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IMPACT OF FINANCIAL EXCLUSION ON TECHNICAL EFFICIENCY OF FARMERS - A DISEQUILIBRIUM CREDIT MARKET APPROACH BASED ON ENDOGENEOUS SWITCHING FRONTIER PRODUCTION FUNCTION

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INTRODUCTION

Agriculture is the primary source of livelihood in rural India. It contributes nearly 24.41 percent (Economic Survey, 2005-2006) of the gross domestic product and 67 percent of employment (Planning Commission, 2002). But Indian farmers are in need of credit and their liquidity constraint provides sub-optional inputs and hence output. The role of credit is to bring the sub-optional income to optimal level and enhance farmers' investment and output (Khandker and Binwanger, 1989).

Government financial intermediation in rural economics is geared to mobilize savings and investment, via lending. There is a growing body of literature that has focused on the linkages between credit market development and economic growth, the role of financial institutions in mobilizing savings and the effect of credit on agricultural investment and output [Goldsmith (1969), Shaw (1973), David and Meyer (1980), Pischke et al., (1983), Giovannini (1985), Braverman and Guasch (1986), Iqbal (1986), Feder et al., (1988), Feder et al., (1991) and Foltz (2004)].

Agricultural credit structure in a developing economy is characterized by dualism, that is co-existence of institutional (formal) and non institutional credit (informal) (Singh et al. 2001). In India, the formal sector consisting of co-operatives, commercial banks and the Regional Rural Banks as the main conduit for providing agricultural credit. From the institutional agencies, the total agricultural credit had increased from Rs.885 crore in 1970-1971 to Rs.1,25,309 crore in 2004-2005. Though there was increase in the flow of institutional credit, the non institutional credit accounted for 38.9 percent in the year 2002. (All India Debt and Investment Survey, 2002). It revealed that notwithstanding the outreach of banking, the formal credit has not been able to absolutely penetrate the informal financial markets. Rather, it seems to have shrunk in some respects in recent years (Throat, 2006). It revealed the absence of adequate institutional credit in agriculture even after various agricultural credit policy oriented reforms. Till the year 2003-2004, the private sector and the public sector commercial banks did not achieve the target lending of 18 percent fixed by the Reserve Bank of India (Report on trend and progress of banking in India, 1987-1988 and 2003-2004). The short term credit[1] provided by the financial institutions covered only 16 percent of the working capital requirements of the farmers in 1971-72. The coverage of working capital by short term credit was 13.93 percent in 1980-81, 28.08 percent in 1999-2000, 36.11 percent in 2001-2002 and 40.83 percent in 2003-2004. Around 60

[1] Short term credit is the crop loan given by the commercial banks to enable the farmer members to cultivate a crop. Under the crop loan system, the amount of loan is fixed according to the scale of finance prescribed for different crops prepared by the district level technical committee of the lead bank. The maturity period is a maximum of one year.

percent of the working capital of the farmers was not financed by the financial institutions and remained as institutional credit gap. The above facts brought out the presence of institutional credit gap in the agricultural sector lending and substantiated for disequilibrium credit market conditions in agriculture. (National Accounts Statistics, 1971-2006).

The share of agriculture and allied activities in the total gross domestic product had declined from 54.56 percent in 1951-52 to 21.9 percent during the period 2000-2001 to 2005-2006. It showed the slowdown in the share of agricultural production to total gross domestic product (National Accounts Statistics, 1971-2006).

In this backdrop, the Indian studies by Shukla el al,, (1977), Lavanya el al., (1977), Subramanyam and Doss (1981), Pandey (1983) and Uddin (2003), attempted to analyse credit requirements, credit gap, credit inadequacy and the impact of credit on agricultural production, employment and welfare. They also attempted to identify the impact of credit by estimating separate production functions (for farm production) or supply functions for borrowers and non-borrowers as well as for before and after availing credit. According to Feder et al., (1990). the major weakness of this approach is the implicit assumption that all borrowers and non-borrowers are respectively homogeneous with respect to their credit demand and supply situations. This assumption is often not valid as many non-borrowers did not borrow because they actually have sufficient liquidity from their own resources and not because they cannot obtain credit, while some non-borrowers do not borrow because they are not credit worthy. Similarly some borrowers may have borrowed adequately and some may not have been able to borrow adequately. Thus the credit constraint situation will occur for both borrowers and non-borrowers.

The incidence of formal credit constraint and credit unconstraint arises among both groups of farmers who have access and do not have access to formal credit. The farmers who have access to credit are credit constrained. when they do not receive adequate amount of credit. The farmers who do not have access to credit are credit unconstrained. when they are not in need of credit.

The studies in India by Kochar (1997) and in other countries by Feder et al. (1991). Diague et al., (2000). Diague and Zeller (2001). Foltz (2004) and Nuryartono et al. (2005) analysed the extent of credit constraint and impact of credit on production. farm income. investment and profit by taking both borrowers and non-borrowers into consideration. The above studies did not analyse the impact of agricultural credit on the technical efficiency of farmers. Moreover. the studies in India on the extent of credit constraint. financial exclusion and the impact of agricultural credit on agricultural sector in a disequilibrium market condition are very limited (Kochar. 1997). The present study tries to cover these gaps.

II. OBJECTIVES

Specific objectives of the study are :-

- To identify the factors determining credit constraint and financial exclusion
- To measure the impact of financial exclusion on production.
- To evaluate the impact of financial exclusion on technical efficiency

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HYPOTHESES

The hypotheses tested are :-

- The agricultural credit constraint and the financial exclusion is independent from the socio-economic characteristics.
- Technical efficiency of farmers was independent of financial exclusion.

III. METHODOLOGY

The methodology adopted in this study are discussed as under:

3.1. Selection of the sample:

3.2. Identification of credit constrained farmers

3.3. Specification of econometric model and estimation issues

3.4. Credit constraint function

3.5 Endogenous switching stochastic frontier production function

3.7. Limitations of the study

3.1 SELECTION OF THE SAMPLE:

The study is based on primary data. The sample borrowers and non-borrowers of the study were selected through multistage and purposive random sampling technique. In the first stage, the 19 rural blocks in Coimbatore district were considered. They are Anamalai, Annur, Avinashi, Gudimangalam, Karamadai, Kinathukadavu, Madathukkulam, Madukkarai, Palladam, Perianaickenpalayam, Pollachi (North), Pollachi (south), Pongalur, Sarkar Samakulam, Sultanpet, Sulur, Thondamuthur, Tirupur and Udumalpet. They were classified as the blocks of above district average credit disbursement if the credit disbursement was higher than the district average and below district average if the credit disbursement was less than the district average. (Annual Credit Plan, Coimbatore District, 2003-2004).

Among the above district average credit disbursement blocks, higher number of loan accounts (18,509) and cropping intensity (95.79 percent) were observed with Thondamuthur block. Hence Thondamuthur block was selected. (Annual Credit Plan, Coimbatore District, 2003-2004).

In the second stage, the branches of State Bank of India, Canara Bank, Corporation Bank, Indian Overseas Bank, Indian Bank, Syndicate Bank, Primary Agriculture Co-operative Societies and Land Development Banks which had achieved and exceeded the target in lending (for the year 2003-2004) to agriculture (Annual Credit Plan, 2004-2005) were selected. In the third stage, the size of borrowers of institutional credit and non borrowers were decided, based on the proportion of borrowers to cultivators in the selected blocks. Accordingly, out of 100 farmers decided in Thondamuthur block, 68 percent of borrowers and 32 percent of non borrowers were selected. In the fourth stage, the farmers were classified as credit constrained and credit unconstrained based on the survey responses of the farmers. In the post stratification, there were 40 credit constrained and 60 credit unconstrained farmers. (Annual Credit Plan, Coimbatore District, 2003-2004).

Z = area under cultivation (in hectares), farming experience (in years), education (in years), family size (in number), non-farm income (in Rs.) and availability of own fund to invest (in Rs.), all being measured in natural logarithmic form. ε is a random disturbance term.

If G*>0, the farmer is credit constrained. With the above formulation, the probability that the farmer becomes credit constrained (G*>0) can be written as

prob (G*>0) = probability (γ 'z+ ε >0).

This formulation leads to a standard probit model to estimate the probability that a household is credit constrained. Assuming ε has a standard normal distribution [N(0, 1)], the log likelihood function for a probit model is

$$\ln L = \sum_{Gi=0} \ln(1-\phi_i) + \sum_{G_i=1} \ln \phi_i$$

where ϕ is the standard normal distribution evaluated at γ' z (Foltz, 2004).

The probit model was also used by Feder *et al.*, (1990), Swain (2002), Foltz (2004), Gilligan *et al.*, (2005), Nuryartono *et al* (2005) and Guirhingeri and Boucher (2006) to measure the probability of a farmer being credit constrained.

As the model is pertaining to imperfect market condition, no unambiguous predictions on the signs of the reduced form estimation of excess credit demand can be made. The reduced form estimation shows the factors which are more important to either supply or demand. A positive estimated co-efficient, γ signifies a characteristic which increases demand more than supply. Among the variables included in the model, non-farm income and availability of own fund were expected to have negative relationship with credit constraint. (Feder *et al.*, 1990). Education, family size, area under cultivation and farming experience were expected to have intermediate a priori sign depending on the strength of its influence on either availability of credit or demand for credit (Feder *et al.*, 1990). The above analysis was carried out through LIMDEP computer package.

3.5 ENDOGENOUS SWITCHING STOCHASTIC FRONTIER PRODUCTION FUNCTION

The technical efficiency in frontier production function. It is a mathematical form yielding maximum output attainable from any given set of inputs. From this definition, the frontier production function represents an upper bound on output. Given a sample of farmers, sharing a common technology as embedded in the frontier function, the observed outputs of farmers can either be on or below the frontier but not above it. The degree to which the sample farmers fall short of the frontier output provides a logical measure of technical inefficiency (Taylor and Shonkwiler, 1986).

Production function was modelled for credit constrained and credit unconstrained farmers. The constructed stochastic frontier production function was of endogenous switching type production function. Production functions of the credit constrained and the credit unconstrained farmers with a criterion function were written as

$$\gamma_{1i}{}^{c}[G_i = 1] = \beta_{1i}{}^{c} x_i - \sigma_{1u}\lambda_{1i} + V_{1i} - 0_{1i} \text{ if } \gamma' Z + \varepsilon_i > 0 \quad - \quad (1)$$

$$\gamma''_{2i}[G_i = 0] = \beta_{2i}{}'' x_i + \sigma_{2u}\lambda_{2i} + V_{2i} - \theta_{2i} \text{ if } \gamma' Z + \varepsilon_i \leq 0 \quad - \quad (2)$$

The estimated results of stochastic frontier production function is shown in table -2.

The parameters estimates of stochastic frontier production function for the credit constrained farmers is shown in column 2 of table-2. It showed that the estimated co-efficients of all the selected variables were statistically insignificant. It shows that all the credit constrained farmers were not able to allocate the resources optimally.

The estimated coefficients of the production function of the credit unconstrained farmers were statistically significant for all the variables except for labour. All the estimated coefficients had expected theoretical sign of positive. It indicates that the production of the credit unconstrained farmers had increased with the increase in the value of area under cultivation, fertilizer, pesticides and farm equipment. It indicates that the credit un-constrained farmers were able to allocate the resources optimally. The co efficient of seeds had negative sign. It indicates that the credit unconstrained farmers were not able to allocate the seeds optimally.

The selectivity variable inverse mills ratio was statistically significant and different from zero for the credit unconstrained farmers. It established selectivity bias in the production function of credit unconstrained farmers.

The difference between actual and frontier output was caused by the farmer's inefficiency to allocate inputs (which is controllable) and random stocks which was beyond the control of the farmers. The key parameter 'γ' measures the proportion of farmer's inefficiency in the production process. It ranges between zero and one, where if 'γ' = 0, farmers inefficiency is not present and if 'γ' = 1, there is no random noise. The parameter 'γ' was statistically significant at one percent level for both the credit constrained and the credit unconstrained farmers. It established the fact that inefficiencies existed in the production function of both the credit constrained and the credit unconstrained farmers. To test the hypothesis 'γ'=0, the loglikelihood ratio test (LR Test) was used. The value of log livelihood ratio was compared with the critical χ^2 value given by Kodde and Palm (1986). The estimated log likelihood ratios for both the credit constrained and the credit unconstrained farmers (98.5208, 15.6581 and 103.2569) were greater than the critical χ^2 value (15.321). Hence the hypothesis of no technical inefficiency in the production function was rejected and accepted that γ = 0. It proved the existence of technical efficiency in the production function of the credit unconstrained farmers.

However, the mean technical efficiency of the credit unconstrained farmers (0.93) was comparatively larger than the mean technical efficiency of the credit constrained farmers (0.84). It proved that financial inclusion had improved the technical efficiency of the credit unconstrained farmers.

CONCLUSION

The credit unconstrained farmers had higher mean technical efficiency compared to the credit constrained farmers. It revealed that adequate credit availability to the credit unconstrained farmers and the financial inclusion had improved the technical efficiency. The views of Carter (1989) and Feder et al (1990) supported the above findings that the credit rationing can cause misallocation of resources in farm production. Venkateswarlu and Bhalorao (1983) and Singh and Rawat (2001) observed that the resource use efficiency of the farmers had increased with the availability of credit.

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