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Productivity and Technological Change in Nepalese Agriculture, 1965-81

This study attempts to estimate the productivity of inputs and the rate of technological change in Nepalese agriculture, during the period covered by the third through the fifth development plans (1965-80) and the initial year of the sixth plan (1981). Programmes of extension of irrigation, improved seeds, fertilisers, crop protection measures, and institutional devices were undertaken particularly since the middle of the sixties.

The productivities are estimated by using the Cobb-Douglas (C-D) and translog production functions, the former, with unitary elasticity of substitution, for its simplicity, and the latter, which does not employ the rather restrictive assumptions of the former, for its flexibility in providing approximation to any arbitrarily twice differentiable function and in capturing interactions among inputs.

The data relate to aggregate agricultural production as well as total land, labour and capital, separately for the two agro-climatic regions of Nepal, the Hill region in the north and the Terai region in the south. Aggregate agricultural production is expressed in millions of Nepalese rupees by valuing ten major crops, accounting for 90 per cent of all crops in the country, at constant (1974-75) prices. Labour is measured in number of days of employment in agriculture. Land input is measured in hectares of total cultivated land. In the absence of detailed data relating to annualised total expenditure on equipment, buildings, and other capital items, total institutional credit provided to agriculture by the Agricultural Development Bank of Nepal (ADBN), in million rupees, at constant (1974-75) prices, has been used as capital input in agriculture. The data are reported in Das (1982).

The regression results for both the functions are reported in Tables I and II. While the coefficients of determination are equally high and there is absence of serial correlation in both cases, ten of the 11 coefficients are significant at the 10 per cent level in the case of the translog function; it is so in the case of only two of the five coefficients of the C-D production function. Unlike the direct estimates of the output elasticities in the case of the C-D function, these are computed as linear transformations of the estimated coefficients in the case of the translog functions (Sidhu and Baanante, 1981).

TABLE I. ESTIMATED PARAMETERS OF THE TRANSLOG PRODUCTION FUNCTION: NEPALESE AGRICULTURE, 1965-1981

Exogenous variable (1)	Parameter estimate (2)	t-statistic (3)
Intercept		
Hill region	8285.021*	2.2688
Terai region	8282.423*	2.2683
ln L (land)	-691.5623*	-2.2145
ln N (labour)	-529.3927*	-2.3123
ln K (capital)	77.0611*	1.9195
$(\ln L)^2/2$	28.7217*	2.1881
ln L ln N	22.4074*	2.2131
ln L ln K	-3.1617*	-1.8299
$(\ln N)^2/2$	16.4540*	2.3231
ln N ln K	-2.5225*	-2.0156
$(\ln K)^2/2$	0.3285	1.3866
R^2	0.9932	-
Durbin-Watson D-statistic	2.3741	-
First-order autocorrelation	0.2121	-

* Significant at 10 per cent level or less.

TABLE II. ESTIMATED PARAMETERS OF THE COBB-DOUGLAS PRODUCTION FUNCTION: NEPALESE AGRICULTURE, 1965-1981

Exogenous variable (1)	Parameter estimate (2)	t-statistic (3)
Intercept		
Hill region	15.8988	1.4836
Terai region	13.9923	1.3291
ln L (land)	1.1256*	1.8056
ln N (labour)	-2.1445*	-2.9611
ln K (capital)	-0.0207	-0.3745
R^2	0.9909	-
Durbin-Watson D-statistic	2.4437	-
First-order autocorrelation	-0.2669	-

* Significant at 10 per cent level or less.

The output elasticities, reported in Table III, show that these were positive and high, particularly in the Hill region, in the case of land, negative and high with regard to labour, and low but negative with regard to capital in the Hills and positive for Terai. The high elasticity of output with respect to land is to be expected for an economy like Nepal. The negative output elasticity of labour only shows that increase of labour force and population on land by itself adds nothing to agricultural output. (The employment figures are really data on number of workers in agriculture rather than the number of actual man-days of work on farms.)

TABLE III. OUTPUT ELASTICITIES AND RATES OF TECHNOLOGICAL CHANGES FOR NEPALESE AGRICULTURE, 1965-1981

Region	Elasticity with respect to[a]			Rate of technological change	
	Land	Labour	Capital	Translog function	Cobb-Douglas function
(1)	(2)	(3)	(4)	(5)	(6)
Hill region	1.2972	-3.2008	-0.0167	0.0450	0.0375
Terai region	0.3143	-3.3486	0.1010	0.0509	0.0456
Nepal	0.8058	-3.2747	0.0421	0.0468	0.0415

a. These elasticities were obtained from the translog function. The Cobb-Douglas function generated elasticities of 1.1256, -2.1445 and -0.0207 with respect to land, labour and capital respectively, for all regions (see Table II).

The very low elasticity of production with respect to institutional credit is also understandable. While the total institutional credit forms only about 24 per cent of all rural credit and that by the ADBN some 85 per cent of this (Asian Development Bank, 1982), not only the bulk of non-institutional credit but possibly also a large part of institutional credit is used for non-productive purposes by the borrowers. That may partly account for the negative elasticity in the Hills.

The contribution of technological change to the increase in agricultural production, estimated by following the method of Solow (1957) and Intriligator (1978), is positive but very low: only about 4 per cent of the average annual growth in agricultural production can be attributed to it. Apparently, the large investments in physical infrastructure, deployment

of trained people in research stations and in extension, besides improved seeds and fertilisers, have done little by way of increase in production. For an economically weak country like Nepal, it is necessary to ensure better use of such resources in agriculture.

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