation is complicated by the fact that they operate in an environment with weak markets. They do not have access to sufficient support institutions that can help them cope with risks. Risks have negative implications to agricultural productivity and farmers' income because it affects the types of investments which farmers embark on.

Methodology

The study was carried out in Umuahia South Local Government Area (LGA) of Abia State, Nigeria. Umuahia South has an area of 95sq meter (245km2), and a population of 320,660 (NPC, 2006). The boundary LGAs are Umuahia North by the north, Isiala-Ngwa north by the south-east, Ikwuano by north-east and Imo river. The people speak Ibeku and Ohuhu as their dialect, and Igbo as a common language. The dwellers are mostly smallholder farmers and civil servants. Umuahia South LGA was created out of the defunct Umuahia L.G.A on the 27th August 1991 and has its headquarters at Apumiri Ubakala, located between latitudes 5°24′N and 5°30′N of the equator and longitudes 7°32′L and 3°37′L of the Greenwich Meridian. The LGA is characterized by heavy precipitation of over 200mm per annum as well as minimum and maximum air temperatures of 22°C and 31°C respectively. The mean soil temperature is 28°C, while relative humidity ranges from 69.0% to 79.0%. The major occupation of the people is farming. Primary data were used for the study and were collected with the use of a well-structured questionnaire. The study covered all arable crop farmers in Umuahia South LGA, Abia State, Nigeria. To select a representative sample, a multistage sampling technique was used. In the first stage, ten (10) autonomous communities were purposively selected from the 23 autonomous communities in Umuahia South LGA, based on the availability of arable crop farmers in these communities. In the second stage, one (1) village was randomly selected from these autonomous communities which gave a total of ten (10) villages for the study. In the third stage, eight (8) arable crop farmers were randomly selected from these villages, gave a total of eighty (80) respondents for the study. The collected data were analysed with descriptive statistics such as means, frequency distribution tables and percentages and regression model. The regression model was specified implicitly as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}) + e \quad \text{..... (1)}$$

Where;
Y= Productivity (proxied by annual sales in Naira)
X_1= Gender (1=male, 0=female)
X_2= Age (years)
X3 = Educational level (years)
X4 = Primary occupation (1= full time farming, 0=otherwise)
X_5= Farming experience (years)
X_6= Household size (no)
X_7= Income (N)
X_8= Membership of farmers' co-operative society (1=yes, 0=no)
X_9= Farm size (ha)
X_{10} = Labour (mandays)
X_{11}= Cost of planting materials (N)
X_{12}= Capital(N)
X_{13}= Number of risks encountered
e = error term

$$TFP = \frac{1 + \text{Total value sales (N)}}{\text{Total value f inputs(N)}} \quad \text{.....2}$$

Where, TFP = Total factor productivity

Results and Discussion

Table 1 shows that 66% of the respondents in the study area were men, while 54 % , were women.

This shows that male farmers were more than female farmers in the study area. This is in consonance with the report from FAO (2001) that women were more involved in off-farm activities than men, especially transportation of farm produce, processing of farm produce, feeding of family members and reproductive functions. The result shows that, 62% of the farmers were married, while 35% were single. The result implies that majority of the farm households are stable. According to Nwaru (2004), this stability should create conducive environments for good citizenship training, development of personal integrity and entrepreneurship, which are very important for efficient use of resources. This also implies that the married people were more involved in farming in the study area. Married farmers are usually involved in farming activities as they know how best to utilize family labour (household) available to them in farming activities. The result shows that 50%, 25% and 5% of the farmers were within the age range of 31-40 years, 41-50 years, and 51-60 years respectively. This implies that farmers in the study area were at their youthful age, more energetic and flexible to cope with risks and uncertainties that characterise farming. They were also more likely to adopt new improved technologies. As noted by Iheke and Nwaru (2014), the risk bearing abilities and innovativeness of a farmer, his mental capacity to cope with the daily challenges and demands of farm production activities and his ability to do manual work decrease with advancing age. About 51% of the farmers had household sizes of between 6-10 members, while 24% and 5% had between 1-5, and above 10 persons respectively. This implies that farmers have large family size and this is expected to influence agricultural production positively. It has been shown that decisions are made by the farm family, since the various farming operations are carried out by the members of the family. The mean household size was 6 persons per household. This is consistent with the findings of Iheke and Ukaegbu (2015). According to Iheke (2010), large household size is desirable and of great importance in farm production as rural households rely more on members of their households than hired workers for labour on their farms. The Educational level of the farmers reveals that 44% of the farmers had secondary school education, while 9% had no formal education. However, 91% of the farmers in the study area were literate with diverse formal educational levels ranging from primary school education to tertiary education. Literacy (ability to read and write) would enable the farmers to utilize effectively and efficiently available resources in the area especially credit for farm businesses and curtail frivolous spending. The farmer's educational level is expected to have a positive influence on the adoption of improved technologies such as farm mechanization, fertilizer use, agro-chemical, and high yielding seeds variety which should have high potentials to increase farm productivity. Higher education would also enhance improved business ideas, skills, innovation and managerial ability for risk management and for business sustainability. This result is in agreement with Nwibo and Okorie (2013) whose findings indicated high educational attainments for majority of their respondents. The result shows that 23% of the farmers had farming experience of between 1-10 years, 58% between 11-20 years, 12% between 21-30 years, while only 7% had farming experience of above 30 years. This could be explained by the fact the active mean age and years of experience can influence adoption of improved production practices, which invariably enhances productivity and net farm income. The number of years a farmer has spent in the farming business may give an indication of the practical knowledge he has acquired on how he can overcome certain inherent farm production problems. Furthermore, 11% of the farmers in the study area had farm size of between 0.5-1.0 hectares, while 33%, 50% and 6% had 1.1-1.5, 1.6-2.0, and 2.1-2.5 hectares respectively. This result shows that the farmers in the study area were small scale subsistence farmers as they were operating on 1-2 hectares of land. This affects income and expenditure negatively. Bedemo *et al*. (2013) confirms that rural households with small landholding and farm output which is the case among majority o the farmers in the study area, depend on the opportunities in the off-farm sector to escape poverty and risk by supplementing income from the farm. About 35%, 61% and 4% of the small farm households generated a monthly income below N50,000, between 50,000-N100,000 and above N100,000 respectively. The result further showed a mean monthly income of N68,000, implying that the farmers were basically low income farmers; thus peasant farmers. These classifications were based on Ezeh, (2007). The mean annual income of the women farmers was N32,587.5. The income status of the respondents has implication for decision, choice of off-farm business enterprise as well as sustainability of the enterprise. Nwibo and Alimba (2013) noted that income level of an individual plays a great role in shaping the type of enterprise to venture into. This finding is justified on the ground that supply of inputs, labour and day to day running of the

business is capital intensive and as such requires steady flow of income for business sustainability.

The result in Table 2 shows that 9 factors out of 13 are significant at various levels. The semi-log function was chosen as the lead equation for the analysis based on conformity with *a priori* expectation of signs, magnitude of coefficients, overall significance of the functional form (F-statistics) and the explanatory power of the variables (adjusted R^2) included in the model. The F –value as significant at 1% level, which implies that the independent variables (Xs) included in the model best explained the dependent variable (Y), the productivity of smallholder farmers. The R^2 value was 0.75 which indicates that 75% of the total observed variations in arable crop farmers' productivity were explained by the variables included in the model, while 25% of the variation was due to error. The F – ratio was significant at 1% indicating goodness-of-fit of the model. The coefficient of gender was significant at 10% and negatively related to productivity. This inverse relationship implies that the female farmers were more productive than their male counterparts, probably because they were more efficient farm managers. The coefficient of age was significant at 5% and positively related to the productivity. This implies that as the age of farmers increased, their productivity also increased. Expectedly, the increase in farmer's age come with demanding responsibilities and as such increase his knowledge, experience, income and efficiency. The coefficient for years of education was significant at 1% and positive. This implies that as the educational level increases, the productivity increases. This is in conformity with *a- priori* expectation that the level of education of the farmers enhances their knowledge of risks and uncertainties as well as their technical and managerial efficiency. The more educated the farmer is, the more his/her efficiency in farming. This result is in agreement with the research findings of Salimonu and Falusi (2009) that farmers level of education increase their productivity. The coefficient of farming experience was significant at 10% and positively related to productivity. It shows that increase in the years of farming experience will lead to an increase in the reduction of risks and uncertainties, thereby enhancing productivity of farmers. Ogoke (2009) observed that the longer the years of farming experience, the more efficient the farmer becomes, because the number of years a farmer has spent in the farming business may clearly give an indication of the practical knowledge he has acquired. This is an advantage in reducing farming risk which will help to boost production in any pre-determined period of farming business. The coefficient of income was significant at 1% and positively related to productivity. This implies that increase in income will lead to increase in productivity. Walker *et al.* (2001) cited in Effiong *et al.* (2014) reported that increased income will assist farmers in tackling additional risk on the farm without being risk averse. This in essence will lead to an increase in productivity of the farmers and will also help farmers to generate income needed to manage other additional farm risks. This may be attributed to the fact that an increase in income will enable the farmer to adopt proper risk management practices. The coefficient of cost of planting materials was significant at 5% and positively related to the productivity. This explains that increase in the planting material will result to an increase in the productivity. This result is consistent with Rowlinson (2008). He noted that the planting material determines the quality and quantity of the farmer's productivity as well as influences the market price. The coefficient of capital input was significant at 10% and positively related to productivity. This suggests that increase in the farmer's capital will result to an increase in productivity. This result indicated that the more capital invested, the more the propensity for higher productivity as a result of technical and managerial efficiency. Conversely, Effiong *et al*. (2014) found that capital input was negative. This may be due to high incidence of risk and uncertainties associated with farming. The coefficient of number of risks encountered by the farmers was significant and negatively related to productivity. The inverse relationship implied that the increase in the number of occurrence of risk and uncertainty will result to a decrease in the farmers' productivity. Farmers face an ever changing weather conditions, price fluctuation, productivity and government policies which result in risk. Miranda (2002), observed that the production risk in farming are caused by unpredictable weather and hence uncertainty as to good productivity. Ajieh, (2010) found natural and social factors in risk and uncertainties influences productivity. This may be attributed to the fact that agriculture prone to risk and uncertainties. However, lack of information, poor record keeping, farmer's level of education and poor/lack of adoption of risk management strategies could be associated with the negative effect of risk and uncertainties on farmer's productivity.

Farmers Attitude to Risk

Farmers' preference or attitude towards risk explains many observed economic decisions. Their economic decisions are overshadowed by risk.

Their attitude towards risk, therefore, tends to display an explanation for the many observed economic decisions Therefore; knowledge of farmers' attitude toward risk has important implications for the adoption of new farm technologies and the success of rural development programmes (Wik and Holden, 1998). Farmers' choice between the binary hypothetical outcomes was taken as an indication of their risk attitudes behaviour. The two hypothetical questions consist of two possible outcomes with given objective probabilities, and the respondents were asked to state which of the two options they preferred. It was mentioned that there was no right or wrong answers to these questions. It is assumed that by answering the hypothetical questions farmers exhibited their true preferences. Their responses in this regards are presented in Table 2.

This result reveals that majority (50%) of the farmers in the study area had positive risk coefficients and were therefore categorized as risk preferring or seeking. Risk attitude largely depends on their socioeconomic characteristics. This implies that a good proportion of the farmers in the study area placed higher preference on risk-taking behaviour, followed by risk averse behaviour (42.5%) by adopting mitigating strategies to averse risk in farming; and lastly risk neutral (7.5%). This result is not in tandem with that of Ayinde *et al*. (2008) who found out in his study that the risk-averse attitudes of small scale farmers ranked first, while risk neutral behaviour ranked second and risk taking behaviour ranked third among the small scale farmers' attitudes towards risk in their crop production

Productivity of Arable Crop Farmers in Umuahia South Local Government Area, Abia State

The productivity of arable crop farmers was estimated using Total Factor productivity index and other production variables. The gross values of output from various enterprises (cassava, yam, melon, maize) alongside the gross values of each production factor were presented in Table 3. Table 4 shows that the selected crop enterprises together with their respective gross values. The result revealed that on average, the arable crop farmers realized N101,200.03 from cassava enterprise, while N64,402.66, N46, 568.31, N31, 245.36, and N28, 401.20 were realized from fluted pumpkin, yam, maize, and melon respectively, giving a total of N271, 817.56 from the combination of the crop enterprises under study. More so, total of N78, 662.45 was spent on production factors [land, labour and other inputs (fertilizer, planting materials and agrochemicals]. The overall productivity index of the arable crop enterprises under study was 3.43. This suggests that arable crop farming is productive in the study area since the productivity index is greater than 1.

Conclusion

The study shows that risks and uncertainty situations were highly prevalent among arable crop farmers in the study area which exert negative effect on the farmers' productivity, and hence income. There is generally low adoption of risks and uncertainty management strategies among the farmers. The behavioural responses of the farmers to risk could constitute a big threat to the rural economy and make rural households fall back deeper into poverty. The result revealed that on average, the arable crop farmers realized N101,200.03 from cassava enterprise, while 64,402.66, N46,568.31, N31,245.36, and N28,401.20 were realized from fluted pumpkin yam, maize, and melon respectively, giving a total of N271,817.56 from the combination of the crop enterprises This suggests that arable crop farming is productive in the study area since the productivity index is greater than one. The results therefore call for policies aimed at provision of affordable education, especially targeted at women farmers to enable them access and process information that will enhance productivity and mitigate risk.

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Table 1: Selected socio-economic characteristics of the smallholder farmers in the study area

Variable	Frequency	Percentage (%)
Gender		
Male	53	66
Female	27	54
Total	**80**	**100**
Marital status		
Single	28	35
Married	49	62
Widowed	2	3
Divorced	1	1
Age (Years)		
21 – 30	10	3
31 – 40	40	50
41 – 50	20	25
51-60	10	3
Household size		
1-5	24	30
6-10	51	64
Above 10	5	6
Total	80	100
Educational attainment		
Primary	20	25
Secondary	35	44
Tertiary	18	23
No formal education	7	9
Years of farming experience		
1 – 10	18	23
11 – 20	46	58
21 – 30	10	12
Above 30	6	7
Farm size(ha)		
0.5-1.0	9	11
1.1-1.5	26	33
1.6-2.0	40	50
2.1-2.5	5	6
Household income(N)		
Below 50,000	28	35
50,000 – 100,000	49	61
Above 100,000	3	4
Total	**80**	**100**

Table 2: Estimated Coefficients of the effect of risks and other factors on the productivity of smallholder farmers in the study area

Variables	Linear	Exponential	Semi log +	Double log
Constant	3324.578	8.15	6651.804	1.324
	(2.228)***	(8.913)***	(11.334)***	-0.545
Sex	-447.06	-0.511	-891.993	-0.743
	(-1.310)	(-2.440)**	(-1.944)*	-2.551)**
Age	4.023	0.009	648.511	0.37
	(2.290)**	(1.907)*	(2.348)**	(1.972)*
Education	28.923	0.004	399.629	0.071
	(5.950)***	-0.132	(5.050)***	(1.830)*
Primary occupation	-82.3	-0.077	-35.354	-0.117
	(-0.596)	(-0.907)	(-0.101)	9-0.685)
Farming experience	9.592	0.002	420.526	0.003
	(8.690)***	(3.570)***	(1.962)*	-0.033
Household size	-43.5	-0.014	220.904	0.045
	(-0.743)	(-0.390)	-0.613	-0.255
Income	0	2.301E-07	52.349	0.117
	-0.586	(6.988)***	(3.330)***	(1.716)*
Membership to cooperative	-170.124	-0.008	-69.215	-0.066
	(-0.587)	(-0.044)	(-0.131)	(-0.255)
Farm size	-0.42	-0.00002569	-230.946	-0.198
	(-1.977)*	(-1.988)**	(-1.120)	(-1.971)*
Labour	-0.747)	-0.417	-0.538	-0.554
	(5.885)***	-1.676	(3.063)***	(2.199)***
Cost of planting materials	0.00005313	3.083E-08	257.252	0.134
	(5.596)***	-0.564	(2.039)**	(2.171)**
Capital	0.002	0.000001476	267.55	0.143
	(2.875)***	(1.706)*	(2.079)**	(2.282)**
Number of risks encountered	-99.522	-0.65	-908.842	-0.28
	(-1.956)*	(-1.745)*	(-2.260)**	(-1.430)
R^2	0.62	0.73	0.75	0.64
R Adjusted	0.6	0.71	0.72	0.62
F -Ratio	14.999***	12.813***	11.942***	12.419***

Source: Field survey data, 2018

Note: (*) = coefficients that are significant at 1%, (**) = coefficients that are significant at 5%, (***) = coefficients that are significant at 10%, Figures in parenthesis are the t-values

Table 2: Distribution of the farmers based on risk attitude/behaviour

Category	Index	Frequency	Percentage
Risk preferring	>1	40	50.0
Risk indifferent/neutral	1	6	7.5
Risk averse	< 1	34	42.5
Total		**80**	**100.0**

Source: Field survey data, 2018

Table 3: Partial Productivity indices of production variable of the respondents

Enterprises	Gross value of output (N)	Land	Labour	Inputs (fertilizer, planting materials and agrochemicals	Total
fluted pumpkin	64,402.66	31,101.42	2,900	18,651.03	78,662.45
yam	46,568.31				
maize	31,24.36				
cassava	101,200.03				
melon	28,401.20				
Total	271,817.56	31,101.42	29,000	18,65.03	78,662.45

Total factor productivity= value of output/value of input.271,817.56/78,662.45=3.43

Field survey data, 2018