INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS
ICAE
29th | Milan Italy 2015
UNIVERSITÀ DEGLI STUDI DI MILANO AUGUST 8 - 14
AGRICULTURE IN AN INTERCONNECTED WORLD

Impact of Use of Credit in rice farming on rice Productivity and Income in Benin

By Kinkingninhoun-Medagbe Florent Mahoukede[1], Diagne Aliou[2] and Biaou Gauthier[3]

1: Africa Rice Center, Benin; 2: University of Gaston Berger, Senegal; 3: University of Abomey-Calavi, Benin,

Abstract

This paper aims to assess the impact of the use of credit in rice farming on productivity and income in Benin. It applies the potential outcomes framework to data collected from 342 rice farmers in Benin to estimate the Local Average Treatment Effect (LATE). Findings show that the use of credit in rice farming has positive and significant impact on farmers' rice yield, rice output, rice income, per capita rice income, annual household income and per capita annual household income. Therefore, facilitating access of rice farmers to agricultural credit is a good strategy for supporting rice sector development, and therefore contributing to food security and poverty alleviation in Benin. Moreover, the impacts were higher for female farmers than male farmers. Therefore, it is important to control for heterogeneity in impact assessment studies in order to appreciate the real effect of interventions on different social categories in the target population.

Keywords: *Rice, Credit, Gender, Impact, Income, productivity, Benin, Local Average Treatment Effect*

JEL *Codes: C21; C26; I31, Q12, Q14*

1. Introduction

It is generally recognized that credit plays a crucial role in economic development in general and agricultural development in particular (Diagne and Zeller, 2001; Diagne, 2002; Honlonkou et al., 2005; Simtowe and Phiri, 2007; Fall, 2008; Simtowe et al., 2008; CTB, 2012). So, credit appears as a solution to the weakness of rural savings by allowing producers to cover the expenses related to production. According to Diagne (2002), the continuing inadequate and limited access of African farmers to credit is believed to have significant negative consequences for various aggregate and household level outcomes, including technology adoption, agricultural productivity, food security, nutrition, health, and overall household welfare. In Benin, access to agricultural credit is one of the major constraints that limit agricultural development. According to Deveze (2000), credit constraint is very crucial in African agricultural sector because of weather and land constraints, but also the unstable socio- economic environment. Other studies have shown that most the Microfinance Institutions (MFI) directly exclude from their system farmers which Internal Rate of Return (IRR) is lower than the cost of the loan which is still high in Africa. This limits farmers' productivity and therefore affects their income and livelihood. Indeed, the intensification of rice production requires a higher inputs use (seeds, fertilizers, labor, pesticides), especially in rainfed rice farming. In addition, the adoption of new technologies, which may require investment, is one of the key options for increasing rice productivity. Furthermore, as a result of recent financial, economic and food crises, input costs, including labor have drastically increased. In this situation, increasing rice production for self-sufficiency in Benin requires significant financial resources for farmers whose savings are generally low. Thus, additional suitable and timely financial resources need to bed provided to farmers to enable them to cope with the high cost of inputs. Therefore, the issue of access to credit is essential for rice farming development in Benin. Access to credit is expected to have positive effect on new technologies adoption, use of good and recommended agricultural practices, and therefore on the productivity and farmers livelihood. According to Diagne (1999), without a well-functioning financial market, there is unlikely to significantly improve agricultural productivity and African rural population livelihood. Furthermore, access to credit and its use in rice farming may significantly improve the demand and use of suitable inputs (Fall, 2008). Thus,

farmers who have access to credit and use it in rice farming could easily manage to get fertilizer, pesticides, labor and other inputs in required quantity and timely, especially when the credit is obtained before the season. This would improve their productivity and income (Morduch, 1998; Robinson, 2001; Kodjo *et al.*, 2003; Honlonkou *et al.*, 2005).

Like many developing countries, several initiatives have been taken and implemented by Benin government and its partners to facilitate access to rural and poor population, including rice farmers. These initiatives include the National Fund for Agricultural Development (FNDA), the Municipal Development Support Fund (FADEC), the Emergency Program for Food Security Support (PUASA), the credit component of the National Company for Agricultural Promotion (SONAPRA), the National Fund for Promotion of Enterprise and Youth Employment (FNPEEJ), the National Fund of Microfinance (FNM) and the Program of Micro-Credit for Poorest (MCPP). These initiatives have been undertaken and implemented by the government and aim to provide credit to vulnerable development actors including farmers and agricultural entrepreneurs. In addition to these governmental initiatives, rice farmers get agricultural credit from local and private initiatives such as the Local Banks of agricultural Credit and Mutual (CLCAM), the Rural Banks for Savings and Loan (CREP), and various NGO and rural development projects. According to OCS (2010), the implementation of these initiatives has improved the access of farmers to agricultural credit, but the rate is still low. However, the real impact of the use of credit in agriculture is not well investigated.

This paper focuses on rice farming households and aims to assess the impact of the use of credit in rice farming on productivity and income. We assume that the use of credit in rice farming will improve the use of inputs by farmers, and enhance their productivity and income. The paper will also test the assumption that any technological change in agricultural system affects men and women differently.

2. Methodology

2.1. The analytical framework of impact of credit

The assessment of the impact of use of credit in rice farming on productivity and income is based on the Sustainable Livelihood Framework (SLF) developed by DFID and its collaborators (Solesbury, 2003; DFID, 2001). It is an evolved thinking about poverty reduction and environmental management. It is the way the poor and vulnerable live their lives and the importance of structural and institutional issues. The approach suggests development activities that are people-cantered, responsive and participatory, multilevel, conducted in partnership with both the public and private sectors, dynamic and sustainable. It draws on the main factors that affect poor people's livelihoods and the typical relationships between these factors. The framework recognizes that every household and community has resources on which to build and support both individuals and the community in acquiring assets needed for their long-term well-being. It is quite attractive in the sense that it provides a simple but well-developed way of thinking about a complex issue (welfare). It is also attractive because it can be applied at various levels of detail as a broad conceptual framework or as a practical tool for designing programs and evaluation strategies.

As in every society, individual households in Benin are endowed with human capital (households' members' skills, aptitudes, knowledge, etc.), natural capital (the quality and quantity of natural resources available like land, water, etc.), physical capital (infrastructure (road, electricity, markets, etc.), tools, and equipment used for increasing productivity), social capital (networks for cooperation, mutual trust, and support, etc.) and financial capital (savings and regular inflows of money including credit), which constitute the resource constraint based on which they maximize their livelihood. These resources are affected by exogenous factors such as agro-climatic conditions (drought, rainfall, etc.), insect pests and diseases which hinder their productivity. Change in financial capital wrought through the availability and possibility to get credit to invest in rice production affect the rice farmers' perception, beliefs expectations and preference toward different inputs used in production. This is because, based on the characteristics of the availability of credit and possibility to get credit, farmers believe that using

credit to improve their inputs use would increase their yield and therefore they anticipate strong benefit. This constitutes the farmers' 'value formation' that in turn will condition their decisions in term of investment, crop and varietal choices, and resource allocation to various inputs. Their decisions have to change because the use of credit in rice production may need more land and different types of other inputs. This can be expected to affect their consumption, marketing of harvested quantities of different crop varieties, savings and income generation activities. Therefore, household decisions and choice constitute the farmers' behavioral outcomes, which will finally affect their productivity, income and poverty levels (livelihood outcomes). In this paper we investigate whether using credit in rice production enhance farmers' productivity to improve their incomes.

2.2. The potential outcomes framework for impact evaluation

In the growing literature on impact assessment of programs or policy interventions, many of the studies have usually relied on fairly macro approaches (Evenson and Gollin, 2003). On the other hand, many other micro-level studies have assessed the impact of use of credit simply by examining the differences in mean outcomes of users and non-users, or by using simple regression procedures that include the use of credit status variable among the set of explanatory variables. Critics have pointed out that such simple procedures are flawed because they fail to deal appropriately with the self-selection bias caused by selection on observables or unobservable present in observational data collected through household surveys. For that reason, these studies fail to identify the causal effect of using new product from programs or policy interventions (Imbens and Wooldridge, 2009; Heckman and Vytlacil, 2005; Lee, 2005; Imbens, 2004; Rosenbaum, 2002; Heckman and Robb, 1985; Rosenbaum and Rubin, 1983; Rubin, 1974).

The potential outcome framework is increasingly becoming the standard approach to deal with the self-selection bias issue for assessing the impact of programs or policy interventions (Rubin, 1974; Imbens and Wooldridge, 2009). The framework is also being advocated as a more suitable and rigorous framework for assessing the impact of endogenous treatment variables like use of credit than the so called "economic surplus" method, which has been until recently the de facto

standard method used by Agricultural economists (De Janvry et al., 2010). The potential outcome framework is used to assess the impact of use of credit on rice farmers' productivity and incomes.

Under the potential outcomes framework, each population unit with an observed outcome *y* has ex-ante two potential outcomes: an outcome when receiving a treatment and an outcome when not receiving a treatment. Here the treatment is use of credit in rice production *j*. Let D_j be the binary variable indicating the use of credit in rice production *j* with $D_j = 1$ indicating use of credit (i.e. $d_j = d_j^1$) and $D_j = 0$ indicating non-use of credit by a population unit (i.e. $d_j = 0$). Also, let $y_1 \equiv g(d_j^1, z)$ and $y_0 \equiv g(0, z)$ be the potential outcomes corresponding to the two mutually exclusive states of use and non-use of credit, respectively. For any population unit, the causal effect of use of credit on the outcome *y* is defined as: $y_1 - y_0$. However, the two potential outcomes cannot be observed at the same time. With the observed outcome *y* given by $y = D_j y_1 + (1 - D_j) y_0$, we can only observe either y_1 or y_0 depending on whether D_j equal 1 or 0, thus making it impossible to measure $y_1 - y_0$ for any population unit. However, if we let Y be the random variable defined in some probability space $(\Omega, \Sigma, \mathrm{P})$ reflecting the distribution in the population of the outcome represented by the outcome variable y[1], then the average causal effect of adoption in the population, $E(Y_1 - Y_0)$ (with E being the mathematical expectation operator), can be determined. Such a population parameter is called the average treatment effect (ATE) in the literature. One can also estimate the mean effect of the use of credit on the sub-population of users of credit: $E(y_1 - y_0 \mid D_j = 1)$, which is called the average treatment effect on the treated and is usually denoted by ATT. The average treatment effect on the *untreated*: $E(y_1 - y_0 \mid D_j = 0)$ denoted by ATU is also another population parameter that can be defined and estimated.

[1] That is, Y takes its values in the same outcome space as the deterministic outcome function $g(a_{\dot{N}}, z)$ that determines the value of *y*. Similarly, from now on, we will use the same probability space $(\Omega, \Sigma, \mathrm{P})$ and use corresponding capital letters to designate the random vectors corresponding to the lower case vector defined above. In particular, *D* and Z will stand respectively for the binary random variable corresponding to *d* and the random vector corresponding to the vector z.

The population means impact parameters ATE, ATT, ATU can generally be identified under some statistical independence assumptions between the population distributions of the treatment status variable D and the two potential outcomes Y_1 and Y_0 (possibly conditional on some observed random vector X of covariates). Two alternative statistical independence assumptions are made to identify ATE, ATT and ATU (Imbens and Wooldrige, 2009) [2]. The first one is the *unconditional independence* assumption: The population distribution of D is independent of that of Y_1 and Y_0. Under this assumption, ATE, ATT and ATU are identified by the mean difference of observed outcomes of users of credit and non-users of credit:

MD= $E(Y \mid D=1)-E(Y \mid D=0)$, which is easily estimated by its sample analogue. The second assumption is the *conditional independence* assumption also called "selection on observables": The population distribution of D is independent of that of Y_1 and Y_0 conditional on some observed component X of the vector $(a^*_{(\dot{N})}, Z)$ of exogenous and endogenous random variables whose values do not depend on $a_{\dot{N}}$. Under this assumption the conditional mean treatment effect are all identified by the conditional mean difference of observed outcomes MD(x) = $E(Y \mid X=x, D=1)-E(Y \mid X=x, D=0)$ and ATE, ATT and ATU are identified by the mean of MD(x) over x in the full population, the subpopulation with D=1 and the subpopulation with D =0, respectively. Several estimators are used to estimate MD(x) (Imbens and Wooldrige, 2009; Imbens, 2004). These include: 1) matching estimators (nearest neighborhood covariates matching, propensity score matching, genetic matching and coarsened exact matching, etc.), 2) regression-based estimators including parametric (OLS/NLS) and non-parametric (kernel, polynomial series, etc.), 3) inverse probability weighting (IPW) estimators and 4) hybrid estimators which combines matching and regression or IPW and regression (the doubly robust estimator).

However, in the case of an endogenous treatment like the use of credit, the assumption of conditional or unconditional independence is a very unrealistic assumption. Instead, the most

[2] These independence assumptions are accompanied by some regularity conditions on the support of the conditional and unconditional distribution of D (see Imbens and Wooldridge, 2009)

plausible assumption in this case is the "selection on unobservables". But, under the case of "selection on unobservables", the ATE, ATT and ATU parameters cannot be identified without making additional arbitrary assumptions that including assumptions about functional form of the outcome function and probability distribution of the unobserved variables (Heckman and Vytlacil, 2005). In this case, Imbens and Angrist (1994) have introduced the *local average treatment effect* (LATE). The LATE assumes the existence of at least one instrumental variable *V* that explains treatment status but is redundant in explaining the outcomes Y_1 and Y_0. LATE is defined as the *mean impact in the subpopulation of "compliers"* (population units who were induced to change treatment status by the instrument *z)*: $LATE = E(y_1 - y_0 \mid C(z))$, where $C(z)$ is the complier subpopulation with respect to *z.*

Under all circumstances (unconditional independence, "selection on observables" or selection on unobservable"), the LATE parameter can be identified using instrumental variables (IV) methods (Heckman and Vytlacil, 1999 and 2005; Heckman and Robb, 1985; Manski and Pepper, 2000; Imbens, 2004; Abadie, 2003; Imbens and Angrist, 1994), which are designed to remove both overt and hidden biases and deal with the problem of endogenous treatment. The IV-based methods assume the existence of an instrument called z, that explains treatment status but is redundant in explaining the outcomes Y_1 and Y_0, once the effects of the covariates *x* are controlled for. Different IV-based estimators are available, depending on functional form assumptions and assumptions regarding the instrument and the unobserved heterogeneities.

The first one is the simple non-parametric Wald estimator proposed by Imbens and Angrist (1994), and suppose that the instrument z is random and totally independent of the potential outcomes Y_1 and Y_0. It requires only the observed outcome variable y, the treatment status variable D, and an instrument z. The second IV-based estimator is Abadie's (2003) Local Average Response Function (LARF) which generalizes the LATE estimator of Imbens and Angrist (1994) to cases where the instrument z is not totally independent of the potential outcomes Y_1 and Y_0 but will become so, conditional on x, a vector of covariates that determines the observed outcome y.

In this study, the instrument we use is *having obtained credit*. Obtaining credit by a farmer can explain the use of credit in rice production, but it is redundant in explaining the two potential states of productivity and incomes. The assumption that obtaining credit is random in the population is, however, unrealistic given the way farmers are aware about credit institutions and criteria to have access to credit. We therefore use the last method, the Abadie's (2003) LARF to estimate the LATE parameter for assessing the impact of use of credit in rice farming on yield and income. In the study, we also check for the homogeneity of the impact by sex-disaggregating the impact . Moreover, we analyze the different livelihood improving strategies used by farmers when using credit in rice farming by assessing the impact of the use of credit on inputs demand.

2.3. Data and descriptive statistics

In accordance with the recommendation of statisticians as revealed by Khandker *et al.* (2010), this study adopted a two-step stratification approach to improve the internal and external validity. In the first step, villages were selected from Communes, and in a second stage the famers from villages. Only one rice farmer has been selected per household. This allows us to collect household level information. The importance of rice and the accessibility of the village were the main criteria used for the village selection. Villages were randomly selected from each group of villages based on the importance of each group. In total, 35 villages were selected: 22 villages in the central region and 13 villages in the northern region. Ten household on average were randomly selected from each village among all the rice farmers in the village. In total, 361 rice producers' households were surveyed for the ex-post impact assessment study. However, due to data quality issue, 342 households' data were used for this study.

Data were collected at village and producer levels in 2010. Data collected are related, among other, to socio-demographic characteristics of farmers, obtaining of credit in cash during the last rice cropping season, obtaining of credit in kind during the last rice cropping season, activities in which the credit is used (including rice farming), land size available, rice area cultivated,

quantity and cost of inputs used (seed, fertilizer, pesticides, labor, hired labor), rice production, rice selling price, revenues and expenses related to other activities and other households members, households assets, children's schooling and health, main foods consumed by households members, etc.

Obtaining a type of credit is the fact that a rice farmer reports to have received this type of credit during the last rice farming season from any source of credit. The following questions have been asked to farmers: '*Did you obtain credit in cash during the three last years?*' and '*Did you obtain credit in kind (seeds, fertilizers, pesticides, etc.) during the three last years?*' The credit we are focusing on is not a specific activity-oriented credit or specific-actor oriented credit, but any credit in general that farmers manage to get from any source (financial or micro-credit institutions, public institution of credit, extension services, private institutions, etc.). The two dummy variables obtained have been combined to a single dummy variable 'Obtaining credit' which expresses the obtaining of credit in cash or in kind by a given farmer. This variable is equal to 1 if the farmer has gotten credit (in cash or in kind) and 0 otherwise. Similarly, the use of credit is the fact that a farmer reports to have used the credit obtained in rice farming activity during the last rice farming season. The following questions have been asked to farmers for each type of credit: '*In which activity have you used the credit obtained?'* The optional answers suggested to farmers included rice farming activity. The codes of using credit in rice farming have been used to generate the two variables related to the use of credit in cash in rice farming and the use of credit in kind in rice farming. A single dummy variable '*Use of credit in rice farming activity*' has been generated from these two variables expressing the use of credit (in cash or in kind) in rice farming activity. This variable is equal to 1 if the farmer has used credit (in cash or in kind) in rice farming and 0 otherwise. The variable obtaining credit will be used as instrumental variable in the estimation of the LATE parameter whereas the variable use of credit in rice farming will be used as treatment variable.

Table 1 reveals that the majority of respondents (64.72%) are female farmers. Only 38.9% of farmers have obtained credit with the highest rate for female farmers (43.0% against 31.4% for male farmers). In addition, all rice farmers who get credit did not use it in rice farming. The rate

of use of credit was estimated at 29.0 % (73.7 % of those who got the credit) with 30.3 % for female farmers against 26.5% for male farmers. Credit users in rice farming (44 years old) are younger than credit non-users (47 years old). The average household size of credit users (6.24 people) is statistically higher the one of non-users of credit (5.62 people per household). In addition, credit users in rice farming have spent less time in their villages (35 years) than the non-users of credit (40.66 years). 29.53% of users of credit reached primary school against 15.9 % for non-users of credit. Furthermore, the users of credit use more ICT / media tools than the non-credit users. 79.55% of them used to listen radio (against 63.76 % for non-users of credit) and 61.36 % of them own a mobile phone (against 35.9 % for non-users of credit). Most of them belong to an association (84.09%) and are in contact with the rice extension institution (59%).

3. Results and Discussion

3.1. Mean differences analysis of inputs and outcomes by treatment status

Evidence from Table 2 shows that the users of credit in rice farming cultivated on average larger land in rice (0.82 ha) than the non-users (0.63 ha). This difference is more pronounced within male farmers (+0.56 ha) than within female farmers (+0.04). In addition, there is a high difference within the users of credit since the male users of credit (1.36 ha) cultivate on average more than twice the average rice land size of female users of credit (0.56 ha) for male non- users. However, apart from the total labor where female users of credit use less quantity (535.6 man-days per hectare) than female non-users of credit (808.8 man-days per hectare), there is no significant difference between users and non-users of credit in terms of quantity of fertilizer per hectare, cost of hired labor per hectare and quantity of pesticides used per hectare. From these findings giving only a higher value in rice land using for the users of credit, one can conclude that the use of credit allow farmers to increase only their rice cultivated area. However, as explained above, the mean difference cannot give the true effect of the use of credit on input demand.

Moreover, mean differences in outcomes (Table 3) show significant and positive differences between users and non-users of credit in rice farming (at 10% level) only for rice income and household income per capita. This reveals that the users of credit in rice farming gained more from rice production than the non-users of credit. The intra-gender analysis shows significant and positive differences between users and non-users of credit only within male farmers for rice income, rice income per capita and household income per capita.

3.2. Impact of use of credit on rice yield and its determinants

Table 4 gives the LATE estimates for rice output and yield. The LATE values are all positive and significant at 1% level showing that the use of credit in rice farming has positive and significant impact on rice output and yield. Potential users of credit in rice farming have harvested an additional paddy of 70.8 kg and 157.2 kg per hectare. This result is confirmed by Hulme and Mosley (1996), Rasoloarison *et al.* (2001), Diagne (2002), Fall (2008), Das *et al.* (2009), Bolarinwa and Fakoya (2011) and Ayaz and Anwar (2011) who found, in studies assessing the impact of agricultural credit, positive and significant impacts of agricultural credit on agricultural output, yield and technical efficiency. In addition, the results show that the increases in rice output and yield are higher among female farmers than male farmers. In other words, the female potential users of credit in rice farming have increased their total rice output by 93 kg of paddy (against 36 kg for male potential users of credit) and their rice yield by 177 kg per hectare (against 126 kg for male potential users of credit). Thus, the impact of the use of credit in rice farming is not homogenous across gender and is more profitable for female rice farmers. This heterogeneity of the impact on productivity has been found by Hulme and Mosley (1996), Fall (2008) and Diagne (2002).

The determinants of rice output and yield as given by the LARF are presented in Table 5. These estimates provide evidence that, apart from a change in credit use, other household socio-demographic variables significantly explain the change in rice output and yield. Household size, watching television, receiving training in agriculture and practicing a secondary activity contribute to increased rice output. Concerning rice yield, household size, watching television,

receiving training in agriculture and exercise a secondary activity contribute to improve rice yield while a attending primary school of education reduced it.

3.3. Impact of use of credit on rice income and annual household income and their determinants

The LATE values exposed in Table 6 are all positive and statistically different from zero showing that the use of credit has positive and significant impact on the rice income and rice income per capita. Thus, the potential users of credit in rice farming increased their rice income on average by 50,974 F CFA ($US107.79) [3] and per capita rice income on average by 1,546 F CFA ($US3.27). Moreover, for both the rice income and per capita rice income, the impacts are higher among female farmers (59,225 F CFA or $US125.24 and 1,709 F CFA or $US3.61 per capita) than among male farmers (37,087 F CFA or $US78.42 and 1,271 F CFA or $US2.69 per capita). In other words, female potential users of credit earn more from using credit in rice farming than male potential users of credit. Furthermore, the results of LARF estimation of the determinants of rice income are summarized in Table 7. Rice income tend to increase with living in a village hosting a participatory varietal selection trial, contact with a NGO and contact with the national research institute (INRAB) while it tend to decrease with the number of years of experience in rice farming.

Table 6 also gives LATE estimates for annual household income and per capita annual household income. As previously, the LATE values are all positive and statistically different from zero revealing that the use of credit also has positive and significant impact on annual household income and per capita annual household income. Thus, potential users of credit improved their annual household income on average by 141,184 F CFA ($US298.56) and gained an average surplus per capita of 13,235 F CFA ($US28) per capita. Furthermore, the impacts on both annual household income and per capita annual household income are not homogenous

[3] Conversion rate : 1 USD =472.89 (BCEAO on 11 March 2014)

across the gender of farmer and are higher for female potential users of credit in rice farming (151,470 F CFA or $US320.31 and 14,081 F CFA or $US29.78 per capita) than male potential users of credit (122,334 F CFA or $US258.69 and 11,686 F CFA or $US24.71). In other words, the households of female users of credit are gaining more from using credit in rice farming than those of male users of credit. In addition, the LARF estimation results for annual household income (Table 7) shows that, apart from the use of credit, practicing upland rice farming and the contact with the National Agricultural Research Institute of Benin (INRAB) increase the annual household income while it decreases with practicing a secondary activity and living in a village hosting a PVS trial.

3.4. Impact of use of credit on inputs demand

The objective of this section is to analyze the inputs utilization choices made by farmers due to the use of credit, and check whether there is a difference which can explain the heterogeneity in the impact. The results in Table 8 show in general that the access to credit has improved farmers' use of inputs in rice farming reducing financial constraints faced by producers in accessing to certain inputs (Djato, 2001 ; Haidara, 2001; Hounlonkou *et al.*, 2005; Kudi, 2007; Fall, 2008; Bolarinwa and Fakoya, 2011). The use of credit in rice farming induced an increase in the rice area cultivated (+0.15 ha), the quantity of fertilizer used per hectare by rice farmers (+38.33 kg) and the cost of hired labor (+8 925 FCFA). In addition, the use of credit allowed farmers to optimize the use of labor by reducing the time spent in rice production activities and increasing the use of hired labor, generally more skilled, and therefore more efficient. Also, the use of credit has no significant impact on the demand of seed. However, the impacts of the use of credit in rice farming vary from an input to another and are different across the gender of farmers. In other word male and female rice famers choose different strategies in using credit in rice farming to improve their productivity. Thus, male farmers have mostly increased their rice area cultivated (+0.21 ha), invest in hired labor (+15 541 F CFA per hectare), while female farmers invested more in purchasing fertilizer (+60.35 kg per hectare) and in the reduction of working time (-255.94 man-days per hectare on average) and the amount of seed used (- 1.44 kg per hectare).

This heterogeneity in the choices of inputs utilization made by farmers contributes to the heterogeneity found in the impacts of use of credit on productivity and income. These findings confirm the importance to take into account the heterogeneity of the impact in any impact assessment study.

Considering the crucial role played by women in their households, these findings reveal that the higher income gained by female users of credit can effectively improve households' livelihood in general and children' livelihood in particular. Thus, mitigating the constraints related to the access to credit and it used in rice farming would really improve rice farmers' productivity, income and their households' livelihood, and therefore contribute to rural poverty alleviation. However, many studies confirmed the heterogeneity of the impact of credit and showed that the effects of mitigating constraints of access to credit may vary from a social stratum to another. According Kpadonou *et al.* (2010), who used the Discrete Stochastic Programming to assess the impact of credit constraints on income and agricultural production, the increase in income resulting from the contribution of an additional CFA of credit is different across social stratum and is equal for small, medium and large farms to 2.62, 0.76 and 0.55 F CFA, respectively. Thus, the increase in income is higher on small farms than on large farms. Opposite results have been found by Fall (2008), Hulme and Mosley (1996) and Diagne and Zeller (2001) who showed lower impact for poor farmers. Indeed, Fall (2008) assessed the impact of access to credit on technical efficiency and income in irrigated system in Senegal and showed that the impacts are almost nil for the poorest farmers whereas they are positive and significantly different from zero for less poor and 'rich' farmers who have other sources of income to get inputs. In the same vein, Hulme and Mosley (1996) found positive and significant impact of credit for farmers who already have a certain level of resources, income and physical assets, while the impact is very low or negative for poorest clients of MFIs. He explained this finding by the fact that poor borrowers generally contract loans for small amounts to support, what does not allow them to invest enough in their farm activities to increase their productivity. Diagne and Zeller (2001) found from a study assessing the impact of access to credit on welfare in Malawi shows that poverty state of poor farmers is so severe that they cannot significantly improve their

productivity with access to inputs. Their added that the contribution of rural microfinance institutions to the income of smallholders can be limited or outright negative if the design of the institutions and their services does not take into account the constraints on and demands of their clients. Diagne and Zeller (2001) reported that when some households choose to borrow, they realize lower profit than those who choose to not borrow. Although this result was not statistically significant, it nevertheless highlights the risk of the loan: Borrowers may be worse-off after repaying the principal and the interest. Therefore, Koloma (2010) proposed some thresholds to be met to avoid Microfinance leading households in indebtedness situations. In conclusion, access to credit and its use in agricultural activities is very profitable and advantageous for smallholders. However, these benefits depend on some agro-ecological and socio- economic factors that may vary over time and over space.

4. Conclusions and suggestions

Credit is a very important tool for agricultural development in developing countries. This paper was initiated to quantify the importance of credit in rice farming in Benin by assessing the impact of the use of credit on rice yield and households' incomes. The potential outcome framework was utilized to estimate the local average treatment effect (LATE). Findings reveal that 38.9% of farmers have obtained credit in cash or kind with a higher rate for female farmers. In addition, all rice farmers who manage to get credit did not use it in rice farming. The rate of use of credit was estimated at 29.0 % with 30.3 % for female farmers against 26.5% for male farmers.

In addition, the use of credit in the rice farming had positive and significant impact on rice yield (+157.2 kg/ha), rice output (+70.8 kg), total rice income (+50,974 F CFA or $US107.79), per capita rice income (+1546 F CFA or $US3.27 per capita) and annual household income (+141,184 F CFA or $US298.56) per capita household income (13,235 F CFA per head) of rice. The access to credit allowed the users of credit in rice farming to improve their inputs utilization (rice land, fertilizer and labor) in order to increase not only their yields and rice output, but also

their rice income and their annual household income. Thus, credit has been found to be important not only to rice farmers, but also to rice sector development. These findings suggest that facilitating access to credit by farmers is a good strategy to enhanced rice farmers' productivity and incomes. Therefore, to contribute to rice sector development, governments, MFIs and development partners should work together to improve the conditions of access of rice farmers to suitable agricultural credit (in kind/ in cash), including the reviewing of interest rates. The government should be encouraged to pursue and improve all its microfinance initiatives targeting agriculture in general, and rice production in particular. The program of Micro-credit to Poorest which is becoming the main provider of micro-credit to women could better contribute to poverty reduction if it was activity based with a higher amount of credit. Furthermore, MFIs should be encouraged to learn better about agricultural sector and farmers' financial needs and adapt their products to their needs. Moreover, ICT tools, media and agricultural extension services may also be used to inform farmers about the credit opportunities, the name and location of MFIs which can provide appropriate credit to them, the application procedures of loan and risks. All these strategies could improve the access of farmers in general, and rice farmers in particular to suitable credit. This would really not only contribute to the intensification of rice production in Africa to meet its increasing rice demand, but also improve rice farmers' productivity and their households' incomes, and therefore contribute to food security and poverty alleviation in Africa in general, and in Benin in particular.

Moreover, the results indicated that the impacts of the use of credit in rice farming are not homogenous among rice farmers. For all the impact indicators mentioned above, the female potential users of credit gained more from using credit in rice farming than male potential users of credit. In other words, the use of credit in rice farming benefits more female rice farmers than male rice farmers. Therefore, it is important to better assess the impact of development interventions on beneficiaries, to take into account the heterogeneity of the impact to better appreciate the real effect of the intervention on the different social categories in the target population for targeted actions. The LATE estimation method used in this study takes into

account this heterogeneity by including the interaction terms (interaction of covariates with the treatment variable).

List of Tables and Figures

Table 1: Socio-demographic characteristics of rice farmers over status of use of credit

	Pool (342)		Male (121)		Female (221)	
Variables	**UC (98)**	**NUC (244)**	**UC (31)**	**NUC (90)**	**UC (67)**	**NUC (154)**
Age	44.39** (10.57)	47.41 (12.31)	47.51 (11.04)	47.42 (12.31)	42.94*** (10.10)	47.41 (12.35)
Household size	6.24* (2.56)	5.62 (2.74)	7.19 (2.79)	6.43 (3.19)	5.81* (2.34)	5.15 (2.32)
Years of residency in village	35.02*** (16.33)	40.66 (16.28)	41.74 (17.74)	43.62 (15.26)	31.91*** (14.75)	38.92 (16.65)
Attending primary school	29.53* (45.69)	15.90 (36.99)	53.15 (50.13)	40 (51.64)	15.51* (36.30)	8.82 (28.79)
Number of year of schooling	1.56 (2.78)	1.27 (3.04)	3.5 (4.65)	2.90 (3.33)	0.76 (2.02)	0.61 (2.06)
Agricultural training	56.81 (50.11)	52.35 (50.03)	100*	60.36 (49.14)	47.59 (50.07)	44.12 (50.40)
Upland rice farming	25 (43.80)	23.83 (42.67)	50 (52.70)	28.82 (45.50)	20.86 (40.74)	17.65 (38.70)
Lowland rice farming	89.26 (31.01)	86.36 (34.71)	90 (30.01)	80 (42.16)	88.77 (31.66)	88.23 (32.70)
Listening to radio	79.55** (40.80)	63.76 (48.15)	100	80.18 (40.04)	73.52** (44.78)	54.01 (49.97)
Owning mobile phone	61.36*** (49.25)	35.9 (48.05)	80* (50.45)	50.45 (50.22)	55.88 (50.40)	27.27 (44.65)
Relationship with public extension	59.09** (49.73)	40.94 (49.25)	90*** (31.62)	48.64 (50.21)	50*** (50.75)	36.36 (48.23)

services						
Belonging to an association	84.09 (36.99)	75.84 (42.88)	90 (31.62)	80.18 (40.04)	82.35 (38.69)	73.26 (44.38)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 2: Inputs used by farmers over status of use of credit

	Pool (342)			**Male (121)**		**Female (221)**	
	UC (98)	**NUC (244)**	**UC (31)**	**NUC (90)**	**UC (67)**	**NUC (154)**	**UC (98)**
Rice area cultivated (ha)	0.82* (0.80)	0.63 (0.84)	0.68 (0.83)	1.36*** (1.11)	0.81 (0.93)	0.56 (0.43)	0.52 (0.76)
Quantity of seeds per hectare (kg/ha)	59.09 (29.62)	62.12 (31.86)	61.24 (31.22)	60.26 (26.25)	60.09 (60.09)	58.53 (31.28)	63.29 (32.05)
Quantity of fertilizer per hectare (kg/ha)	255.51 (291.45)	213.83 (382.42)	225.90	273.18 (497.60)	222.28 (231.03)	247.07 (298.05)	247.07 (317.55)
Quantity of total labor per hectare (man-day/ha)	594.08 (1311)	711.21 (865)	677.30 (1014)	716.60 (2210)	542.29 (720)	535.57** (499)	808.83 (927)
Cost of hired labor per hectare (F CFA/ha)	37394 (55073)	39525 (111587)	38908 (98535)	25065 (32470)	40656 (149554)	43283 (62446)	38871 (82638)
Quantity of pesticides per hectare (L/ha)	2.76 (15.8)	0.68 (8.1)	1.28 (10.9)	8.22 (44.1)	0.57 (3.0)	0.97 (4.0)	0.23 (2.1)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*

Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 3: Mean differences analysis for rice yield and income and households income

	Pool (342)		Male (121)		Female (221)	
	UC (98)	**NUC (244)**	**UC (31)**	**NUC (90)**	**UC (67)**	**NUC (154)**
Production (kg)	1440.68	1104.53	2233.13*	1506.01	1074.03	869.90
	(1500.88)	(2011.58)	(1853.21)	(2011.07)	(1148.14)	(1980.89)
Rice yield (kg/ha)	2007.84	1841.65	1953.43	1974.63	2033.02	1763.93
	(1074.84)	(1124.06)	(1034.68)	(1112.73)	(1098.87)	(1175.96)
Rice income	131274.27*	97134.60	221772.69*	134628.34	93095.25	75355.14
	(183071.4)	(145316.37)	(293035.28)	(202178.41)	(86311.81)	(92500.3)
Rice income per capita	36942.01	27171.11	66043.71**	26120.722	23477.049	27784.975
	(103727.44)	(59108.65)	(177999.54)	(34315.30)	(28800.07)	(69735.41)
Household income	473728.05	343560.94	786417.36	424487.07	329050.9	296266.45
	(596105.27)	(486804.55)	(890810.82)	(432998.94)	(307196.16)	(511089.45)
Household income per capita	61573.07*	48353.18	79482.16***	52533.35	54017.67	45924.99
	(45243.72)	(40709.19)	(46633.26)	(44149.48)	(42794.28)	(38531.44)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 4: LATE estimates for rice output and rice yield

	LATE for rice output (kg)	LATE for rice yield (kg/ha)
Pool	70.80 *** (18.04)	157.17 *** (12.88)
Male farmers	35.97 *** (17.69)	126.25 *** (20.81)
Female farmers	93.03 *** (27.0)	176.91 *** (10.78)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 5: LARF estimates of determinants of rice output and yield

Variables	**Rice output (kg)**	**Rice yield (kg/ha)**
Use of credit in rice farming	573 (812)	1010** (812)
Growing rice in upland ecology	411 (409)	45 (219)
Contact with extension services	479 (432)	-134 (231)
Attending primary school	-295 (353)	-389** (189)
Household size	164*** (55)	33*** (29)
Watching television	1887*** (507)	10*** (271)
Receiving training in agriculture	668* (345)	750*** (185)
Practicing secondary activity	584* (327)	369** (174)
Growing rice in upland ecology _use of credit	606 (597)	-176 (319)
Contact with extension services _use of credit	-335 (665)	358 (356)
Attending primary school _use of credit	676 (632)	143 (338)
Household size _use of credit	-97 (98)	-53 (53)
Watching television _use of credit	-1968 * (732)	-298 * (392)
Receiving training in agriculture _use of credit	-329 (551)	-795*** (295)
Practicing secondary activity _use of credit	886 (537)	-544** (287)
Constant	-495 (494)	1234*** (264)
Number of observations	*252*	*252*
R-squared	*0.1737*	*0.1311*
Adj R-squared	*0.1248*	*0.0797*

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 6: LATE estimates for rice income and annual household income(F CFA)

	Rice income	Rice income per capita	Annual household income	Per capita annual household income
Pool	50974 *** (1435)	1546*** (316)	141184 *** (4764)	13235*** (182)
Male farmers	37087*** (4877)	1271 (1094)	122334*** (10457)	11686*** (269)
Female farmers	59225*** (856)	1709*** (380)	151470*** (3374)	14081 *** (268)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*

Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Table 7: LARF estimates of determinants of rice income

Variables	Rice income (F CFA)	Annual household income (F CFA)
Use of credit in rice farming	3295 (33867)	86438 (79456)
Growing rice in upland ecology	-15616 (24052)	130615** (59271)
Watching television	-55683 (34024)	-97298 (103629)
Practicing secondary activity	-49758** (20091)	-112961** (49206)
Living in PVS village	100703*** (20722)	74127 (52135)
Contact with NGOs	93104 *** (29013)	84542 (73564)
Number of year of experience in rice farming	-1762** (878)	-2885 (2175)
Contact with INRAB	234032** (103680)	1007359***(372608)
Growing rice in upland ecology _use of credit	107993*** (35623)	-1921 (86386)
Watching television _use of credit	62609 (47203)	65526 (130065)

Practicing secondary activity _use of credit	59506* (33265)	284363*** (79378)
Living in PVS village _use of credit	-76706** (3466)	-180958** (84797)
Contact with NGOs _use of credit	-87851* (48217)	-223099* (119176)
Number of year of experience in rice farming _use of credit	1212 (1478)	-179 (3531)
Contact with INRAB _use of credit	-227241 (160807)	29759 (468032)
Constant	93938 *** (22496)	252556 *** (53306)
Number of observations	*245*	*225*
R-squared	*0.2210*	*0.2422*
Adj R-squared	*0.1727*	*0.1916*

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

Tableau 8: LATE estimates on inputs demand

	Rice area cultivated (ha)	Quantity of fertilizer (kg per hectare)	Quantity of seed (kg per hectare)	Total labor (man-days per hectare)	Cost of hired labor (F CFA per hectare)
Pool	0.15** (0.071)	38.33 *** (3.81)	-0.95 (0.81)	-180. 80*** (29.88)	8925*** (7412)
Male farmers	0.21** (0.090)	3.85 (9.33)	-0.20 (0.97)	-61.76 (43.46)	15541*** (1380)
Female farmers	0.12** (0.069)	60.35 *** (3.36)	-1.44 * (0.86)	-255.94 *** (28.27)	4748*** (650)

*Legend: Standard errors are in brackets; ***=Significant at 1%, **= significant at 5%, *=significant at 10%.*
Source: AfricaRice/PAPA 2010, NERICA impact assessment survey.

References

Abadie, A., 2003. Semi parametric instrumental variable estimation of treatment response models, Journal of econometrics, Elsevier, vol. 113(2), pp 231-263.

Ayaz, S., Anwar, S., Sial, M.H., Hussain, Z., 2011. Role of Agricultural Credit on Production Efficiency of Farming Sector in Pakistan- A Data Envelopment Analysis. Department of Economics, University of Sargodha, Sargodha –Pakistan. Pakistan Journal of Life and Social Sciences. (2011), 9(1): 38-44

Bolarinwa, K.K., Fakoya, E.O., 2011. Impact of Farm Credit on Farmers Socio-economic Status in Ogun State, Nigeria. J Soc Sci, 26(1): 67-71 (2011)

CTB (Coopération Technique Belge), 2012. Financements durables et adaptés pour l'agriculture au Bénin : les défis de FAIA, la nouvelle intervention de la coopération bénino-belge. Rapport d'activités.

Das, A., Senapati, M., John J., 2009. Impact of Agricultural Credit on Agriculture Production: An Empirical Analysis in India. Reserve Bank of India Occasional. Papers. Vol. 30, No.2, Monsoon 2009

De Janvry, A. Dustan, A. and Sadoulet, E., 2010. Recent Advances in Impact Analysis Methods for *Ex-post* Impact Assessments of Agricultural Technology: Options for the CGIAR. SPIA report version **3.1** Prepared for the workshop "Increasing the rigor of ex-post impact assessment of agricultural research: A discussion on estimating treatment effects", organized by the CGIAR Standing Panel on Impact Assessment, SPIA, on Saturday October 2, 2010, Berkeley.

DFID (Department for International Development) (2001): Sustainable Livelihoods Guidance Sheets. URL: http://www.livelihoods.org/info/info_guidanceSheets.html#6.

Deveze, J.C., 2000. Comment promouvoir le financement des exploitations familiales ? Grain de sel n°16 - novembre 2000

Diagne, A., 1999. Impact of Access to Credit on Household Technical Efficiency and Productivity in Growing Maize and Tobacco in Malawi, Visiting Research Fellow Report.

Diagne, A., Zeller, M., 2001. Access to Credit and Its Impact on Welfare in Malawi. Research Report 116 International Food Policy Research Institute Washington, D. C. 169p.

Diagne, A., 2002. Impact of Access to Credit on Maize and Tobacco Productivity in Malawi" in Manfred Zeller and Richard L. Meyer (eds.). The Triangle Of Microfinance: Financial Sustainability, Outreach And Impact. The John Hopkins University Press, Baltimore and London.

Food Consumption and Nutrition Division. Washington, D.C.: International Food Policy Research Institute. 28p.

Djato, K.K., 2001. Crédit agricole et efficacité de la production agricole en Côte d'Ivoire. In: Économie rurale. N°263, 2001. pp. 92-104. http://www.persee.fr/web/revues/home/prescript/article/ecoru_0013-0559_2001_num_263_1_5245

Evenson, R.E., Gollin, D., 2003. Crop Variety Improvement and its Effect on Productivity: the Impact of International Agricultural Research. CABI, Wallingford, UK.

Fall, A.A., 2008. Impact du crédit sur le revenu des riziculteurs de la vallée du fleuve Sénégal. Thèse pour l'obtention du diplôme de Doctorat en Economie et Gestion du Développement Agricole, Agro-alimentaire et Rurale. Université Montpellier I

Haïdara, M., 2001. Déterminants socio-économiques des investissements en caféiculture et cacaoculture ivoirienne, Ecole Supérieure d'Agronomie, Yamoussoukro, 93p.

Heckman, J.J., Robb, J.R., 1985. Alternative Methods for Evaluating the Impact of Interventions. In: Heckman, J.J., Singer, B. (eds.): Longitudinal Analysis of Labor Market Data: 156-245. Cambridge University Press: Cambridge; New York and Sydney.

Heckman, J.J., Vytlacil, E.J., 1999. Local Instrumental Variables and Latent Variable Models for Identifying and Bounding Treatment Effects. Proceedings of the National Academy of Sciences 96 (April): 4730-4734.

Heckman, J.J., Vytlacil, E.J., 2005. "Structural Equations, Treatment Effects, and Econometric Policy Evaluation." Econometrica 73 (May): 669-738.

Hounlonkou, A.N., Acclassato, D., Kokou, R., 2005. Impacts de la Microfinance sur la Réduction de la Pauvreté au Bénin. Rapport d'étude. Association Nationale des Praticiens de la Microfinance- Consortium Alafia. Benin

Hulme, D., Mosley, P., 1996. Finance Against Poverty. Routlegde, London.

Imbens, G.W., Angrist, J.D., 1994. Identification and Estimation of Local Average Treatment Effects. Econometrica 62 : 467-476.

Imbens, G.W., 2004. Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review. In: Review of Economics and Statistics 86 (1): 4-29.

Imbens G.W., Wooldridge, J.M., 2009. Recent Developments in the Econometrics of Program Evaluation. Journal of Economic Literature, 47(1): 5–86.

Khandker, S.R., Koolwal, G.B., Samad, H.A., 2010. Handbook on impact evaluation: quantitative methods and practices. The World Bank, Washington, D.C.

Kodjo, M.K.Z., Abiassi, E.H., Allagba, M.C., 2003. Le financement de l'agriculture béninoise dans un contexte de libéralisation: contribution de la micro finance. ELIFID, Bénin.

Koloma, Y., 2010. Effets de seuil dans la relation entre l'accès au microcrédit et l'amélioration du bien-être des bénéficiaires. Mondes en développement 2010/4 (n° 152) Editeur De Boeck Université I.S.B.N. 9782804161071. 160p.

Kpadonou, R.A.B., Adegbola, P.Y., Tovignan, S.D., 2010. Application de la Programmation Stochastique Discrète à l'évaluation de l'impact de la contrainte de crédit sur le revenu et la production agricoles dans la basse vallée de l'Ouémé. Poster presented at the African

Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010.

Kudi, T.M., Odugbo, S.B., Banta, A.L., Hassan, M.B., 2009. Impact of UNDP microfinance programme on poverty alleviation among farmers in selected local government areas of Kaduna State, Nigeria International Journal of Sociology and Anthropology Vol. 1(6) pp. 099-103 0ctober, 2009

Lee, M.J., 2005. Micro-Econometrics for Policy, Program and Treatment Effects. Advanced Texts in Econometrics. Oxford University Press.

Manski, C.F., PEPPER, J.V., 2000. Monotone Instrumental Variables: with an Application to the Returns to Schooling. In: Econometrica 68 (4): 997-1010.

Morduch, J., 1998. Does Microfinance Really Help the Poor? New Evidence from Flagship Programs in Bangladesh. Working Papers 198, Princeton University, Woodrow Wilson School of Public and International Affairs, Research Program in Development Studies.

OCS (Observatoire du Changement Social), 2010. Rapport sur le Profil Social National, édition 2009 : Microfinance et pauvreté. MPDEPP-CAG, Cotonou, Bénin

Rasoloarison, O., Rakotovao, J.M., Bockel, L., 2001. Accès au capital, crédit, accès au foncier et pauvreté rurale à Madagascar. Note d'analyse UPDR, version 3. Août 2001

Robinson, P.R., 2001. Observational Studies. Second Edition. Agriculture and Human Values, Springer-Verlag. New York.

Rosenbaum, P.R., Rubin, D.B., 1983. The Central Role of The Propensity Score in Observational Studies for Causal Effects. In: Biometrika 70 (1): 41-55

Rosenbaum, P.R., 2002. Observational Studies. Second Edition. Springer-Verlag, New York.

Rubin, D.B., 1974. Estimating Causal Effects of Treatments in Randomized and Non-Randomized Studies. Journal of Educational Psychology 66: 688-701.

Simtowe F., Phiri, M.A.R., 2007. To what extent are credit constraints responsible for non-seperable behavior at household level. Evidence from rural Malawi. Journal of Applied Sciences 6(7)1377-1399

Simtowe, F., Diagne A., Zeller, M., 2008. Who is credit constrained? Evidence from Rural Malawi, Agricultural Finance Review, Vol. 68 Iss: 2, pp.255 - 272

Solesbury, W., 2003. Sustainable Livelihoods: A Case Study of the Evolution of DFID Policy. Working Paper 217. Overseas Development Institute, 111 Westminster Bridge Road, London, SE1 7JD, UK