



Leibniz Institute of Agricultural Development
in Transition Economies

Effects of Credit Constraints on Technical Efficiency of Rice Growers: Evidence from Rice-cropping Zone of Punjab, Pakistan

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Outline

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- **Methods and data**
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Introduction

- Agriculture sector in Pakistan is considered as a cornerstone of the national economy.
- It contributes approximately 20.9 percent to the national gross domestic product.
- Generates employment for more than 45 percent of the country's total labor force.
- Supports directly or indirectly about 67 percent of the population (GOP, 2016).

Introduction

- The agricultural sector in Pakistan has remained largely underdeveloped.
- Most farmers particularly small landholders in rural Pakistan are in desperate need of finance.
- To meet the required investment, it is necessary to have some external financial source.
- The rural financial market in Pakistan operates under imperfect condition.

Introduction

- Credit constraints are consequence of asymmetric information and problem of incentive compatibility (Blancard *et al.*, 2006)
- The financial institutions in rural Pakistan are characterized as highly fragmented (Conning and Udry, 2005).
- Borrowers are systematically treated against different types of legal and non-legal agreements and other multiple contracts frequently involved in trading environment (Mehmood *et al.*, 2017).
- These institutional imperfections often restrict adequate performance and impose disequilibrium in rural financial market of Pakistan.

Introduction



Why selected rice crop?

- Rice is the second food and valued cash crop after wheat in Pakistan.
- Rice crop accounting for 3.1 percent in the value added in agriculture sector.
- This crop contributes 0.6 percent in the national gross domestic product (GOP, 2016).
- Rice production area is decreasing in the country.
- At present, rice production is threatened by two main factors: firstly, rising cost of production; and secondly, natural resource limitations.

Credit constraints and farming in Pakistan

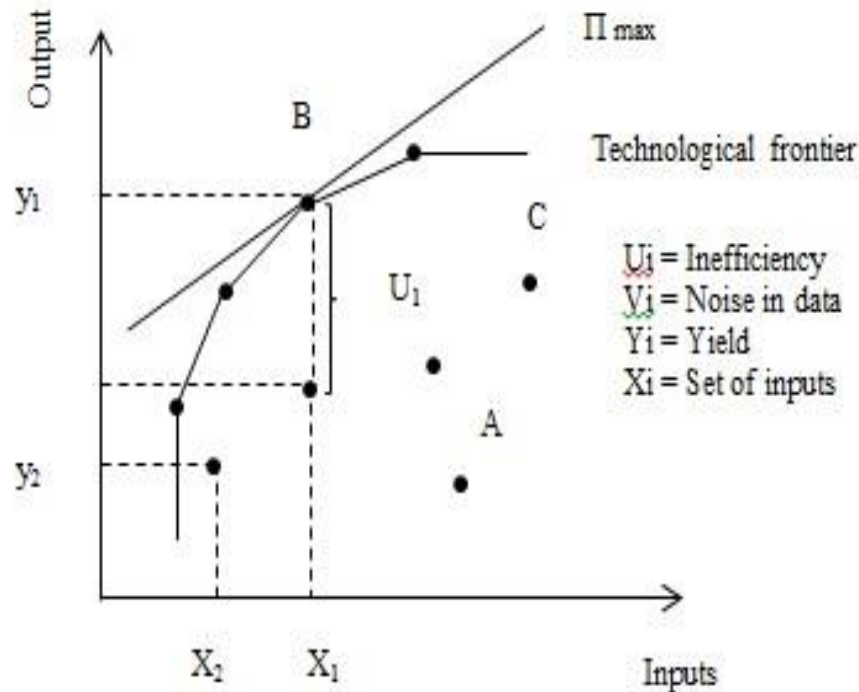


Nexus between credit constraints and technical efficiency

The relationship between credit constraints and technical efficiency mainly depend on:

- Theory of agency costs
 - Concept of free cash flow
- The agency costs is the costs incurred by the arbitrator that need to be paid for loan acquisition. This cost has adverse effect on the households' technical efficiency.
 - The concept of free cash flow explains that increased efforts by debtors to release financial obligations to lenders. That may enhance farmers efficiency and farm production.

Credit constrained and credit non-constrained households on the technological frontier



The curve indicates technological frontier, that is maximum attainable level of output with given inputs.

Below curve means inefficient utilizing the same level of inputs because of credit constraints

Identification of credit constraints

- **Indirect method**

This method particularly categorized the sample respondents into more and less credit constrained based on the ownership of assets, consumption expenditures and some other common measures.

- **Direct method**

This method directly estimate the credit constraint status of household and then find the effects of credit constraints on households' yield, profit, efficiency, productivity, etc.

Identification of credit constraints

Direct method: direct elicitation method

- Demand-side credit constraints

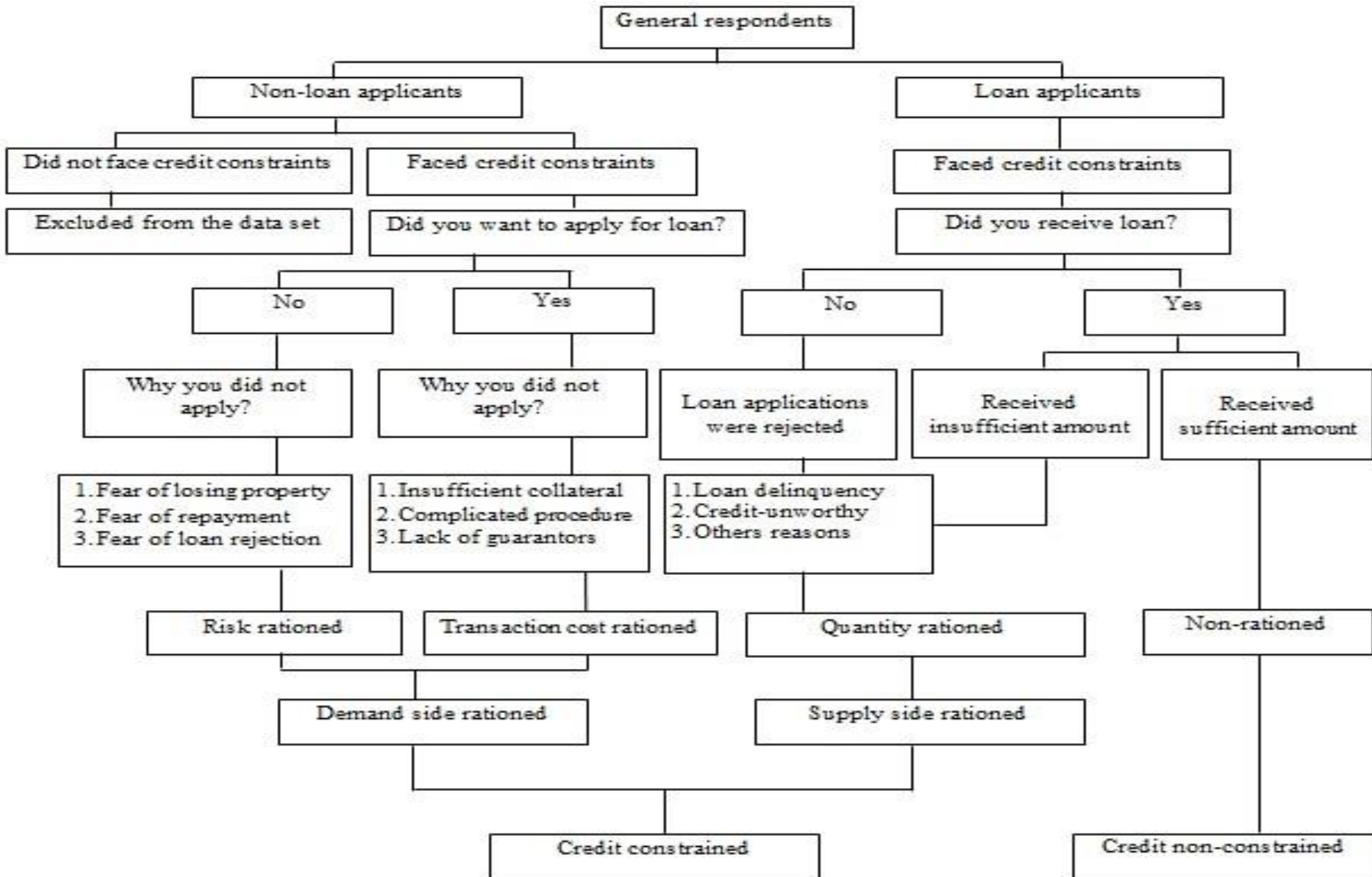
 - Risk rationed

 - Transaction cost rationed

- Supply-side credit constraints

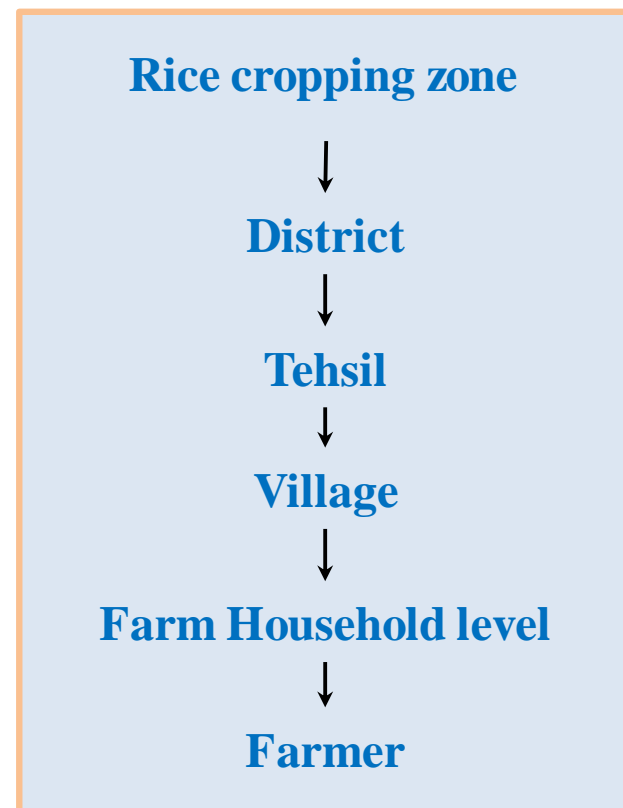
 - Quantity rationed

Theoretical model to identify credit constrained and credit non-constrained: Direct elicitation method



Sampling technique and data collection

- Random sampling
- The data regarding households' socio-economic characteristics, farm productivity, credit constraints, non-constraints status were recorded.
- 474 rice growers



Study map

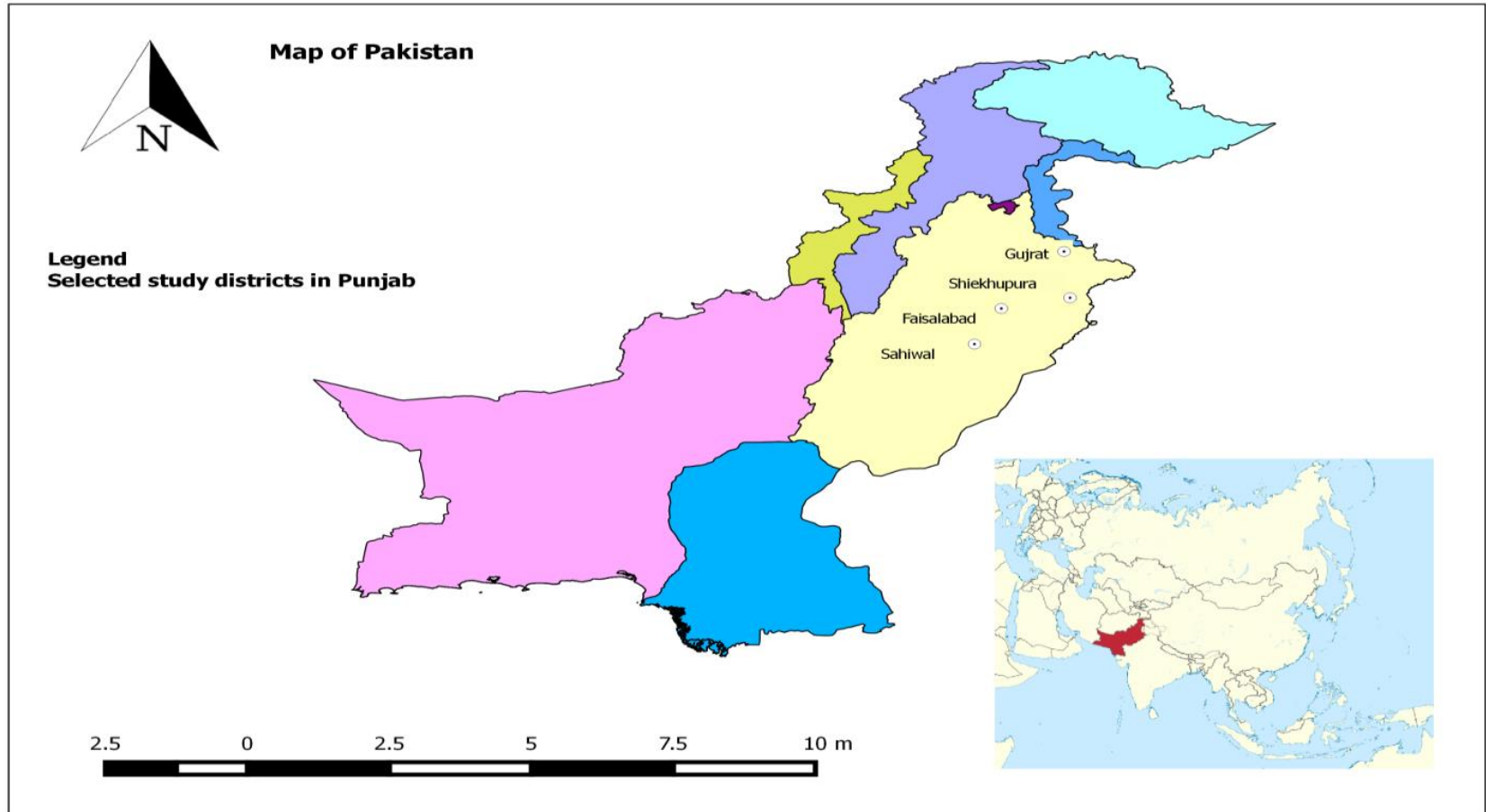


Figure: Study areas in Punjab province of Pakistan.

Table: Income sources and credit rationing status of credit constrained farm households

	Shiekhupura	Sahiwal	Faisalabad	Gujrat	Total
Income sources					
Crops farming as a preliminary income source (HH percentage)	81.444	73.846	68.085	85.365	78.694
Livestock business as a preliminary income source (HH percentage)	14.432	10.672	23.404	14.634	15.120
Diversified sources of income (HH percentage)	26.804	36.923	44.680	20.731	30.240
Credit rationing status of the farm households					
Credit quantity rationed	19	7	5	13	44
Transaction cost rationed	17	11	8	9	45
Risk rationed	13	8	5	14	40
Total observations (HH numbers)	97	65	47	82	129

Methods

- **Stochastic Production Frontier – Maximum likelihood estimates (Aigner *et al.* (1977).)**

An index for technical efficiency is explained as the ratio of the known output (y) and maximum potential output (y^*) of rice crop that could be attained:

$$TE_i = \frac{f(x_{ij};\beta).exp(v_i - \mu_i)}{f(x_{ij};\beta).exp(v_i)} \exp\{-(\mu_i|\varepsilon_i)\} \dots\dots\dots [6]$$

$$TI_i = 1 - TE_i$$

$$\ln Y_i = \beta_0 + \sum_{j=1}^8 \beta_{ij} \ln x_{ij} + v_i - \mu_i.$$

- **Inefficiency Effects Model (Caudill *et al.* (1995))**

$$\sigma_{\mu i} = \sigma_{\mu} \exp (Z_{mi}; \alpha) \dots$$

Z_{mi} represents managerial strategies of rice growers that identify inefficiency, while α is unknown parameters of inefficiency model

Results

Results

Table: Maximum likelihood estimates of stochastic frontier

	Credit constrained	Credit non- constrained
Variables	Coefficients	Coefficients
Ln Operating land	0.011	0.013**
Ln Land preparation	0.044**	0.026**
Ln Seed rate	0.05**	0.100***
Ln Fertilizer application	0.134***	0.208***
Ln Organic manure	0.009***	0.004**
Ln Plant protection measures	0.012	0.02**
Ln Irrigation application	0.095**	0.084**
Ln Farm labor	0.052***	0.004

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results

Table: Estimates of inefficiency effect analysis of rice growers

Variables	Credit constrained	Credit constrained	non-
Household head age	0.006	0.022*	
Household head education	-0.900**	-0.068**	
Dependency ratio of family members	-0.73**	-0.298	
Livestock business (Yes=1)	-0.568	-0.776**	
Income diversification (HH Index)	-0.812	0.966	
Interest rate on principal amount	0.144**	0.28**	
Credit size (US Dollars)	-0.0001**	-0.00004**	
Supply side rationing	-0.494	-	
Demand side rationing	0.5633**	-	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Conclusions

- Educational level, interest rate, credit size had significant positive effect on technical efficiency of both group of growers.
- Supply-side credit constraints had positive effect on technical efficiency of credit constrained growers, but found non-significant.
- Demand-side credit constraints had negative and significant effect on technical efficiency of credit constrained growers.

Policy recommendations

- Financing in agricultural enterprises relates to high risk. The State Bank of Pakistan should monitor the performance of commercial bank each year.
- Increase expenditures on enhancing efficiency and research at farm level.
- State Bank may reduce the agency cost, charged from commercial banks to facilitate the farmers.

Policy recommendations

- Institutional support (through extension services about credit programs awareness).
- Provision of subsidized crop insurance against exogenous uncertainties.

Thank you!

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