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Full length Research paper

Credit Use and Farm-Level Technical Efficiency in Nigeria: Gender Perspectives

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This study examined the effect of gender gap in credit use on farm level technical efficiency (TE) among small scale farming households in Nigeria. The study engaged the Generalised Household Survey (GHS) panel data collected by Nigerian Bureau of Statistics in 2015. Data analysis involved the estimation of TE using Data Envelopment Analysis (DEA) while Tobit regression was carried out to determine the gender gap effect of credit use on farm-level TE of farmers. Results indicated that average TE was generally low and the gender differential of 0.12 was biased against female-headed farming households. . The results of Tobit regression showed that gender did not exert significant impact on TE but the impact of gender gap in credit use on TE was highly significant and the sign of the coefficient (0.113) suggested an increasing impact for male headed households. Other channels of transmission of the impact of credit use on TE included the significant impact of the interaction of loan size with critical inputs such as land, improved seed, hired labour and fertilizer. The practice of mixed cropping also had significant impact on TE of farmers. These results suggested that policy interventions should focus on relaxing factors that constraint female headed household access to high volume loan and this can be achieved with the acceptance of other gender friendly alternatives to land as collateral.

Key Words: Gender, Credit Use, Technical Efficiency, Small Scale, Farming Households

BACKGROUND

Several empirical studies have confirmed that small scale farmers in Nigeria are generally resource poor and have limited access to institutional services and that increased access to and use of credit will provide opportunity for them to meet their production and consumption expenditures in order to attain improvement in farm level efficiency and productivity (Singbo, 2012; Sagib*et al*, 2018). Thus, efficient credit market presents opportunities for adequate use of productive inputs by small scale farmers leading to sustainable livelihood, poverty and hunger reduction (Mathew *et al*,2018; Sagib*et al*, 2018 and Afolayan*et al*, 2019)Theory have confirmed that the relationship between access to credit and agricultural production can be bi-directional (Tirivayi*et al*, 2016; Mathew *et at*, 2018) and Sossou*et al,* 2014 had earlier confirmed that the efficiency and productivity gain in credit use is often achieved through the combination of credit with other production inputs which is reflected in the interaction of credit and other variable inputs.. Also, studies such asAwotide*et al* (2015) and Samson and Obademi (2018) have emphasized importance of credit as an essential input in production and that productivity and growth have been found to be usually hindered by limited access to credit facilities by smallholder farmers in Nigeria. According to Awotide*et al* (2015), the impact and significance of other soci-economic and farm characteristics differ for smallholder cassava farmers that are credit constraints and those who are not credit constraints in Nigeria.This same view was held by Samson and Obademi (2018) in a study on the determinants of impact of credit access on productivity of farmers in Oyo state, Nigeria.Meanwhile, one dimensionthat was not covered in previous studies is the gender gaps in credit use and the resultant effects on farm-level technical efficiency (TE). This dimension is very important as previous studies outside Nigeria such as Quisumbing, and Pandolfelli (2010) had found that inequality in the distribution of resources between men and women led to production inefficiency and the gender gap thus created, hinder women's productivity and reduce their contributions to agricultural sector.Similar study by Adre*et al* (2013) had also revealed evidence of

gender gap in productivity due to access to production resources and suggested active policies that support women access and participation.

Meanwhile, the need to promote gender inclusive credit and financial policies has been underscored in a study by Benerie*et al.* (2015) along the lines of human right and capabilities arguments. These arguments were used to establish the importance of ensuring gender equality and hence, eliminating the gender gap in credit use. Integrating this argument with the neo-classical theory provided the theoretical construct for analyzingthe effects of gender gap in credit use on farm-level technical efficiency.

The neoclassic theory states that the objective of all producers is to maximize profit as such; a producer allocates resources according to market conditions so as to maximize its profit. Thus, a farmer is rational when for producing a specific output, with n inputs $x = x1 \cdots x2$, purchased at prices $w = w1 \cdots w2$; the production system runs on the production frontier. This mean that, for fixed inputs the production system optimizes the inputs combination so as the outputs are closer to the production frontier. Then, technical efficiency (TE) seeks the best inputs combination allowing being closer to the production frontier such that any other deviations from the production frontier measure the technical inefficiency (TI) of the production system (Kumbhakar and Lovell, 2000).

Given that smallholder farmers are resource poor and often suffer lack of institutional services (Singbo, 2012); improvement in the farm level efficiency and productivity could be achieved by a better access to agricultural credit. Meanwhile, the theoretical link between credit use and firm-level technical efficiency has been traced to farmers' allocation behaviors in which farmers allocate credit obtained in two ways: (1) investments in household consumption and social requirements (debts refunding, weddings, burial etc.) and (2) investments in farming requirements - inputs purchasing, labour, and so forth (Sossou*et al,* 21014). This theoretical construct suggests that credit in combination with other production inputs increase the production system TE. This is because credit is a production input and, in combination with others inputs such as labour, pesticides, fertilizer, seeds/seedlings, etc. can determine farms TE and this combination is reflected in the interaction between amount of creditand other inputs variables. For example study by Chanido*et al,* (2017) found that credit access increase average farm size among smallholder farmers in Pakistan with significant implication for increased productivity. In other words, farm size and access to credit were the two main factors for increasing agricultural production and farm-level technical efficiency among the farmers. The expected efficiency gain caused by credit availability can, therefore, not been trivialised because the effect of credit is likely to differ between liquidity constrained and unconstrained credit farmers. This means that the marginal effect of credit may actually be zero for borrowers for whom liquidity is not a binding constraint. When liquidity is a binding constraint, the amount and combination of inputs used by a farmer will deviate from their notional optimal level (the levels that would have been utilized if liquidity were not binding constraint). The marginal contribution of credit is, therefore, to bring input levels closer to optimal levels, thereby increasing output (Lau *et al.,* 1990, Tirivayi*et al,* 2016). Osabohen*et al,* (2020) examined the impact of household access to agricultural credit on production among small scale farmers in Nigeria and concluded that households that were not credit constraint had yield three times higher than households that were credit constraint.Against this background, this study evaluated the implication of gender gap in credit use among smallholder farming households for farm level technical efficiency.

Conceptual Framework

The conceptual framework adopted in this study for analyzing gender gap in credit use and the impact on TE of smallholder farming households in Nigeria draw extensively from existing literatures on gender and financial inclusion particularly credit access and use as well as the impact of credit on farm-level efficiency and productivity. Literatures have demonstrated that gender differentials in credit constraints factors can lead to differentials in credit access and the outcome (loan size). In other words, gender differentials in socio-economic factors, access to productive resources (farm characteristics) and institutional factors can lead to observable gap in credit access and loan size. These differentials have been established widely in literatures (Adamon and Adeleke, 2015 andSamson and Obademi, 2018)

Similarly, available literatures have also confirmed that for resource poor smallholder farmers, access to and use of credit is required to meet their production and consumption expenditures and to achieve the level of improvement in their farm level efficiency (Singbo, 2012, Mathew et al, 2018). However, this efficiency gain can only be achieved through the combination of credit with other production inputs which is often reflected in the interaction between loan size and other production inputs (Sossou*et al,* 2014). As a result, the observed gender gap in loan size is expected to pass through these channels of interaction to produce differential efficiency outcomes. Thus accounting for this differential outcome and the sources is very critical for gender inclusive credit and finance policies in Nigeria. This is very important since the efficiency differentials can reinforce vicious cycle of poverty thereby further exacerbate gender gap in credit access and use. Hence this framework sets the analytical basis for evaluating gender gap in credit use and the channels through which the use impact on farm-

level technical efficiency in Nigeria using the NBS_GHS wave 3 data for 2015.

Methodology and Data Requirement

This study utilized secondary data collected by National Bureau of Statistics in a nationwide survey conducted under the Generalized Household Survey (GHS-LMS) wave 3 in 2015**.** The survey was conducted in two periods; pre and post planting season. The wave 3 survey covered a total 5000 households and data sets provided an ambient for analyzing the gender dimension of credit use and farm-level TE in Nigeria. The data set covered household variables, farms and farming characteristics as well location information and community characteristics.

The household component captures the socio-economic as well as the demographic information at the household levels while the agriculture component covered farm level activities as well as other post-harvest activities undertaken by farming households including input use such as farm size, family and hired labour use, fertilizer use, seed variety as well as other financial inclusion variables such as credit use for agricultural purposes, credit use for other purposes, access to financial services, access to information, commodity prices and marketing of outputs.

Estimating Technical Efficiency

The first step taken was the determination of the TE of the households while the second step involvedthe consideration of factors that determine the estimated TE. Therefore, the study adopted DEA method for the estimation of the TE scores of the farming households ahead of other method such as Stochastic Frontier Analysis (SFA) based on its suitability for analysing multiple inputs and multiple outputs production unit (Coelli, 1995). Aside, estimation procedures do not require the assumption of a functional form to specify the relationship between inputs and outputs and also, do not require the distributional assumption of the inefficiency term. Thus, a Data envelopment analysis (DEA) is a mathematical technique, based on linear programming (LP), which is used to measure the relative efficiency of decision making units with multiple inputs and multiple outputs and has been described as one of several techniques that can be used to calculate a best practice production frontier (Helfand and Levine 2004).This study, however, adopted a two-step approach where in the first step, the DEA model was used to measure TE of credit users' households as an explicit function of some discrete variables and in the second step, some socio-economic and farm specific variables that wereassumed to have effect onthe efficiency of the farming households were interacted with credit use in a Tobit regression framework to explain variations in the measured efficiencies. In order to measure the effect of crop diversification on TE, a dummy variable was introduced tocapture the cropping patterns.

Estimating TE Using DEA

The measure of technical efficiency introduced by Farrell (1957) is an input oriented which measureby how much inputs could be reduced while maintaining the existing level of output. The alternative way in which to consider technical efficiency is an output oriented measure—by how much could output be increased while using the given level of inputs. The measure of technical efficiency (input and output oriented) has subsequently been extended to accommodate multiple inputs and outputs. This approach to measuring technical efficiency yields a relative measure. It measures the efficiency of a farm relative to all other farms in a sample. Farrell argued that this is more appropriate as it compares a farm's performance with the best actually achieved rather than with some unattainable ideal (Fraser and Cordina, 1999). This study focused on input oriented models, where the decision-making units' ability to consume the minimum input given the level of outputs that should be attained is considered. The input-orientation is more appropriate in this instance because the output level is given by the target of crop production. The decision on the orientation of DEA models is also supported by considering the degree of a farmer's control over variables in the decision-making unit's production mix. Farmers have more control over their inputs than their outputs. Coelli*et al.,* (1998) have argued that the constant return to scale (CRS) DEA model is only appropriate when all firms are operating at optimal scale. But in an environment like Nigeria, imperfect competition or constraints on finance (credit) may cause a firm to not operate at optimal scale. For this reason, an input-oriented variable return to scale (VRS) DEA model is used to calculate technical efficiency in this study and is given as:

$$\begin{aligned} &\min_{\theta,\lambda} \theta \\ &st, \\ &-q_i + Q\lambda \leq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &N1'\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \qquad 1$$

Where θ is a scalar, λ is N x1 vector of constant and N1 is an N x 1 vector of ones. The θ is the efficiency score of the*ith* farm and satisfies the condition that θ ≤ 1. A farm with a score of 1 is said to be fully technically efficient, i.e. operating on the frontier (Farrell, 1957). As a result, the linear programming problem needs to be solved *N* times and a value of θ is generated for the number of farms in the sample. Q_i is crop output and X is a vector of inputs.

As earlier noted, the DEA with a constant return to scale assumption is a restrictive one and to account for imperfect markets, financial market constraints and government interventions, a variable returns to scale DEA model was imposed on the model for analysis. The TE efficiency was generated for male and female credit users while the differential in the average TE between the two groups was established.

Description of Variables

$Q_i$is the output of farm household (*i*) in kg. .The inputs vector (X_i) included five variables: Farm size (in hectare), the quantity of labour (in number of persons), fertilizer use in (kg), quantity of seed in (kg), and cost of agro-chemicals (Naira). The elasticities of the inputs vector X_i are expected to have a positive impact on the production level.

Tobit Model

For the purpose of capturing the gender and credit use impact on TE, a Tobit model that included gender and credit use variable as well as the interaction between credit and other factors of production was specified. Since the efficiency scores usually falls between the interval 0 and 1— making the dependent variable a limited dependent variable, a commonly held view in literatures is that the use of the Tobit model can handle the characteristics of the distribution of efficiency measures and thus provide results that can guide policies to improve performance. In recent years, many DEA applications use a two-stage procedure involving both DEA and Tobit. DEA efficiency measures obtained in the first stage are the dependent variables in the second stage Tobit model. The goal of the second stage is to explore relationships between the technical efficiency measure and other relevant socio-economic and farm specific variables Thus, the standard Tobit model as given by Amemiya (1984) can be defined for observation (farm) *i* as follows:

$K_i^* = X_i\beta + \boldsymbol{\mu}_i$ 2

Where $K_i$is the dependent variable; X_i are the independent variables vector to estimate; and $\boldsymbol{\mu}_i$ is the error term normally distributed, having a null mean and a constant variance σ_ε.

Given that, for a farm *i*, the TE scores vary between 0 and 1, it leads to

$K_i = K^*$ if $0 < K^* < 1$ 3

$K_i = 0$ if $K^* \leq 0$ 4

Therefore the empirical model is;

$K_i^* = \beta_0 + \sum_{i=1}^{n} \beta_n Xi + \mu i$ 5

Equation 5 was estimated using Maximum likelihood method to avoid the errors associated with the use of OLS (Gujarati, 2004) and was carried out for male and female credit users. Thus, K_i^* is the TE score of *i* farm, Xi is the vector of independent variables while β_0 and $\beta_n$are parameters to be estimated.

As such, the independent variables used in the estimation of equation 5 included four (4) socio-economic variables, 8 farm characteristics variables, one institutional variable and the cross product of gender and credit use (log of loan size). Out of the eight farm variables, six (land ownership, improved seed, fertilizer use, hired labour, use of machines and application of agrochemicals) were interacted with loan size to track the channel of transmission of the impact of credit use on TE. The socio-economic variables included sex measured as a binary variable (1 if the household head is male and 0 otherwise) and it is acknowledged that sex often create differential impact on TE and this was interacted with loan size to determine gender impact of credit use on TE, age is measured in years (this could approximate years of experience in farming) and is expected influence positively TE, exposure to formal education is expected to enhance technology adoption as well as drive the motivation to access formal credit and thus create positive influence on TE (measured as dummy 1 if respondent has formal education and 0 otherwise) while marital status is a mark of social responsibility in Nigeria and often enlist the commitment to ones work. As such, married couples are often found to be more hard working and committed to their work which thus, ensures greater efficiency and productivity. It is measured as a dummy variable (1 if the household head is married as at the time of the survey and 0 otherwise).

The farm characteristics variables included the amount of credit used (log) measured in Naira is expected to ginger households towards increased use of farm inputs in order to achieve greater efficiency. Others included land ownership as captured by availability of collateral for loan and measured by a dummy variable (1, if owned land and 0, otherwise), the use of improved seed varietiesthat could raise output level significantly thereby increasing the TE of the household (measure as dummy; 1 for use) and the use of hired labour which is expected to enhance household efficiency particularly where such household is family labour constrained (dummy; 1 for use). Other variables included the use of agrochemicals (pesticides and herbicides) for controlling weeds as well as pest and diseases thereby reducing loss and thus influence TE positively (dummy 1 for use), the use of fertilizer for enriching soil nutrients and achieving increased output (dummy; 1 for use) and the use of machine to increase the operational efficiency of farmers by increasing the rate of substitution of capital for labour (dummy; 1 for use). Also, the practice of irrigationfarming was included as a way of mitigating the risk of weather and climate variability on crops and thus, increase output per unit of area (dummy; 1 for use). A

Farming was included as a way of mitigating the risk of weather and climate variability on crops and thus, increase output per unit of area (dummy; 1 for use). A dummy variable cropping pattern (1 for mixed cropping and 0 otherwise) was also added to capture the effect ofcrop diversification (producing more than one crop). This practice is important in smallholder farming as a mean of risk mitigation and output enhancement and the institutional variable included in the model is exposure or access to extension services and was also captured by dummy (1, if respondents received extension services during the year)

RESULTS AND DISCUSSIONS

Gender and Credit Use

This section presented the result of the analysis of gender gap in credit access and use (loan size) among the smallholders in Nigeria. The descriptive analysis of the socio-economic and farm characteristics was carried out while the test of differences of mean or proportion between male and female headed households were also determined and the results displayed in Table 1. From the table, gender difference was found to be significant for age, household size, farm size and loan size. It was not significant with respect to distance to the market. This may not be unconnected with the fact that both male and female headed households live within the same neighborhood. Apart from the fact that the difference in the mean loan size was significant, it indicated that male smallholders received more than twice the average loan size of their female counterparts. The reason could be traced to the fact that loan of higher magnitude require collateral such as land which in most cases can only be provided by men. The area of land cultivated by male smallholders also double that of their female counterparts, a situation that could be traced to limited access to and ownership of land by the female headed households. Land ownership is very important in smallholder farming as it determines the type of crops, the crop mix as well as other cultural practices that could be engaged by farmer.

Table1: Test of Gender Differences in Mean of Discrete Variables

Variables	**Male**	**Female**	**Difference**	**t-values**
Mean Age (years)	52.378	62.211	(9.833)***	9.923
Mean household size (No)	8.238	4.957	3.280***	13.391
Mean farm size (ha)	5. 160	2. 102	2.454**	7.579
Mean loan size (N,000)	1248.08	719.30	529.77**	7.610
Mean distance to the market (km)	7. 69	5..264	2.905	1.669

Source: NBS GHS-Survey, 2016: *** significant at 1%; ** significant at 5% and figures in bracket are in favour of female smallholders

Credit Use and Technical Efficiency by Gender

The gender gaps in the use of farm inputs were calculated per hectare while the test of difference of mean between the two groups was carried out using t-statistics and the result is as presented in Table 2. The mean difference in quantity of critical inputs like seeds and fertilizer were significantly biased against female headed households. The Table showed that the use of these critical inputs was sub-optimum. The Food and Agricultural Organisation recommendations for optimum use of these inputs were 50 and 100 kg/ha for seeds and fertilizer respectively. Even though the mean difference with respect to farm size was bias in favour of male headed households, it was not statistically significant. Conversely, the mean difference with respect to the cost of agro-chemicals was bias in favour of female headed households and was also not statistically significant. These results indicated that the higher relative quantity of critical input engaged by male headed households can be linked to their ability to mobilize higher loan size which is likely to impact on farm-level TE.

Table 2: Gender Gap in Inputs Use among Smallholder Farming Households

Inputs –Mean	**Male (n = 2, 094)**	**Female (n = 564)**	**Mean difference**	**t-statistics**
Land (Hectares)	5. 23	3. 58	1.65	1.238
Labour (no of persons)/ha	7	9	(2)	1.452
Quantity of seed (kg/ha)	19.491	12.574	7.083***	3.662
Quantity of fertilizer (kg/ha)	92.402	61.478	31.076**	2.597
Cost of Agro-chemicals (N)	4718.60	4738.71	(20.113)	1.094

Source: NBS, GHS-LMS Survey 2016:; *** significant at 1% and ** significant at 5% and figures in bracket are in favour of female credit users

The test of difference of the socio-economic and farm variables was carried out and the results presented in Table 3. For the socio-economic variables, the difference in the proportion of respondents with exposure to formal education was biased in favour of male headed households and was highly statistically significant while the difference with respect to marital status was biased in favour of female smallholders and also significant. In the case of farm characteristics, the observed gender gap in the proportion of households that engaged inputs such as improved seed, fertilizer and machines was significantly biased against female headed households. The difference in land ownership was also found to be significantly biased against female headed households which further confirmed the earlier findings by Awotide et al, (2015) in Nigeria and Chanido et al, (2017) in Pakistan. This confirmed the fact that fertilizer and tractor subsidy policies in Nigeria were gender insensitive. The gender difference in proportion of households with respect to the use of agro-chemicals and the practice of irrigation was, however, biased in favour of female headed households but was not significant.

Equation 1 was estimated using VRS DEA model to determine the frontier (most technical efficient farming household) while the technical efficiency of each household was generated reference to the frontier farming household and subsequently, average TE was computed for male and female headed households. The average TE was low for both groups at 0.46 and 0.34 for male and female headed household respectively and the efficiency gap was not significant. However, the scale efficiency was twice higher for male headed households and statistically significant suggesting higher return to scale.

Table 3: Descriptive Statistics by Male and Female Credit Users

Variables	**Males**	**Female**	**Difference**	**t- values**
Socio-economic Characteristics	**n = 2 094**	**n = 564**		
Mean age of respondent (years)	56.46	59.00	(2.54)	1.027
Exposure to formal education (% of respondents)	62.29	56.16	6.13**	3.756
Marital Status (% of respondents married)	22.11	26.26	(4.15)**	2.732
Farming Characteristics	**Percent**	**Percent**	**Difference**	**X^2 values**
Land ownership	93.25	17.80	75.45*	6.87
Use improved seed	29.57	23.46	6.11**	5.431
Hired labour used	74.61	82.08	(7.47)***	4.981
Cropping pattern	78.02	59.47	18.55**	2.652
Use of Agro-chemicals	21.04	23.52	(2.48)	1.543
Use of fertilizer	30.57	26.26	4.31**	2.676
Use of machines	10.69	7.81	2.88**	3.872
Use of Irrigation	4.91	5.82	(0.91)	1.258
Exposure to extension agent	1.85	0.34	1.51	1.009
Average TE (VRS)	0.461	0.344	0.117	1.378
Average Sale Efficiency	0.647	0.346	(0.301)***	3.567

Source: NBS, GHS-LMS Survey 2016: *** Significant at 1%; ** significant at 5%; and figures in bracket are in favour of female credit users

Gender and Credit Impact on Technical Efficiency

Following the determination of TE for each of the households, equation 5 was estimated to examine gender and credit use impact on TE of the households and the result presented in Table 4. The result further confirmed the non-consequential effect of gender on TE as gender alone did not have significant impact on TE. However, the impact of gender gap in credit use as measured by the interaction of gender and loan size was highly significant and revealed an increasing impact for male headed households. This indicates that the observed gender differential in average TE could be traced to the higher average loan size received by the male headed households. Acquiring formal education by household head also exerted significant and positive impact on TE and which confirmed the result of the two stage Heckman analysis on the significant importance of formal education not only for credit access but also for amount of loan that can be mobilized by the households. The descriptive analysis however, pointed out that this variable was particularly biased against female headed smallholder farmers in Nigeria.

In terms of farm characteristics, not only is the impact of loan size on TE significant but the channels of transmission of the impact as measured by the interaction of loan size and other critical economic resources also revealed different level of significance. For example, the interactions of loan size with land ownership, use of improved seeds, hired labour and fertilizer use were positive and significant at 5 per cent. The significance of its interaction with land ownership

confirmed the relative advantage of men over women in the use of land as collateral for loan. The descriptive analysis had earlier confirmed the significant of gender gap biased in land ownership in favour of male headed household. Similar significant gender gap exists in favour male headed households in the use of critical economic resources such as fertilizer and other agrochemicals (Table 3). The observed gender gap biased probably accounted for the higher TE of male headed households relative to their female headed counterparts and this can be linked to the relative advantage of male headed households in terms of loan size received. The coefficient of the dummy variable used for capturing the impact of crop diversification on TE (cropping pattern) was also highly significant confirming the fact that households practicing mixed cropping (planting more than one crop) attained higher level of TE when compared with their counterparts practicing sole cropping. Similarly, access to extension services has significant influence on the level of TE of small holder farmers.

Table 4: Gender and Credit Use Impact on Technical Efficiency

Variables	**Estimates**		
Socio-economic Characteristics	**Coefficient**	**Standard Error**	**T values**
Gender	0.363	0.211	1.72
Age	-0.321	1.375	-0.233
Formal education	1.896**	0.544	3.48
Marital status-married	0.471	0.638	0.74
Gender X Loan size	0.113***	0.023	4.91
Farm Characteristics			
Loan size	6.4801**	2.303	2.81
Loan size X Land ownership	0.625**	0. 241	2.59
Loan size X Improved seed	8.129**	2.921	2.78
Loan size X Hired labour used	36.596**	12.392	2.95
Loan size X Agrochemical use	11.405	10.315	1.32
Loan size X Fertilizer use	117.353**	53.400	2.20
Loan size X Machine use	6.736	7.168	0.79
Copping pattern	82.115**	32.035	2.56
Use of irrigation	0.241	0.411	0.59
Access to EAs	0.456***	0.087	5.20
Constant	588.553	503.830	1.17
Number of observations	2, 658		
LR chi^2 (16)	39.94		
Prob>chi^2	0.0013		
Psuedo R^2	0.007		
Log Likelihood	-27624		

Source: NBS, GHS-LMS Survey 2016: ***=1%, **= 5%, *=10% level of significance.

CONCLUSION

Findings from this study revealed that the use of critical efficiency induced inputs such as fertilizer and improved seeds were found to be generally sub-optimum andgender gap analysis confirmed that it was biased against female-headed households. This may not be unconnected with the gender gap biased in average loan size. All though the estimated gender gap of 0.117 in TE was not significant, it was less proportional than the observed gender gap in loan size. This led us to the conclusion that the observed gender gap in TE could be traced to the advantage conferred on male headed households by the differential access to credit and average loan size received which afforded them the opportunity to engage higher productive inputs that led to higher TE.

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