

*Full Length Research Paper*

# Credit constraints and household welfare in the Eastern Cape Province, South Africa

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**Rural households in developing countries may remain trapped in poverty by a lack of finance needed to undertake profitable investments. Improved access to credit could generate pro-poor economic growth if the credit constraints that poor households faced are relaxed. This study examines the effect of credit constraints on household welfare among the clients of the Eastern Cape Rural Finance Corporation (ECRFC), in the Amathole District Municipality of the Eastern Cape Province. Credit constrained households are identified based on direct elicitation of credit status from survey questions, and then an endogenous switching regression model is used to analyse the effect of credit constraints on the welfare of a representative sample of 150 households. Empirical results indicate that households with older household heads, more access to land, higher value of assets and higher debt repayment capacity are less likely to be credit constrained, and that increased access to credit can improve the welfare of credit constrained households.**

**Key words:** Credit constraints, household welfare, switching regression.

## INTRODUCTION

Von Pischke et al. (1983) recognized that resource-poor people may remain trapped in poverty by a lack of finance needed to undertake productive investments. The provision of credit to poor households has been widely perceived as an effective strategy to help alleviate poverty (Sharma, 2000). Increased access to financial services, especially credit, can relax the liquidity constraints that impoverished households face, improve households' risk bearing ability and productivity, equip them with new skills and create jobs, and encourage activities that generate dynamic economic growth. It also helps households cope with ex-post risks of negative-income shocks and to smooth income and consumption flows (Asian Development Bank (ADB), 2002; Zeller, 2000; Parker and Nagarajan, 2001; Rosenzweig, 2001; Khandker, 2003). Expanded access to credit has therefore been enthusiastically canvassed in the development community for its ability and potential to generate

sustainable economic growth that favours the poor (Murdoch, 1995; Robinson, 2001; Murdoch and Haley, 2002; Coleman, 2002). There is a large body of evidence in the literature to demonstrate the positive relationship between the provision of credit and poverty reduction. However, while the positive impact of credit on household welfare is evident and widely agreed, there is little evidence in South Africa as regards the effect of credit constraints on household welfare.

A common notion is that credit market imperfections, especially credit constraints, may severely limit the investment and operations of household economic activities. Such imperfections can limit the size and growth, profits, activations and liquidations, and possibly the scope of operations of household firms (Monge-Naranjo and Hall, 2002). Credit constraints have a number of serious consequences for production and consumption in the short run and for asset accumulation, poverty reduction and the evolution of well-being in the long run. Credit constraints also, inter alia:

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(i) Reduce households' capacity in the face of income shocks to smooth consumption (Zeldes, 1989);

- (ii) Can obviate households' investment in the education and health of their members (Behrman et al., 1982; Foster, 1995);
- (iii) May have strong implications for the likelihood that households fall into or overcome poverty traps (Carter and Barret, 2006; Zimmerman and Carter, 2003); and
- (iv) Affect the level and distribution of income in the overall economy (Aghion and Bolton, 1997; Banerjee and Newman, 1993).

Credit constraints could also lead to other behavioural adaptations, which include the fragmentation of fields, migration, gift-giving and the establishment of patron-client relationships (Townsend, 1995; Rosenzweig and Stark, 1989; Fafchamps, 1992). That credit may not be easily accessible to everyone has thus further compounded the effects of credit constraints on the economic behaviour of rural households and their enterprise investments. While liquidity constraints may arise due to factors like inadequate internal funds or inefficient management and, therefore, are within the control of the household, credit constraints are also the result of factors beyond the control of the household. This makes it even more important to recognize the degree to which a binding credit constraint contributes to the loss in potential productivity and economic welfare of households.

Two distinct stages are involved in the credit process (Zeller, 1994). In the first stage, which constitutes the demand side of the bargain, the household which wants credit decides on the sum to apply for from a particular source at the prevailing market interest rate. In the second stage, the lender makes a financing decision on the loan application, and this constitutes the supply side of the bargain. The lender undertakes the screening of the potential client based on observable characteristics in order to try and minimize default risk; hence, the results of this screening process influence the lender's response to the client's credit demand. Three outcomes are possible.

Firstly, the loan amount demanded by the client may be fully granted by the lender. Secondly, the loan amount demanded by the client may be partially granted by the lender and thirdly, the loan application may be completely rejected by the lender. The two last scenarios represent credit constraint, that is, the state in which the borrower is constrained in his/her access to credit markets or his/her credit rationed by the lender (Zeller, 1994).

Although credit constraint problems have been recognised in the economic literature in South Africa, little emphasis has been given to their effects on rural household welfare. This study, therefore, first investigates the determinants of household credit constraint conditions among the clients of the Eastern Cape Rural Finance Corporation (ECRFC), in the Amathole District Municipality in the Eastern Cape Province of South Africa in 2007. It then analyses whether or not credit constraints affect the welfare of selected households in this

municipality.

The rest of the paper is organized as follows: a survey of the empirical literature on the rationale for credit rationing is provided and the study data and research methodology are discussed. It further presented the results of the study and finally, discusses some policy implications of the study.

### Rationale for credit rationing

Market imperfections, institutional and household-related factors may constrain access by households to credit markets. Stiglitz and Weiss (1981) argue that market imperfections and information asymmetry problems create disequilibrium in the form of credit rationing. In market equilibrium, credit supply equilibrates with credit demand: if demand should exceed supply, interest rate will rise, thereby decreasing the quantity demand or increasing supply until demand is equated at the new equilibrium price.

Therefore, if interest rates are flexible, credit rationing is not possible. Changing the price of the loans (interest rate) will not equilibrate the demand and supply of loans, thus lenders may restrict the amount of credit extended to borrowers at the prevailing interest rate in order to try and minimize loan default risk.

Loan default risk<sup>1</sup> may be influenced by factors such as the expected returns of the project, the terms of the loan (interest rate and loan period), market imperfections and borrowers' characteristics. According to Kochar (1997), the expected returns on the proposed project have a significant influence on the lenders' decision to ration credit or not. If the expected returns of the project are less than the principal loan amount plus accrued interest, the probability of default will be high. The optimal decision would then be to ration the client's credit. The borrower's debt servicing capacity<sup>2</sup> based on the lenders assessment also affects the likelihood of the borrower's credit being rationed (Zeller, 1994), that is, the lower the capacity, the greater the possibility of the credit being rationed.

The strength of the previous business relationship between the client and the lending institution, in addition to the client's reputation in the credit market, is also a determinant of the lender's credit-rationing behaviour (Aleem, 1990; Bell, 1990; Siamwalla et al., 1990). According to Hoff and Stiglitz (1990), this relationship-specific social capital built between the lender and the borrower is used as a non-price-related mechanism for credit rationing. This implies that the stronger and more long-standing the relationship, the lower the probability of the borrower's credit being rationed.

Interlinked credit, defined as credit contracts linked to

<sup>1</sup> Defined as the risk of the borrower being unable to pay back the principal loan amount plus accrued interest.

<sup>2</sup> Measured as outstanding debt as proportion of total household income and household wealth.

either product markets or labour markets, also provide alternative forms of collateral. When a client accepts an interlinked loan contract, the odds of his/her credit being rationed decrease because this contract lowers the probability of loan defaults (Udry, 1990). This contract is a non-conventional form that removes some of the difficulties associated with adverse selection and moral hazard. According to Bell (1990), the interlinked credit contract presents the borrower with a further incentive to repay the loan.

Other socio-economic variables such as the borrower's gender, age, household wealth and/or asset values (Zeller, 1994), educational level and access to network information (Vaessen, 2001) can influence the probability of a borrower's credit being rationed. Men may be perceived by lenders as more credit-worthy than women because they generally control household resources. Household wealth and/or asset values are important as collateral and male control of these can reduce the probability of credit rationing. Educational attainment enhances human capital in the form of skills, which is associated with effective utilization of credit and minimization of default risk. Access to network information enables the screening of potential clients and reduces default risk, as only those with good reputations are likely to be recommended for credit (Okurut and Schoombee, 2007).

The next section describes the data and research methodology used to study the factors that affect the credit status and welfare of the sampled households in the Amathole District Municipality.

## STUDY DATA AND RESEARCH METHODOLOGY

### Study data

Data were collected using structured questionnaires from a cross-section of 150 rural household heads in the Amathole District Municipality of the Eastern Cape Province, who had applied for credit from the Eastern Cape Rural Finance Corporation (ECRFC). Noteworthy, the ECRFC is an organ of the Eastern Cape Department of Agriculture; however, the corporation was established by the ECRFC Act No. 9 of 1999 and has as its core objective the financing and development of projects in rural areas of the province. It is mainly, but not exclusively, established to assist SMME entities creating development in rural areas (ECRFC, 2002).

Data collected were on the demographic and socio-economic characteristics of the household heads and income and expenditure variables. A multistage sampling technique (Barnett, 1991) was used to select representative households for the study. The first stage involved the selection of three local municipalities in the District Municipality, such as Ngqushwa, Amahlathi and Nkonkobe. The second stage involved random sampling of six villages within these local municipalities from which 25 respondents each were randomly selected. These villages were Peddie and Hamburg for Ngqushwa, Stutterheim and Keiskammahoek for Amahlathi, and Alice and Seymour for Nkonkobe. Respondents are restricted to those who applied for credit in 2007, (that is, those who had their demand for credit met or unmet by the lenders). The estimation of the impact of credit constraint on household welfare is therefore based on a 'restrictive' definition of credit constraint, in which only

quantity rationed households are classified as credit constrained.

### Research methodology

Households are categorized as credit constrained or unconstrained based on the replies to direct questions about whether the household applied for credit or not and if such applications were denied or the quantity was rationed. However, whether a household had an excess demand for credit or not is established through a series of questions. Excess demand for credit is therefore treated as a latent variable for each household. While this procedure does not assess the magnitude of the constraint, it provides an indicator of whether or not a household is credit constrained (Gilligan et al., 2005). Examples of this direct elicitation methodology (DEM) include Petrick (2004) who evaluated the impact of credit constraints on farm output in Poland; Foltz (2004) who evaluated the impact of credit constraints on farm profit in Tunisia; and Carter and Olinto (2003) who examined the impact of credit constraints on household investment level in Paraguay.

Following Maddala (1986), an endogenous switching regression model is used to estimate the effect of credit constraints on households' welfare, because in each period, the probability of a household being credit constrained is non-zero. This probability varies according to household characteristics, and only one realisation of these probabilities is possible in one period (Gilligan et al., 2005). The endogenous switching model allows for joint estimation of the determinants of households' credit constraint conditions and whether household welfare is affected or by household being credit constrained or unconstrained. Distinct regressions are estimated for credit constrained and unconstrained households, with a mean monthly per adult equivalent household expenditure as the explanatory variable, being a proxy for household welfare. To correct for possible self-selection biases, a 'probit' credit constrained criterion function was first estimated and the inverse Mills ratio from this function was then used to correct the error term in each regression equation. These equations are estimated jointly using the maximum likelihood (ML) method (Maddala, 1986). As a consequence, the econometric specifications of these models are outlined.

### Econometric specifications

Following Maddala (1986) and Foltz (2004), the first step is to estimate the household credit constrained condition by a probit function with the specification:

$$C_i^* = \alpha Z_i + \mu_i > 0 \quad \mu_i \sim (0,1) \quad (1)$$

$$C_i = \begin{cases} 1 \\ 0 \end{cases}$$

Where  $C_i = 1$  if  $C_i^* > 0$  (credit constrained) and  $C_i = 0$  otherwise (unconstrained).

Equation (1) indicates the degree to which a household is credit constrained, and is given by an index  $C_i^*$  which is a latent variable as the researcher cannot directly observe the amount of a household's excess demand for credit (Foltz, 2004). This index is explained by  $Z_i$  which represents a vector of explanatory variables, where  $\alpha$  is a vector of estimated coefficients, and  $\mu_i$  is

a random error term, distributed as a normal function with null mean. As a result, the variance is normalized to one in order to estimate the coefficients. Since  $C_i^*$  is unobservable, credit status is first estimated via a probit model which estimates the probability that a household is credit constrained. Finally, a household welfare equation is estimated by the following regression equations with regime 1 representing credit constrained households and regime 0 representing unconstrained households:

$$y_{1i} = \beta_1' X_1 + \varepsilon_{1i}, \quad \text{if } C_i = 1 \tag{2a}$$

$$y_{0i} = \beta_0' X_0 + \varepsilon_{0i}, \quad \text{if } C_i = 0 \tag{2b}$$

with covariance matrix

$$\Sigma = \begin{pmatrix} \sigma_1^2 & \rho_{10} & \rho_{1\mu} \\ \rho_{10} & \sigma_0^2 & \rho_{0\mu} \\ \rho_{1\mu} & \rho_{0\mu} & 1 \end{pmatrix}$$

where,  $X_1$  and  $X_0$  are vectors of the explanatory variables for credit constrained and unconstrained households, respectively.  $\beta_0'$  and  $\beta_1'$  are vectors of corresponding estimated coefficients, and  $\varepsilon_{1i}$  and  $\varepsilon_{0i}$  are random error terms distributed as normal functions with zero means. As demonstrated by Maddala (1983), the expected values of the error terms  $\varepsilon_{1i}$  and  $\varepsilon_{0i}$  are not zero. This makes direct 'ordinary least square' (OLS) estimation of equations (2a) and (2b) inappropriate. This problem is addressed by calculating the inverse Mills ratio from the probit model estimated for equation (1) as thus explained.

The expected household welfare, conditional to the credit constrained regime ( $y_{1i}$ ) can thus be computed as:

$$\begin{aligned} E y_{1i} | X_i, C_i = 1 &= \\ E y_{1i} | X_i, \alpha Z_i + \mu_i > 0 &= \beta_1' X_1 + E \mathbb{1}_{\mu_i > -\alpha Z_i} \\ &= \beta_1' X_1 + (\sigma_1 \sigma_\mu \rho_1) \phi(\alpha Z_i) / \Phi(\alpha Z_i) \end{aligned} \tag{3a}$$

and the expected household welfare, conditional to the unconstrained regime ( $y_{0i}$ ), is given by:

$$\begin{aligned} E y_{0i} | X_i, C_i = 0 &= E y_{0i} | X_i, \alpha Z_i + \mu_i < 0 \\ &= \beta_0' X_0 + E \mathbb{1}_{\mu_i > \alpha Z_i} \\ &= \beta_0' X_0 + (\sigma_0 \sigma_\mu \rho_0) - \phi(\alpha Z_i) / 1 - \Phi(\alpha Z_i) \end{aligned} \tag{3b}$$

where,  $\phi$  and  $\Phi$  are the probability density function and cumulative distribution function of the standard normal distribution,

respectively, and the ratio  $\phi$  and  $\Phi$  evaluated at  $\alpha'Z$  is the inverse Mills ratio ( $\lambda$ ) (Greene, 2003). This reflects the truncation of a normal distribution at  $\alpha'Z$ . Therefore, the inverse Mills ratio variables,

$$\lambda_1 = \phi(\alpha Z_i) / \Phi(\alpha Z_i) \quad \text{and} \quad \lambda_0 = -\phi(\alpha Z_i) / 1 - \Phi(\alpha Z_i)$$

could be added to the  $X_1$  and  $X_0$  vectors, respectively, in equations (3a) and (3b) to yield:

$$E y_{1i} | X_i, C_i = 1 = \beta_1' X_1 + (\sigma_1 \sigma_\mu \rho_1) \lambda_1 + \varepsilon_{1i} \tag{4a}$$

$$E y_{0i} | X_i, C_i = 0 = \beta_0' X_0 + (\sigma_0 \sigma_\mu \rho_0) \lambda_0 + \varepsilon_{0i}. \tag{4b}$$

The covariance of the credit constrained criterion (equation 1) and the credit constrained household welfare (equation 4a), and the covariance of the credit constrained criterion (equation 1) and the unconstrained household welfare (equation 4b), are represented by the multiplicative terms  $\sigma_1 \sigma_\mu \rho_1$  and  $\sigma_0 \sigma_\mu \rho_0$ , respectively. These covariances can be split into the standard deviations of the appropriate equations  $\sigma_\mu, \sigma_1, \sigma_0$  and the correlations  $\rho_1$  and  $\rho_0$ . However,  $\sigma_\mu$  cannot be estimated and is normalised to 1.0, because of the model structure and the nature of the derived data (Greene, 2003).

To measure the endogeneity of the credit constrained condition, a test of whether  $\rho_1$  and  $\rho_0$  are statistically different from zero is required, since estimates of  $\rho_1$  and  $\rho_0$  show the correlation of the "unobservables" of the credit constrained criterion equation with the "unobservables" of the credit constrained and unconstrained household welfare equations, respectively. If  $\rho_1$  and  $\rho_0$  are zero, then the credit constraint is exogenous, and it would not be necessary to model and include the credit constrained criterion (equation 1) in estimating the effect of credit constraints on household welfare.

The software LIMDEP (1998) was used to estimate equations (1), (4a) and (4b), whereas the probit function for equation (1) was first estimated by ML using OLS estimated starting values. The predicted values from the probit function were then used to calculate the inverse Mills ratio, which is subsequently included as an explanatory variable when estimating equations (4a) and (4b) by OLS. A single parameter is estimated for  $\sigma_1 \rho_1$  and  $\sigma_0 \rho_0$  because of the linear structure of these equations. Finally, using previous estimates of  $\beta_1, \beta_0$ , and  $\alpha$  for starting values, equations (1), (4a) and (4b) were estimated jointly by ML. With the ML equation, separate estimates for  $\rho_1$  and  $\sigma_1$ , and then  $\rho_0$  and  $\sigma_0$ , are possible. The log likelihood function for the model is made up of two components and can be written as:

$$\begin{aligned} \log L &= \sum_{i=1}^n \text{prob } C_i = 1 \int \log(y_{1i}) | C_i = 1 \\ &+ \text{prob } C_i = 0 \int \log(y_{0i}) | C_i = 0 \end{aligned} \tag{5}$$

**Table 1.** Explanatory variables used in the probit model and household welfare functions.

Variables	Measurement and units	Expected effect on credit status
Gender	Gender of household head. Male = 1; Female = 0	+/-
Age	Age of household head (in years)	-
Education	Years of school attendance (in years)	-
Access to land	Household access to land use Yes = 1; No = 0	-
Dependency ratio	The number of dependants (aged 0 - 14 and over the age of 65) to the total household size, expressed as a percentage.	+
Monthly income	Amount earned (in rands)	-
Remittances and pension	Amount received (in rands)	-
Savings	Amount of savings (in rands)	-
Asset value	Value of all assets (in rands)	-
Repayment capacity	Debt-income ratio	-
Social capital	Number of associations they belong to	-

with:

$$prob C_i = 1 = \Phi(\alpha Z_i)$$

$$prob C_i = 0 = 1 - \Phi(\alpha Z_i)$$

$$f \log(y_{1i}) | C_i = 1 = \Phi(\alpha Z_i)^{-1} \sigma_1^{-1} \phi \sigma_1^{-1} \log(y_{1i}) - \beta_1' X_{1i} \times \Phi \left\{ \left( 1 - \frac{\rho_1^2}{\sigma_1^2} \right)^{-1/2} \left[ \alpha Z_i - \frac{\rho_1}{\sigma_1} \log(y_{1i}) - \beta_1' X_{1i} \right] \right\} \quad (6a)$$

$$f \log(y_{0i}) | C_i = 0 = 1 - \Phi(\alpha Z_i)^{-1} \sigma_0^{-1} \phi \sigma_0^{-1} \log(y_{0i}) - \beta_0' X_{0i} \times \Phi \left\{ \left( 1 - \frac{\rho_0^2}{\sigma_0^2} \right)^{-1/2} \left[ \alpha Z_i - \frac{\rho_0}{\sigma_0} \log(y_{0i}) - \beta_0' X_{0i} \right] \right\} \quad (6b)$$

The maximization of this coefficient allows for the estimation of the following parameters:

$\alpha$ : Coefficients of the factors explaining household credit constraint conditions;

$\beta_1$ : Coefficients of the factors explaining household welfare condition on being credit constrained;

$\beta_0$ : Coefficients of the factors explaining household welfare condition on being non-credit constrained;

$\rho_1$  and  $\rho_0$ : Correlation terms between the household credit constraint criterion in equation (1) and welfare in equations (4a) and (4b) and

$\sigma_1^2$  and  $\sigma_0^2$ : Households' welfare variances in the two credit constraint regimes.

The dependent variable in the probit model is dichotomous (=1 if

household is credit constrained, and 0 if the household is unconstrained). The explanatory variables used to explain this credit status are presented in Table 1. Due to the fact that they are the outcome of the imperfect credit market equilibrium, no unambiguous predictions on the signs of these variables effects on credit status can be made (Foltz, 2004).

The age, education level and access to land use by the household head are all expected to have a negative influence on a household being credit constrained. Higher monthly income, remittances/pension, savings and asset values are also expected to improve credit worthiness and so increase the likelihood of a household being credit unconstrained. A higher degree of social capital could also reduce the probability of being credit rationed. However, a higher repayment capacity is likely to increase credit supply from the formal market and potentially also from the informal market. A high dependency ratio reduces repayment capacity and is expected to increase the likelihood of a household being credit constrained. Only household gender has an indeterminate sign *a priori*, although some past research cited previously indicates that men may be less credit rationed.

Empirical results of the characteristics of the sample credit constrained and unconstrained households, the probit model and the welfare functions are thus presented.

## EMPIRICAL RESULTS

### Household welfare measured as mean monthly per adult equivalent household expenditure (MPAEHE)

Household welfare was measured by the mean monthly per adult equivalent household expenditure (MPAEHE). The average MPAEHE for all the households sampled for the study was about R334 per adult equivalent. For households that are credit constrained, the average MPAEHE was estimated at R231 per adult equivalent, compared to R380 per adult equivalent for those households that are not constrained. The average value of assets for credit constrained households was estimated at R1 703, while for unconstrained households the average asset value was R54 929.

Summary statistics in Table 2 show that credit constrained households differ in many ways from those

**Table 2.** Explanatory variable means by credit status used in the probit model and household welfare functions.

Variables	Credit constrained households (n = 122)	Credit unconstrained households (n = 28)	t-test
Gender of household head (Male = 1; Female = 0)	0.65(0.043)	0.57(0.095)	0.21 <sup>NS</sup>
Age of household head (in years)	45(0.888)	38(0.865)	2.47 <sup>**</sup>
Education (Years of school attendance)	8(0.330)	10(0.298)	0.88 <sup>**</sup>
Access to land	0.92(0.025)	1.00(0.000)	0.05 <sup>**</sup>
Dependency ratio	56(4.321)	24(3.283)	10.8 <sup>**</sup>
Monthly income (in rands)	2 110.32(209.73)	5 829.25(304.14)	738.9 <sup>**</sup>
Remittances and pension (in rands)	496.64(134.39)	311.07(72.602)	305.5 <sup>NS</sup>
Savings (in rands)	2 876.88(193.14)	4 015.35(321.74)	750.5 <sup>**</sup>
Asset value (in rands)	1 7029.81(1, 003.41)	54 928.57(3, 145.33)	6, 603 <sup>**</sup>
Repayment capacity (Debt-income ratio)	1.75(0.274)	0.32(0.021)	0.008 <sup>**</sup>
Social capital (Number of associations they belong to)	0.184(0.0352)	0.321(0.0886)	0.19 <sup>**</sup>
Mean monthly per adult equivalent household expenditure (MPAEHE)	230.75(7.69)	379.64(11.13)	27.1 <sup>**</sup>

Note: Standard errors of the means are in parentheses. \* indicates statistical significance at the 5% level; NS = Not statistically significant. Source: Calculated from Field Survey Data, 2007.

who are not constrained. For sample credit constrained and unconstrained households, there is no statistically significant difference in the gender of the household heads.

Also, credit constrained households tend to have older heads, less education, less access to land, a higher dependency ratio, lower monthly income, lower savings and lower asset values. Statistically, the amount received as remittances and pension was not significantly different between the groups.

About 81% of the households (122 out of 150) identified themselves as credit constrained, although about 64% of those households reported that they had access to credit (could borrow but were quantity rationed), while about 36% of those households had their loan application rejected and therefore considered themselves as credit constrained as they had an unmet demand for credit for their investment activities. A total of 28 households out of 150 deemed themselves to be credit unconstrained.

### Determinants of household credit constraint condition

The ML coefficient estimates of the probit model showing the determinants of the household credit constrained conditions are presented in Table 3. A probit model was appropriate as information was available only on whether a household was credit constrained or unconstrained in the credit market. The set of explanatory variables used here included gender, age, education, access to land, values of assets, savings, monthly income, remittances and pension, dependency ratio, repayment capacity and social capital.

The age of the household head, access to land, asset

value and repayment capacity are statistically significant factors determining the credit constraint condition of the sample households. Younger household heads and those that have social capital (measured as numbers of the local associations they belong) and guarantors, who sign an undertaking with the lenders, are significantly less likely to be credit constrained statistically. These young people may have had more opportunities to build business relationships with lenders and to establish social links with communities.

Statistically, access to land and the value of household assets are also, significantly, negatively related to the credit constrained condition, implying that the probability of being credit constrained decreases for households with more access to land and relatively higher asset values. The value of visible assets (mainly oxen, poultry and livestock) could be used by lenders as a measure of a client's collateral and repayment capacity (last resort to liquidate in order to recover the credit in the event of household default). Access to land increases the potential productivity and hence the repayment capacity of the household, *Ceteris paribus*.

The debt-income ratio was used as a proxy for repayment capacity, and is statistically, significantly related to the credit constrained condition positively. The possible explanation for this result is that the higher the debt-income ratio, the higher the household's exposure to default risk.

This raises the likelihood of the household being credit constrained. The adjusted  $R^2$  value for the estimated probit model is 0.61, indicating that 61% of the variables explaining credit constraint condition of the households are included in the model. The study further presents the estimated household welfare functions for the switching regression model.

**Table 3.** Estimated coefficient for the probit model of a household being credit constrained. Switching regression (part 1) (N = 150).

Variables	Estimated coefficients	Standard errors	z- statistics	$P\left \frac{z}{ z }\right  > z$
Constant	-5.3653***	0.5066	-10.590	
Gender	-0.0287	0.2655	-0.1081	0.6734
Age	0.0982**	0.3591	2.7341	0.0341
Education	-0.0103	0.2873	-0.0362	0.1556
Monthly income	0.0011	0.0024	0.4500	0.1922
Access to land	-0.0675**	0.0343	-1.9641	0.0332
Value of assets	-0.0014*	0.0007	-1.8904	0.0782
Savings	-0.0001	0.0000	-1.5262	0.9644
Remittances and pension	-0.0002	0.0001	-1.3950	0.1725
Dependency ratio	0.0042	0.0026	1.6153	0.6424
Repayment capacity	0.1345**	0.0544	2.4690	0.0204
Social capital	0.0069	0.0076	0.9064	0.6743
Adjusted $R^2 = 0.61$		Log likelihood function = -160.5712		
Restricted log likelihood = -172.2030		Chi-square ( $\chi^2$ ) = 23.2636		
Degrees of freedom = 10		Significance level = .0000		

Note: \*\*\*, \*\* and \* denote statistical significance at the 1, 5 and 10% levels, respectively. Source: Probit regression estimation using the software LIMDEP (1998).

### Effects of credit constraints on household welfare

The effect of credit constraints on household welfare for the sample households is presented in Table 4. The mean monthly per adult equivalent household expenditure (MHAHE) is used as the dependent variable. However, the same explanatory variables used in the probit model were specified in the credit constrained and unconstrained equations. This is because these variables were transformed in the probit credit constrained criterion equation; therefore, singularity was not a problem.

The estimated coefficients for household savings, remittances and pension and social capital all have a statistically significant positive effect on household welfare for credit-constrained households. However, the dependency ratio has a statistically significant negative effect on household welfare for these households. This could be as a result of relatively limited resources at the household level being diverted to funding dependents and so reducing credit access and household welfare. For the credit unconstrained households, gender (specifically being male), age and education of household head, monthly income, access to land and value of assets, all

have a statistically significant positive effect on household welfare. Again, the dependency ratio has a statistically significant negative effect on household welfare.

The correlation between the credit status equation error and welfare equation for the credit constrained regression error ( $\rho_1$ ) of 0.097 is significantly different from zero statistically. The corresponding correlation between the credit status equation error and welfare equation for the credit unconstrained regression error ( $\rho_0$ ) of -0.675 is significantly different from zero statistically. These signs and statistical significances agree with the expectation that credit unconstrained households in the study sample have a higher welfare outcome than the credit constrained households. This result indicates that credit constraint is endogenous and shows that it is necessary to model and include the credit constraint criterion equation in estimating the effect of credit constraints on household welfare. A Wald test of whether the estimated coefficients as a group are different between the credit constrained and unconstrained equations gave a  $\chi^2$  value of 32.56 ( $\alpha = 0.05$ ), implying that the null hypothesis that the estimated coefficients for each credit regime are the same can be rejected, that is, the coefficient

**Table 4.** The effect of credit constraints on household welfare, estimated by maximum likelihood method: Switching regression (part 2) (N = 150).

Variables	Estimated coefficients	Standard errors	t-statistics
<b>Credit constrained equation</b>			
Constant	4.234 <sup>***</sup>	0.2243	18.874
Gender	-0.1747	0.2877	-0.607
Age	0.0123	0.1518	0.812
Education	0.0049	0.0317	0.155
Monthly income	0.0069	0.0076	0.906
Access to land	0.1323	0.7782	0.170
Value of assets	-0.0012	0.0033	-1.212
Savings	0.0406 <sup>*</sup>	0.0229	1.767
Remittances and pension	0.0017 <sup>**</sup>	0.0007	2.464
Dependency ratio	-0.0048 <sup>**</sup>	0.0024	-1.960
Repayment capacity	0.3245	0.3663	0.886
Social capital	0.3604 <sup>**</sup>	0.0001	2.414
<b>Credit unconstrained equation</b>			
Constant	3.896 <sup>***</sup>	0.1134	34.342
Gender	0.3172 <sup>***</sup>	0.1206	2.630
Age	0.0115 <sup>***</sup>	0.6438	3.066
Education	0.0196 <sup>**</sup>	0.0096	2.024
Monthly income	0.3242 <sup>**</sup>	0.6438	1.986
Access to land	0.3724 <sup>**</sup>	0.1576	2.363
Value of assets	0.0059 <sup>*</sup>	0.0033	1.737
Savings	0.0032	0.0025	1.280
Remittances and pension	0.0056	0.0075	0.746
Dependency ratio	-0.0079 <sup>**</sup>	0.0036	-2.194
Repayment capacity	0.1346	0.1178	1.143
Social capital	-0.0059	0.6189	-0.095
<b>Variance estimates</b>			
$\sigma_1^2$	0.601 <sup>*</sup>	0.3288	1.828
$\sigma_0^2$	0.300 <sup>***</sup>	0.2980	10.097
$\rho_1$	0.097 <sup>*</sup>	0.0488	1.987
$\rho_0$	-0.675 <sup>***</sup>	0.1063	-6.345
<b>Log likelihood function = -260.3271</b>			

Note: \*\*\*, \*\* and \* denote statistical significance at the 1, 5 and 10% levels, respectively. Source: Switching regression estimation from field survey data using the software LIMDEP (1998).

estimates are significantly different from zero for credit constrained and unconstrained households statistically.

According to the equations of expected household welfare condition to credit constraint conditions (Equations 4a and 4b) and the signs  $\rho_{1\mu}$  and  $\rho_{0\mu}$ , neglecting the selection would then overestimate welfare for both credit constrained and unconstrained households, but this overestimation would be larger for unconstrained households. The switching regression also

shows that the predictors of household welfare differ between the credit constrained and unconstrained household in the study area.

## CONCLUSION AND POLICY IMPLICATIONS

Credit, both as a development tool and an effective strategy for poverty alleviation, coupled with the limited availability of credit for those that may really need it has

become a crucial issue for government and credit providers. In addition, credit provided at the prevailing market interest rate can result in a marginal benefit for credit constrained households. This study has investigated the determinants of household credit constraint conditions and the effect of credit constraints on household welfare using a switching regression model, with separate regressions for a sample of 150 credit constrained and unconstrained households in the Amathole District Municipality of the Eastern Cape Province in 2007. Probit model results show that the gender and age of the household head, access to land, value of assets and repayment capacity are statistically significant in determining whether a household is credit constrained or not. Credit constrained households are also estimated to have lower welfare outcomes.

These results support the claims that credit policies can play an important role in rural development and that additional rural finance can enhance productivity and household welfare, thus contributing to pro-poor growth. Given the relatively high demand for credit and the limited access of rural households to both informal and formal credit in the Eastern Cape Province, the degree of effective credit rationing seems to be relatively high. The switching regression results imply that there could be a substantial impact in providing incremental credit to constrained households and in removing the constraints through access to sufficient credit. In addition, if credit access were improved, this might help to activate rural land markets by allowing households to rent or buy the optimal size of land, provided they receive permission from the tribal authority or can gain title to the land.

An improved welfare outcome may only be achieved if credit reaches those households whose investment activities are actually constrained. Since many households lacking access to credit are also credit constrained, expanded access to credit in the Eastern Cape Province must target those households with both investment opportunity and insufficient credit. Thus, in this case, expanded and incremental access to credit targeted to credit constrained households would contribute to improved welfare and poverty alleviation. Further research is needed to access whether or not the benefits of better access to credit markets could exceed the cost of implementing credit programmes.

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## REFERENCES

Asian Development Bank (ADB) (2002). Finance for the poor:

- Microfinance development strategy, Asian Development Bank, Manila, Philippines.  
<http://www.adb.org/documents/policies/microfinance/financepolicy.pdf>  
 .Assessed on 21/05/2006.
- Aghion P, Bolton P (1997). A theory of trickle-down growth and development. *Rev. Econ Stud.*, 64(2): 151-172.
- Aleem I (1990). Imperfect information, screening, and the costs of informal lending: A study of a rural credit market in Pakistan. *World Bank Econ. Rev.*, 4(3): 329-349.
- Banerjee A, Newman A (1993). Occupational choice and the process of development. *J. Political Econ.*, 101(2):274-298.
- Barnett V (1991). *Sample survey: Principles and methods*. London: Edward Arnold.
- Behrman J, Pollack R, Taubman P (1982). Parental preferences and provision for progeny. *J. Political Econ.*, 90: 52-73.
- Bell C (1990). Interaction between institutional and informal credit agencies in rural India. *World Bank Econ. Rev.*, 4(3): 297-327.
- Carter M, Barrett C (2006). The economics of poverty traps and persistent poverty: an asset-based approach. *J. Dev. Stud.*, 42(2): 178-199.
- Carter M, Olinto P (2003). Getting institutions right for whom? Credit constraints and the impact of property rights on the quantity and composition of investment. *Am. J. Agric. Econ.*, 85(1): 173-186.
- Coleman BE (2002). Microfinance in Northeast Thailand: Who benefits and how much? Asian Development Bank-Economic and Research Department Working paper 9. Asian Development Bank, Manila, Philippines.  
[http://www.adb.org/Documents/ERD/Working\\_Papers/wp009.pdf](http://www.adb.org/Documents/ERD/Working_Papers/wp009.pdf)  
 Assessed on 25/04/2007.
- Eastern Cape Rural Finance Corporation (ECRFC). (2002). *Promotion of Access to Information Manual*. ECRFC, King Williams Town.
- Fafchamps M (1992). Solidarity networks in preindustrial societies: Rational peasants with moral economy. *Econ. Dev. Cultural Change*, 41(1): 147-174.
- Foltz J (2004). Credit market access and profitability in Tunisian agriculture. *Agric. Econ.*, 30: 229-240.
- Foster AD (1995). Prices, credit markets and child growth in low-income rural areas. *Econ. J.*, 105: 551-570.
- Greene WH (2003). *Econometric analysis*. 5<sup>th</sup> Edition, Upper Saddle River, NJ: Prentice-Hall.
- Gilligan D, Harrower S, Quisumbing A (2005). How accurate are reports of credit constraints? Reconciling theory with respondents' Claims in Bukidnon, Philippines. Washington D. C.: International Food Policy Research Institute.
- Hoff K, Stiglitz JE (1990). Imperfect information and rural credit markets – Puzzles and policy perspectives. *World Bank Econ. Rev.*, 4(3): 235-250.
- Khandker SR (2003). Microfinance and poverty: Evidence using panel data from Bangladesh. *World Bank Policy Research Working Paper 2945*. Washington D.C.: World Bank.
- Kochar A (1997). An empirical investigation of rationing constraints in rural credit markets in India. *J Dev. Econ.*, 53: 339-371.
- Limdep (1998). *Version 7.0, Econometric Software*. New York: Plainview.
- Maddala GS (1983). *Limited dependent and qualitative variables in econometrics*. Cambridge: Cambridge University Press.
- Maddala GS (1986). Disequilibrium, self-selection, and switching models. In: Z. Griliches and M. Intriligator (eds). *Handbook of econometrics*, Vol. 3. New York: Elsevier Science Publishers BV.
- Monge-Naranjo A, Hall L (2002). Access to credit and the effect of credit constraints on Costa Rican manufacturing firms. *Inter American Development Bank, Research Network Working Paper #R-471*.  
<http://www.idb.int/res/publications/pubfiles/pubR-471.pdf>. Assessed on 23/08/2007.
- Murdoch J (1995). Income smoothing and consumption smoothing. *J. Econ. Perspect.*, 9(3): 103-114.
- Murdoch J, Haley B (2002). Analysis of the effects of microfinance on poverty reduction. *New York University (NYU) Wagner Working Paper No 1014*. New York.  
[http://pdf.wri.org/ref/morduch\\_02\\_analysis\\_effects.pdf](http://pdf.wri.org/ref/morduch_02_analysis_effects.pdf), Assessed on 06/07/2007.
- Okurut FN, Schoombee A (2007). Credit market access in Uganda:

- Evidence from household survey data 1999/2000. *South Afri. J. Econ. Manage. Sci.*, 10(3): 371-383.
- Parker J, Nagarajan G (2001). Can microfinance meet the poor's needs in times of natural disaster? *Microenterprise Best Practices*, Development Alternatives, Inc.
- Petrick M (2004). A Micro-econometric analysis of credit rationing in the Polish farm sector. *European Rev. Agric. Econ.*, 31(1): 77-101.
- Robinson M (2001). The microfinance revolution: Sustainable finance for the poor. Washington DC: IBRB/World Bank.
- Rosenzweig MR, Stark O (1989). Consumption smoothing, migration and marriage: Evidence from Rural India. *J. Political Econ.*, 97(4): 905-926.
- Rosenzweig MR (2001). Savings behaviour in low-income countries. *Oxford Rev. Econ. Policy*, 17(1): 40-45.
- Sharma M (2000). The scope of policy reforms in rural microfinance. Policy Brief No 14: Rural Financial Policies for Food Security of the Poor. Washington D. C.: International Food Policy Research Institute.
- Siamwalla A, C. Pinthong N, Poaponsakorn P, Satsanguan P, Nettayarak W, Mingnaneenakin Tubpun, Y (1990). The Thai rural credit system: Public subsidies, Private information and segmented markets. *World Bank Econ. Rev.*, 4(3): 271-269.
- Stiglitz JE, Weiss A (1981). Credit rationing in markets with imperfection information. *Am. Econ. Rev.*, 71(3): 393-410.
- Townsend R (1995). Consumption insurance: An evaluation of risk-bearing systems in Low-Income-Economies. *J. Econ. Perspectives*, 9(3): 83-102.
- Udry C (1990). Credit markets in Northern Nigeria: Credit as insurance in rural economy. *World Bank Econ. Rev.*, 4(3): 251-269
- Vaessen J (2001). Accessibility of rural credit in Northern Nicaragua: The importance of networks of information and recommendation. *Savings Dev.*, 25 (1): 5-31.