

Impact of Agricultural Extension on Productivity: Econometric Analysis Using Household Data in India

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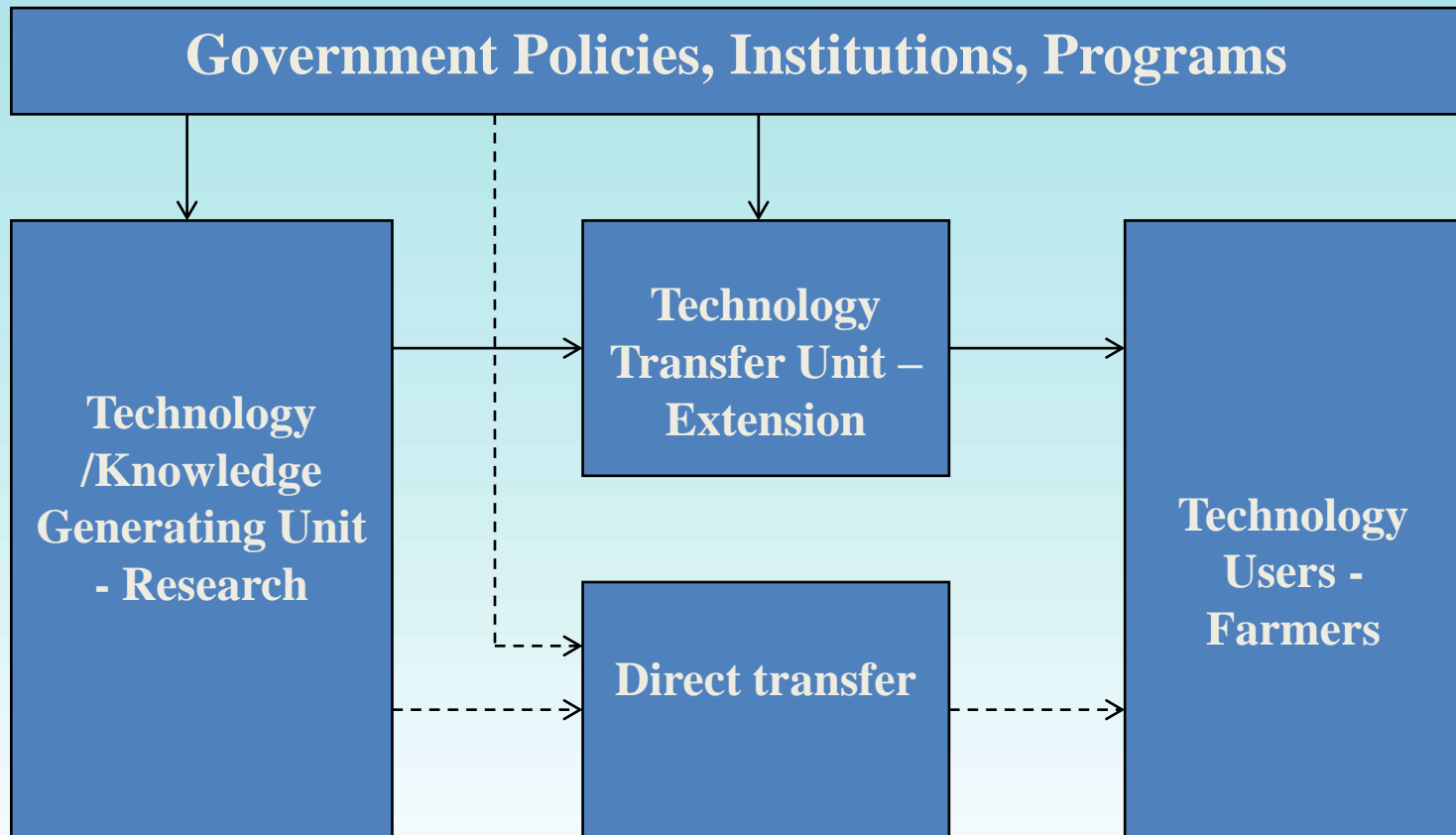
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Background

Extension mechanism for technology transfer



Background

Why India?

Regional distribution of the poor (millions) under international poverty standards of \$1.00–2.50 a day in 2005

Region	Living <\$1.00	Living <\$1.25	Living <\$2.00	Living <\$2.50
East Asia and Pacific	179.8	336.9	748.3	987.2
Eastern Europe and Central Asia	16.0	23.9	50.1	69.5
Latin America and Caribbean	27.6	45.1	98.7	132.9
Middle East and North Africa	6.2	14.0	58.0	94.3
South Asia	350.3	595.5	1091.6	1246.4
Of which India	266.5	455.8	827.7	938.0
Sub-Saharan Africa	299.1	384.2	551.0	609.9
Total	879.0	1399.6	2597.8	3140.2

Source: Chen and Ravallion, 2008

➔ India - center of focus in poverty alleviation challenge

Background

Why Indian agriculture?

- 75 % World's poor rely on agriculture
- 70 % Indian rural population subsisting on farming
- 58.4 % labor force is employed in agricultural sector
- Welfare depends on agricultural development
- Indian agriculture is the central focus

Background

Why Indian agricultural extension?

- Low productivity and diminishing reserves of potentially cultivable land
- Farmers interact with various extension sources
- Extension is the primary means that the government uses

Related Literature

- Egziabher *et al.* (2011) reported positive impact of extension participation in household income increase and income diversification
- Dercon *et al.* (2009) found access to extension significantly influence the consumption growth and reduce poverty

Research Questions

- Whether agricultural extension programs influences productivity for the individual farms or not
- If influence, at what extent

Research Objectives

- To estimate the productivity of farm-level agricultural production
- To assess the benefits of participating in government, private and other extension programs on household agricultural productivity

Empirical Model

Estimation in two steps

➤ Step 1:

Stochastic frontier analysis

(Battese and Coelli, 1992)

➤ Step 2:

Treatment effects model – Control function approach

(Heckman, 1979)

Empirical Model (contd.)

Step 1: Stochastic frontier model

$$\ln(\text{Output}_i) = \beta_0 + \beta_1(\ln \text{Land}_i) + \beta_2(\ln \text{Labor}_i) + \beta_3(\ln \text{NonLabor}_i) + \nu_i - u_i,$$

The technical efficiency for the i^{th} farm is

$$\text{TE}_i = \exp(-u_i) = Y_i / Y_i^*,$$

Empirical Model (contd.)

Step 2: Treatment effects model

The productivity equation

$$TE_i = \alpha + \beta(Ext_i) + \phi_1(Age_i) + \phi_2(Age_i^2) + \phi_3(Edu_i) + \phi_4(Sex_i) + \phi_5(Hsize_i) + \phi_5(Hland_i) + \varepsilon_i$$

The participation equation

$$Ext_i = \eta + \delta_1(Regis_i) + \delta_2(AgTrain_i) + \gamma_3(Edu_i) + \omega_i$$

where extension service received either –

- Government extension
- Private extension
- Krishi Vigyan Kendra (agricultural science center)
- Primary cooperative society
- Credit agency

Data

- 59th round of India's National Sample Survey
- Survey during January to December, 2003
- 51,770 random households - rural area
- Sampled farmers - 16,644

Results: Productivity Analysis

Results of stochastic frontier analysis

Variable	Unconstrained model		CRS model	
	Coefficient	Std. error	Coefficient	Std. error
Constant	3.7412***	0.0450	2.9037***	0.0136
lnLand	0.3497***	0.0080	0.4400***	0.0066
lnLabor	0.2313***	0.0063	0.2575***	0.0063
lnNonLabor	0.2997***	0.0069	0.3025***	0.0070
σ_u	0.9272	0.0135	0.9170	0.0139
σ_v	0.5682	0.0068	0.5853	0.0069
σ^2	1.1825	0.0210	1.1834	0.0212
λ	1.6319	0.0187	1.5668	0.0191
γ	0.7270		0.7106	
Wald χ^2	23744.84***		7281.93***	
No. of observation	16,664		16,664	
LR statistics	8.1e+02***			

The symbol *** indicates 1% significance level

Results: Productivity Analysis

Descriptive statistics of technical efficiency

Model	Mean	Std. deviation	Median	Minimum	Maximum
Unconstraint	0.5500	0.1548	0.5679	0.0109	0.9343
CRS	0.5528	0.1510	0.5696	0.0101	0.9298

Results: Impact Analysis

Effect of government and private extension programs on productivity
(dependent variable=technical efficiency)

Variable	Government extension			Private extension		
	Coefficient		Std. error	Coefficient		Std. error
Constant	0.4505	***	0.0243	0.5057	***	0.0994
Extension service	0.0296	*	0.0161	0.1512	*	0.0798
Age	0.0016	***	0.0006	-0.0014		0.0033
Age ²	-0.00001	***	5.63e-06	0.00002		0.00004
Education	0.0010	***	0.0002	0.0030	***	0.0009
Sex	0.0113	**	0.0054	0.0261		0.0288
Household size	0.0035	***	0.0004	0.0023		0.0023
Homestead land	0.0128		0.0182	-0.0200		0.0574
λ	-0.0231		0.0078	-0.0652		0.0286
ρ (P value)	-0.1468	**	0.0468	-0.4053	*	0.1738
	(0.01)			(0.09)		
Model χ^2 (P value)	133.44 (0)	***		21.06 (0)	***	
N	14,291			14,291		

The symbols *, ** and *** indicate 10%, 5% and 1% significance levels, respectively

Results: Impact Analysis

Effects of other extension services on productivity (dependent variable=technical efficiency)

Variable	Krishi Vigyan Kendra (KVK)		Primary cooperative society		Credit agency	
	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
Constant	0.5122 ***	0.0991	0.5009 ***	0.0999	0.5161 ***	0.0999
Extension service	0.2049 **	0.0807	0.1636 ***	0.0430	0.1233 *	0.0672
Age	-0.0015	0.0033	-0.0016	0.0033	-0.0013	0.0033
Age ²	0.00002	0.00004	0.00002	0.00004	0.00002	0.00004
Education	0.0027 **	0.0009	0.0027 ***	0.0009	0.0029 ***	0.0009
Sex	0.0289	0.0289	0.0254	0.0289	0.0288	0.0289
Household size	0.0020	0.0023	0.0016	0.0023	0.0021	0.0023
Homestead land	-0.0237	0.0567	-0.0125	0.0584	-0.0340	0.0578
λ	-0.0833	0.0288	-0.0125	0.0584	-0.0568	0.0266
ρ (P value)	-0.5177 ** (0.03)	0.1752	-0.4744 (0) ***	0.1056	-0.3521 (0.11)	0.1611
Model χ^2 (P value)	23.84 (0) ***		31.78 (0) ***		21.47 (0) ***	
N	744		744		744	

The symbols *, ** and *** indicate 10%, 5% and 1% significance levels, respectively

Results: Impact Analysis

Comparison of extension programs impact on productivity

Extension programs	Coefficient	Std. error
Government	0.0296*	0.0161
Private	0.1512*	0.0798
KVK	0.2049**	0.0807
Primary cooperative society	0.1636***	0.0430
Credit Agency	0.1233*	0.0672

Key Findings

- Farms operate at slightly more than half of their full potential
- Prospects for further productivity improvements
- Extension participation significantly increases productivity

Key Findings

- Participants of private extension showed five times higher productivity improvement than that of government extension participants considering their respective non-participants
- Among other extension programs, participants in KVKs showed greater improvement than participants in programs sponsored by credit agencies and primary cooperative societies

Policy Recommendation

- Easing terms and conditions for farmers' participation
- Relaxing rules and regulations for extension operation
- Strengthening government extension
- Higher long-term productivity by improving skills
- Expanding range of services for solving farming problems



Thank You