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DOMESTIC RESOURCE COST OF TEA PRODUCTION IN NEPAL

Bishnu B. Silwal

HMG - U.S. AID - A/D/C PROJECT
STRENGTHENING INSTITUTIONAL CAPACITY IN THE
FOOD AND AGRICULTURAL SECTOR IN NEPAL

Foreword

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ABSTRACT

This study was undertaken to measure Nepal's comparative advantage in tea production, and within Nepal, to measure the relative advantages of the Hills and Tarai regions. The concept of Domestic Resource Cost (DRC) was used to estimate these advantages. Data were obtained for the period 1974/75-1977/78, and three different discount rates -- 6, 10, and 15 percent -- were used to derive DRC ratios. For discount rates of 6 and 10 percent, Nepal's tea industry had a comparative advantage during the study period. However, at 15 percent, DRC ratios were greater than one, implying that the industry did not have a comparative advantage. In all cases the ratios for the Hills were less than those for the Tarai, indicating that the Hills had a comparative advantage over the Tarai in tea production.

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INTRODUCTION

The tea industry in Nepal was started nearly a hundred years ago. However, the two oldest tea estates -- Ilam and Soktim, in Ilam district of Mechi zone -- were of only historical importance until the 1960s because of poor management and frequent changes of ownership.

In the mid-sixties the Nepal Tea Development Corporation was formed to look after these two estates and to start new ones in the public sector. During this time six estates were also established in the private sector. At present, there are altogether 11 tea estates located in Jhapa and Ilam districts. All six private tea estates and two of the five public estates are located in Jhapa (Tarai), two of the public estates are in the Hills, and the remaining one is in the Inner Tarai. Total planned area by 1986 is 2630 hectares, of which 1560 hectares have been planted so far. In addition to these estates, the Out-Growers Tea Development Project was started in 1979 for small-holders in Ilam district with a target of 890 hectares by 1983/84.

In spite of the long history of tea plantations in Nepal, the tea industry has stagnated for nearly a century, and only in the past 15 years have efforts been made to accelerate its growth. The estates are now getting loans at low interest rates, and they are exempted from taxes and custom duties. Recently British aid of £3.7 million has been received to complete projects in all three sectors -- private, public, and small-holders.

The share of domestic production in total tea supply was only 4 percent in 1970 but reached 29 percent in 1980. With the completion of all projects, Nepal should be able to export quality tea and earn foreign exchange equivalent to Rs. 3.3 million in 1986, and an estimated Rs. 26 million by 2000. This, however, will not be an exportable surplus as such. The tea to be exported will be the high quality tea produced in the Hills, whereas domestic demand is for the common type of tea. Nepal has been importing tea from India and will have to do so in the future to meet domestic demand because production from the Tarai will not meet the demand and there is little scope for expansion there. However, tea production in the Hills can be increased, and foreign currency can be earned by exporting quality tea. Therefore the Nepalese tea industry can be termed as partially import substituting and mainly export earning.

Objective of the Study

This study is designed to provide information on the feasibility of increasing tea production in Nepal. In particular, the objective of this study is to measure Nepal's comparative advantage in tea production, and within Nepal, to measure the relative advantages of the Hills and Tarai regions, by using the concept of Domestic Resource Cost.

ANALYTICAL FRAMEWORK

Domestic Resource Cost (DRC) is a technique used to measure the degree of comparative advantage of productive activities. The theory of comparative advantage states that the optimum pattern of production and trade for a country should be determined by comparing the opportunity cost of producing a given commodity with the price at which the commodity can be imported or exported. In equilibrium, no commodity is produced which could be imported at a lower cost, and exports are expanded until marginal revenue equals marginal cost. Furthermore, with full employment and perfect competition, the opportunity costs of factors of production -- that is, their values in alternative uses -- are equal to their market prices. However, when there are distortions in factor markets, these factors should be evaluated using shadow prices.

The definition of comparative advantage used here is the one suggested by Bruno (1972) in terms of Domestic Resource Cost. Comparative advantage exists if the following inequality holds:

$$DRC = \frac{D}{(P - F)} < E$$

where D = total per-unit direct and indirect domestic factor costs, expressed in local currency;

P = per-unit export or import price, expressed in foreign currency;

F = total per-unit direct and indirect foreign factor costs, expressed in foreign currency; and

E = foreign exchange rate.

If each side of the above formula is divided by the exchange rate, the criterion for comparative advantage becomes:

$$\frac{DRC}{E} < 1$$

The degree of comparative advantage depends on the value of domestic resources used in producing a commodity. The relative comparative advantage of a country, region, or industry vis-a-vis another country, region, or industry is obtained by calculating their DRC/E ratios. If the DRC/E ratio for the first country is less than that for the second country, then the former has a comparative advantage in producing the commodity.

In this study the method for calculating DRC is adopted from Akrasanee (1974) and Pearson, Akrasanee, and Nelson (1976). This formula, which is based on Bruno's formula, is expressed as follows:

$$DRC = \frac{\sum_{s=1}^{m} F_s V_s + \sum_{i=1}^{n} (a_i P_i)(1 - \alpha_i)}{U - M}$$

where: F_s = primary factor inputs used to produce one unit of the good

V_s = shadow price of F_s

a_i = domestic intermediate inputs used to produce one unit of the good

P_i = shadow price of a_i

α_i = proportion of imported content in a_i

U = foreign exchange earned by exporting or saved by substituting for the import of one unit of the good

M = direct and indirect foreign exchange cost required to produce one unit of the good

s = 1, 2, ... m (index of primary factor inputs)

i = 1, 2, ... n (index of intermediate inputs)

DRC calculations were done in terms of one kilogram of tea For example, U is the foreign exchange saved by substituting for the import, or earned by exporting, one kilogram of tea. The formula used to calculate the Domestic Resource Cost for each tea estate is:

$$DRC = \frac{\dfrac{\text{Total direct and indirect domestic costs (Rs.)}}{\text{Total tea output (kg)}}}{\text{CIF price of one kg of tea (US\$)} \text{ Less } \left(\dfrac{\text{Total direct and indirect foreign costs (Rs.)}}{\text{Total tea output (kg)}} \Big/ \text{Exchange Rate} \right)}$$

To study comparative advantage by using DRC calculations, the social opportunity costs of direct and indirect domestic resources and foreign factors used in production must be known. In many underdeveloped countries, unemployment is increasing as capital-intensive technology is adopted. This is sometimes because the price of capital is kept low to protect "infant" industries, while the price of labor is kept high as a result of trade unions, or for other political reasons. Profit-maximising firms will use more of the factors which cost relatively less. To calculate DRCs, shadow prices should be imputed for major components such as wages, capital, the foreign exchange rate, and prices of material inputs. The cost components and the derivation of their shadow prices are described in detail below.

Domestic factor costs. Domestic factor costs were divided into primary, intermediate or material, and non-material components. Primary factor costs are composed of labor costs, capital costs, and land costs.

Labor cost is the per-unit cost of skilled and unskilled labor. The tea industry is labor-intensive, with wages accounting for 25 to 30 percent of total costs. It is generally argued that in LDCs wages received by workers in industrial or estate employment are higher than their marginal products. Unskilled labor employed by industry often comes from subsistence agriculture, where a worker consumes his average product, which is greater than his marginal product. This means that the opportunity cost of employing an additional worker will be lower than his wage. However, because he has more income in his new employment, the worker

will consume more, and this increase in consumption is a cost to the society. In this study an average of unskilled and semi-skilled shadow wage rates derived by the Industrial Service Centre (Phillips 1978) is used to calculate the social cost of labor. This social cost conversion factor was 0.76.

Capital cost was divided into domestic and foreign components, and import duties were deducted from foreign capital costs in the DRC calculation. Capital cost is a flow concept which includes depreciation and interest. The rate of depreciation depends upon the kind of capital. For instance, factory buildings and vehicles depreciate faster than office buildings. A weighted average was thus used to calculate the depreciation of capital stock. Nepal, like many developing countries, has a dual financial market: there are government-regulated institutions which lend at low rates and mainly service the modern sector, and there are private money-lenders who charge high rates of interest and mainly operate in the rural sector. In this study three discount rates were used -- 6, 10, and 15 percent.

The social cost of land is its value in the use to which it would otherwise have been put. Social cost differs from private cost if the land benefits from public facilities such as irrigation canals, subsidized fertilizers, or tax advantages. However, this was not the case for land under tea during the study period. Therefore, the private cost was used as the social cost of land. The opportunity cost of land was Rs. 450 and Rs. 150 per acre in the Tarai and Hills, respectively.

Intermediate or material inputs included fertilizers, insecticides, herbicides, petrol, diesel, fuel and oil, tea chests, and firewood. These intermediate inputs were separated into domestic and imported contents. Firewood was the only domestic intermediate input, and a shadow price was calculated only for it. The price paid for firewood used by the estates was lower than that charged to consumers in urban areas, where the price is set by the Fuel Corporation according to demand and supply. Therefore the social cost of firewood used in drying tea was estimated from consumer prices in urban areas. The use of other inputs such as bamboo and polyethylene sleeves was not significant, so market prices were used for these inputs.

Non-material inputs include payments such as staff salaries, transportation, and excise and sales taxes. Excise and sales taxes are not costs to the society, so they were

deducted from non-material costs. Most of the transportation inputs were provided by the estates, so these costs were evaluated like other costs. No adjustment was made to the salaries of managers and clerks, since generally there is no difference in salaries for this group in alternative employment.

Foreign factor costs. These include imported machines and imported intermediate inputs. Import taxes were deducted from the value of imported capital. Similarly, indirect foreign costs such as the import content in non-machine capital goods were adjusted for import duties. A one percent rate of import duty was charged on imported machinery and an average rate of ten percent was charged on the import content of non-machine capital like factory buildings and office buildings. Fertilizers, insecticides, and herbicides were not subject to import taxes, so the only adjustment made was the added cost which was subtracted from foreign factor cost and added to indirect domestic cost. The added cost was found to be 32 percent of the retail price. A 24 percent import tax and a 12 percent added cost was used to adjust the costs of diesel, petrol, and oil.

Foreign exchange rate. Comparative advantage should be calculated using a shadow exchange rate, because market exchange rates in most developing countries are distorted. Exchange rates may be distorted if there is direct government control over exchange rates, widespread black market trading, or protective tariffs and import controls.

While all three of these are found to some extent in Nepal, the existence of only a small difference between official and black market rates and the ARTEP/ILO Mission's (1976) remark that Nepal's tariff structure is primarily designed to raise revenues suggest that the foreign exchange rate is not substantially distorted. Consequently, the official rate can be used as a good approximation of the shadow price of foreign exchange. Pearson and Meyer (1974) have also used the official rate of exchange in studying comparative advantage among African coffee-producing nations, and they contend that the official rate should be used if there is no well-defined and justified alternative.

CIF Price (U). The value saved by substituting for imports, or earned by exporting, should be expressed in terms of foreign currencies. Nepal imported considerable quantities of tea from India during the study period. The CIF price of

one kilogram of tea -- for which the production of one kilogram of domestic tea will substitute -- is calculated as the weighted monthly average of Calcutta auction prices on the basis of the IMF exchange rate (FAO). CIF prices differ for the Hills and the Tarai, and change from year to year.

The local currency used is Rupees and the foreign currency used is the US Dollar. The exchange rate used for this study was Rs. 12.5 = US$ 1.00.

EMPIRICAL RESULTS

Only eight of the ten estates studied were producing, and the ratios of DRC to the foreign exchange rate for these estates for the years 1974/75 to 1977/78 appear in Table 1. The ratios show that in 1974/75 all eight estates had a comparative advantage in tea production for the 6 percent discount rate. At a 10 percent discount rate, only three of the eight estates had DRC ratios less than 1.0, and when the rate was raised to 15 percent all but one estate had ratios greater than 1.0. In 1975/76 at 6 and 10 percent discount rates the results were the same as for 1974/75, but when discounted at 15 percent, three of the eight estates had ratios less than 1.0. For 1976/77 and 1977/78 all estates except one had a comparative advantage at a 6 percent discount rate, but with a 15 percent discount rate, four estates had ratios less than 1.0.

Using a weighted average of DRC ratios, the tea industry did not have a comparative advantage at a 15 percent discount rate during the study period. However, with discount rates of 10 and 6 percent, the DRC ratios are generally less than 1.0, implying that the industry had a comparative advantage (Table 2).

Only one of the two estates in the Hills was producing during the study period. In most cases, the DRC ratios for the Hills estate were less than for the Tarai estates, suggesting that the Hills has a comparative advantage over the Tarai in tea production.

The variation in DRC ratios during the study period and among the estates is attributable to differences in productivity, level and quality of output, factor prices, and world prices. However, it is difficult to identify specific factors responsible for changes in DRC ratios during the study

Table - 1

DRC Ratios (1974/75 - 1977/78)

		Tarai							Hills
Estates		A	B	C	D	E	F	G	H
Year/Discount Rate (Percent)									
1974/75	6	0.87	0.53	0.96	0.92	0.80	0.82	0.82	0.74
	10	1.04	0.64	1.23	1.14	0.99	1.00	1.01	0.89
	15	1.26	0.78	1.61	1.45	1.22	1.24	1.27	1.09
1975/76	6	0.50	0.58	1.04	0.72	0.85	0.90	0.82	0.60
	10	0.72	0.70	1.38	0.84	1.04	1.09	1.02	0.70
	15	0.88	0.58	1.80	1.03	1.28	1.35	1.27	0.80
1976/77	6	0.64	0.56	1.13	0.52	0.71	0.75	0.68	0.56
	10	0.78	0.67	1.43	0.61	0.88	0.87	0.85	0.65
	15	0.98	0.82	1.86	0.74	1.12	1.08	1.07	0.77
1977/78	6	0.67	0.73	1.12	0.57	0.76	0.64	0.77	0.59
	10	0.81	0.88	1.43	0.67	0.93	0.78	0.96	0.66
	15	0.98	1.07	1.84	0.81	1.18	0.96	1.22	0.78

Table - 2

Production-Weighted Average DRC Ratios for Nepal's Tea Industry

	Discount Rate (Percent)		
Year	6	10	15
1974/75	0.82	1.00	1.24
1975/76	0.74	0.91	1.10
1976/77	0.70	0.85	1.06
1977/78	0.71	0.87	1.07

period. An analysis of the factors responsible for these changes would help determine the sensitivity of DRC ratios to changes in input prices, output, and output prices. The major inputs which contribute to the size and direction of movement of the DRC ratios are labor, land, domestic capital, foreign capital, and management. Changes in yield, world prices, and foreign exchange rates are other factors to which the ratios are sensitive.

Keeping other factors constant, DRC elasticities with respect to yield, world price, labor cost, and domestic capital cost were calculated for comparison. A increase in yield decreases the DRC ratio through a change in direct and indirect domestic costs in the numerator, while an increase in labor cost or domestic capital cost increases the DRC ratio. An inverse relationship exists between the world price and the DRC ratio. An increase in the world price will increase the net foreign exchange earned or saved in the denominator of the formula, resulting in less domestic cost per unit of foreign exchange earned or saved. The calculated elasticities are given in Table 3. These numbers show the percentage by which a factor in question has to be changed to obtain a one percent change in DRC, and the signs show the directions of these relationships.

Yield and world price. The DRC elasticity with respect to yield ranges from -1.12 to -0.51 for the study period. Except for one estate in 1974/75 and 1976/77 and two estates in 1977/78, all estates have DRC elasticities greater than -1.0, and the mode is -0.8, which shows that the DRC of the tea industry as a whole is elastic to yield. (It is elastic because a 0.8 percent change in yield results in a 1.0 percent change in DRC, so a 1.0 percent change in yield will result in more than a 1.0 percent change in DRC.) Similarly, DRC elasticities with respect to the world price are generally greater than -1.0, indicating that the DRC of the tea industry is also elastic to the world price.

Labor cost and domestic capital cost. The DRC elasticities with respect to labor cost range from 2.97 to 7.63, and the elasticity with respect to domestic capital cost ranges from 1.19 to 2.33. The mode elasticities are 3.8 and 1.6 respectively, which shows that the DRC of industry as a whole is inelastic with respect to both labor and domestic capital costs.

The DRC elasticities indicate that the tea industry can have a comparative advantage in the future if yields and world

Table - 3

DRC Elasticities with Respect to Yield, World Price, Labor Cost, and Domestic Capital Cost
(1974/75 - 1977/78)

	Tarai				Hills			
Estates	A	B	C	D	E	F	G	H
1974/75								
Yield	-1.12	-0.97	-0.72	-0.76	-0.93	-0.87	-0.90	-0.80
World Price	-1.00	-1.00	-0.75	-0.72	-0.48	-0.90	-0.94	-0.81
Labor Cost	3.53	2.97	5.12	5.46	7.63	5.91	5.05	5.58
Domestic Capital Cost	1.55	1.50	1.59	1.81	1.53	1.68	1.44	2.19
1975/76								
Yield	-0.88	-0.97	-0.63	-0.81	-0.87	-0.83	-0.87	-0.85
World Price	-0.97	-0.96	-0.63	-0.88	-0.92	-0.84	-0.84	-0.85
Labor Cost	4.42	4.27	6.02	3.14	3.87	4.99	5.88	5.18
Domestic Capital Cost	1.74	1.80	1.61	1.96	1.61	1.78	1.63	1.80
1976/77								
Yield	-0.89	-0.94	-0.51	-0.81	-0.84	-0.86	-0.86	-1.00
World Price	-0.90	-0.92	-0.72	-0.82	-0.84	-0.85	-0.87	-0.97
Labor Cost	3.78	3.87	5.74	3.81	3.53	3.87	4.58	3.53
Domestic Capital Cost	1.44	1.84	1.59	2.23	1.50	1.66	1.47	1.89
1977/78								
Yield	-1.17	-0.96	-0.71	-0.73	-0.85	-0.92	-0.81	-1.10
World Price	-1.00	-0.96	-0.71	-0.83	-0.69	-0.95	-0.86	-0.96
Labor Cost	5.05	3.89	6.71	3.63	3.70	5.31	5.65	3.27
Domestic Capital Cost	1.77	1.68	1.53	2.22	1.61	1.64	1.57	1.78

a) These DRC elasticities were calculated by assuming a ten percent increase in each factor, keeping other factors constant, and deriving the resulting changes in DRC ratios. The changes needed in each factor to give rise to a one percent change in the DRC ratio were then calculated.

prices increase over time, other things remaining the same. The world price is exogenous to the industry. Consequently, the only option available to the industry is to increase the productivity of factors through more efficient management of the gardens and by reducing the domestic capital cost per unit of output, because the DRC elasticity with respect to this component is lower than that of labor cost.

SUMMARY

The comparative advantage study using the concept of Domestic Resource Cost gives different results for different discount rates. When capital costs are evaluated at 6 and 10 percent, DRC ratios are less than 1.0, implying that the tea industry has a comparative advantage. However, at a 15 percent discount rate, the comparative advantage cannot be maintained because the ratios for the industry are generally greater than 1.0. The ratios for the Hills estate are generally less than those for the Tarai estates, implying that the Hills has a comparative advantage over the Tarai in tea production. The DRC is elastic with respect to yield and world price but inelastic with respect to labor cost and domestic capital cost. This implies that it will be relatively easier for the industry to have a comparative advantage in the future if yields and/or world prices improve over time.

POLICY IMPLICATIONS

In project analysis internal rates of return are often calculated and compared with the accounting rate of interest to measure the relative profitability of projects. Similarly, the concept of DRC can be used to compare the relative social profitability of different projects. Such a comparison of DRCs in this study indicates that social profitability, as measured by domestic resource cost per unit of foreign exchange saved by producing a marginal unit of tea, is higher in the Hills than in the Tarai. This suggests that Nepal should expand the area under tea in the Hills and should export high quality Hill tea to earn foreign exchange, while importing Tarai-type common tea for domestic consumption. However, the Tarai-Hills comparison results should be interpreted with caution because only one tea estate in the Hills was covered by this study.

The DRC is most sensitive to yield, so policies should be aimed toward achieving higher productivity. Nepal's comparative advantage in tea production can best be maintained by increasing productivity. To increase productivity, the first and foremost task is to identify problems prevailing on individual tea estates. A detailed study of the technical and economic aspects of production and the probability of reducing costs in the different stages of production is needed. Once problems are identified, solutions can be devised and implemented in an effective and rational way.

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