Estimating the Social Cost of Using Agricultural Land in the Punjab

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Introduction

Pakistan, like any developing country, must regularly divert some of the scarce agricultural land to an alternative use—to another crop, to a site for a reservoir or a plant for processing agriculture's output, or to industrial, commercial or housing purposes. This paper is an exercise in estimating the social cost of releasing agricultural land in the Punjab for use in another activity. It will, hopefully, serve as a model for planners and policy-makers who are confronted with specific projects requiring cost-benefit analysis. For example, Pakistan's Fifth Five-Year Plan calls for construction of numerous sugar mills, sites for which will require an estimated 100 acres of agricultural land per mill. The cost of using this land for sugar refining may be expressed in terms of the net value of the agricultural output foregone. Similarly, if cane cultivation is extended to provide input for the refineries, its cost must be evaluated by the value of the crops which are foregone.

Although the examples used in this paper are drawn from the Punjab, the method is general. Of course, the price data used in any replication of this exercise must be drawn from the specific case to be examined.

The need to estimate the *social* cost of using land arises because its *market* price does not normally reflect its scarcity value. Market prices are an imperfect measure of social cost or value for various reasons: imperfect markets, differential taxes and subsidies on inputs or outputs, differential tariffs or multiple exchange rates, and price control. For example, the social value of agricultural land is overstated by its rental rate or market price if agricultural inputs such as fertilizer and insecticides are subsidized. If public policy has set the domestic price of farm output below its price in world markets, the market price of land will understate its social value. Tenancy relationships which place a premium on mere ownerships of land can result in a market price in excess of social value.

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This study is a part of a broader research effort by the Pakistan Institute of Development Economics to estimate the shadow prices for factors of production and principal produced inputs that figure importantly in cost-benefit analysis of development projects.

Our purpose is to convert *domestic market* prices, which measure *private* costs or returns, into social accounting prices.[1] Essentially we will estimate the private return or rental value of land and then adjust this value to reflect differences between private and social accounting prices. This figure will tell us what *society* gives up if it diverts land to an alternative use. We will estimate the annual social return per acre per year of land in the various uses to which agricultural land is put. The annual return may be converted to a price by capitalization in accordance with the usual formula:

$$CV = \frac{R}{i}$$

i.e. the capitalized value of a property (CV) is the annual net revenue (R) divided by the appropriate social discount or interest rate (i).

Prior work on this topic has been done by Lawrence [6] and Afzal [1]. Lawrence was interested in evaluating alternative cropping patterns for the purpose of generating foreign exchange, either through exporting or by replacing imported agricultural products with domestic production. Afzal calculated the social returns to an acre of land under different crops and crop combinations but his paper was concerned principally with the efficiency of land use after the " Green Revolution ". While their estimates are relevant to the valuation of land in project appraisal, additional work is needed. First, neither Lawrence nor Afzal used accounting prices for all outputs and inputs in the production process. Second, relative prices have shifted sharply since 1970-71 and new estimates should be provided. Finally, the methodology should be more explicit, so that future changes in prices and technologies can be used to update the results, and so that similar calculations can be easily made for other crops and other areas.

The paper consists of four sections, the first of which provides a general review of methodological problems. The main part of the paper is contained in the second section in which all the relevant input and output data are converted from private market to social accounting prices. The latter are then used to calculate the average social return per acre of land under existing cropping patterns. The method and the rationale for each step or calculation are explained. The third section presents some illustrative uses of the results, and the fourth section summarizes the results and offers some policy observations.

I. Methodology

The method is based on procedures for estimating the social cost of non-traded goods as outlined by Little and Mirrlees in their manual for project analysis [8]. Since land is not an internationally traded good, the world market price cannot be used as its social accounting price.[2] And since land is a non-reproducible factor of production, its value cannot be broken down into the value of its inputs. There is no *direct* way to convert its market price to a social value. Instead we will calculate the social value of land's annual output per acre,

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[1]The latter are often referred to in professional literature as *shadow* or *border* prices.

[2]The social accounting prices of traded goods are ' normally ' current world market or ' border ' prices which would obtain under free trade conditions. A justification for this procedure is provided by Little and Mirrlees [7] and also by Lal [5, pp. 143—148].

and then subtract the annual social cost of all inputs except land. The residual is the return to the land itself, the traditional economic rent of land, expressed in social accounting prices.

We confine our attention to land under the four major crops grown in the Punjab, viz. wheat (Winter or *Rabi* Season), rice and cotton (Summer or *Kharif* Season), and sugarcane (an annual crop). We assume that the present cropping pattern reflects the most rewarding use of the land under market conditions. We recognize, of course, that other cropping patterns are feasible and that the land is of different qualities. These facts present two methodological problems. First, when valuing land under different crops we ought to use the cropping pattern which would prevail at social accounting prices. Since this information is not available, the cropping pattern at market prices is used. The second problem is that we cannot calculate the value of all the different parcels of land. Rather we will calculate the *average* social cost or value of land under the several major crops. Replication of this exercise in connection with any particular project would require substitution of data relating to the particular price of land under consideration.

The procedure is uniform for all crops. The input-output data are taken from a report to the Government of the Punjab on agricultural production costs[3] [13], hereafter referred to as the Report. First the market price of output is converted to social accounting values and then the social accounting cost of inputs is calculated for the following categories of inputs:[4]

1. Labour, family
2. Labour, hired
3. Bullock power
4. Management
5. Seed
6. Fertilizer
7. Farmyard manure
8. Insecticides
9. Water
10. Capital, depreciation and repair
11. Transport
12. Interest

Since the data on labour and bullock power are listed in the Report in a fairly disaggregated form, the process of aggregation needs to be described. For operations such as ploughing, levelling, planting and sowing, the total cost includes charges for labour, bullock and the residual which is attributed to

[3]The Report provides cost data with *average* resource use. It does not include data for the cost of tractors, combine harvesters, etc. We have no data on the cost of using a mechanized, capital-intensive technology although it would likely change—*up or down*—the social accounting cost of production. In any event, the majority of farmers and the majority of land cultivated in the Punjab still utilize animal technology.

[4]The Report includes two additional cost categories, Land Revenue/Taxes and Land Rent. Unlike the listed categories, these costs are fixed rather than variable. Conceptually they should be treated as a part or a division of the residual return to land.

depreciation and repair of capital. One acre is cultivated in one day under average conditions. Thus, for example, the costs involved in one ploughing of one acre include one man day (at Rs. 7), one bullock day (at Rs. 10.50)[5] and miscellaneous costs such as capital depreciation and repair of machinery. The costs of other operations such as thinning, bund-making, winnowing and harvesting are entirely labour costs. All capital, bullock and labour costs are added up, and each is separately listed as an input into the cost of production of the crops being considered. The labour costs are then once again subdivided,[6] since family and permanent labour is priced differently from casual (hired) labour. All the other inputs are taken directly from the Report.

Having socially priced both the outputs and inputs, we derive the ' residuals ' which are regarded as the social return to land under different crops by subtracting the latter from the former.

The justification for the use of this methodology is provided by Euler's theorem, which states that the total product will be exhausted if factors are paid their marginal products, given a homogeneous production function. If this relationship holds between inputs and output, then the residual obtained by subtracting the social value of all inputs, except land, from the social value of output is the marginal contribution of land.

II. Conversion Factors for the Derivation of Accounting Value of Outputs and Inputs : Method and Estimates

This section explains how domestic market values of outputs and inputs have been converted into their equivalent in accounting or social values, by the use of a ' conversion factor.' This factor will obviously vary from one good to the other depending on whether it is non-traded or traded, imported or exported, and taxed or subsidized, and on the extent of protection which it receives. The method by which the various conversion factors have been derived is explained first, and it is then followed by estimates of these conversion factors for the year 1974-75.

A. Outputs

(a) Principal Crops

The conversion factors for the principal crops traded internationally are the ratios of the accounting[7] to domestic prices of these crops. Multiplying these conversion factors by the domestic value of output we obtain its accounting value. The same result is attained by multiplying the yield per acre of exported goods, such as cotton, and price by their respective f.o.b. prices, and of imported goods, such as wheat, by their c.i.f. prices.

[5]*See* Appendix Table II.

[6]Total expenditure on casual labour for different crops is worked out by multiplying the daily wage rate with the number of days worked by them, in activities for which casual labour is hired; see Eckert [2] and Khan [4].

[7]The accounting price of a traded good includes the c.i.f./f.o.b. price (i.e. the border price) plus the accounting value of transport services and wholesaling and retailing costs normally involved in moving crops from the point of production or import to the point of sale. In the absence of any information on transport and marketing margins for these crops, they are ignored even though they may not necessarily be negligible.

A problem arises with sugarcane, however, since it is neither imported nor exported. Its accounting price cannot be determined by multiplying its market price by a conversion factor because there is no f.o.b. or c.i.f. reference price on which the conversion factor can be based. Rather the social value of sugarcane must be built up by adding together the accounting values of the separate inputs which go through cane production, including land. It would appear that there is some circularity involved here since it is the social cost of land which is being derived. But the circularity is only apparent since in equilibrium the social cost of land and sugarcane would be uniquely determined. The only problem is practical: how to find by iteration the correct equilibria price for sugarcane and land without solving a system of equations. In this paper we simply approximate the social cost of land used in sugarcane by the accounting return to land under *tradeable* crops. The actual estimate of the conversion factor of cane is relegated to Appendix Table I.

The conversion factors for the value of output of each of the four crops are listed in Table 1. The domestic prices of wheat and rice are taken from the *Yearbook of Agricultural Statistics* [12], and their c.i.f./f.o.b. prices are taken from the *Monthly Statistical Bulletin* [11]. Both domestic and border prices of cotton were taken from the *Monthly Cotton Review* [10].

Table 1

Conversion Factors for Wheat, Rice, Cotton and Sugarcane in Pakistan

(Rupees per maund)

Crops	Domestic Price (Rs.)	Accounting Price (Rs.)	Conversion Factor (Col. 3÷Col. 2)
(1)	(2)	(3)	(4)
Wheat	37.00	75.85	2.05
Cotton	79.00	131.16	1.66
Rice (IRRI)	43.00	156.95	3.65
Rice (*Basmati*)	90.00	294.82	3.27
Sugarcane	4.75	9.50[a]	2.00

[a] Implied accounting price equivalent; *See* Appendix Table I.

Thus if the domestic value of the output of wheat is Rs. x, its equivalent in accounting value is x multiplied by the conversion factor for wheat.

(*b*) *Straw*

Apart from the main crop, the value produced by the farmer also includes the by-products of each crop. One of the by-products of wheat, rice and cotton is straw. Wheat straw is used for fodder, rice straw for paper-board manufacture and cotton straw for fuel. The by-product of sugarcane is called bagasse, which can be used as fuel in *gur* (*desi* or indigenous sugar) production. In the Report a value is assumed for the by-products of wheat, rice and cotton but none for the by-product of cane.

Since straw is non-traded, the ratio of the total social expenditure to private expenditure incurred when growing a particular crop is used as a conversion factor for straw, which is a by-product of that crop. Table 2 shows how the conversion factors for straw are estimated.

Table 2

Conversion Factor for Straw[a]

Straw	Private Cost of Production	Social Cost of Production	Conversion Factor
	Rupees/Acre	Rupees/Acre	
Wheat	603	1129	1.87
Cotton	596	1023	1.72
Rice (IRRI)	570	1590	2.79
Rice (*Basmati*)	681	1641	2.41

a. To get to the conversion factor for straw we already need to know the conversion factor for the final output in order to estimate the social cost of production. An iterative procedure would have to be followed to arrive at the correct values for both. To simplify matters without losing much accuracy, the ratios of border price to domestic price of various crops were used as conversion factors for labour, management and seed when estimating the social cost of production and the conversion factor for straw. This explains why the social cost of production in Table 2 above is different from that calculated in Table 7, when the conversion factor for the total product is used to covert labour management and seed into accounting prices.

(*c*) *Other By-products*

In the case of both rice and cotton there are other important by-products. Farmers produce seed-cotton the value of which can be decomposed into cottonseed oil cake (58%), cottonseed oil (9%) and raw cotton (33%) [9]. Since seed-cotton is not directly traded, its conversion factor will be the average of the conversion factors of the three components weighted by the proportions of each in one unit of seed-cotton.[8] The conversion factor of cottonseed oil cake, which is traded, turned out to be approximately 1. Although cottonseed oil is not traded, the import price of soya-bean oil (the most important edible oil imported) is used as its border price, since the foreign exchange cost of a unit of soya-bean oil is the foreign exchange saving from domestically producing one unit of cottonseed oil. Based on this methodology, the conversion factor for cottonseed oil is 1.21. The conversion factor of raw cotton is already listed above in Table 1.

[8] The domestic price of cottonseed oil cake is Rs. 33.83 per maund [10]. Its border price was taken from [11]. The domestic price of cottonseed oil (Rs. 200 per maund) was taken from [10]. The border price of soya-bean oil (Rs. 328 per maund) was taken from [11].

The conversion factors for the principal crops and their by-products are applied to the domestic value of output to change them into accounting value. This procedure is shown in Table 4.

Table 4

Domestic and Accounting Value of Output

S. No.	Crop	Domestic Value of Output	Conversion Factor	Accounting Value (Col. 3 × Col. 4)
(1)	(2)	(3)	(4)	(5)
		(Rupees per acre)		(Rupees per acre)
1.	Wheat	924	2.02	1,866
2.	Cotton	866	1.27	1,100
3.	Rice (IRRI) ..	1,680	3.32	5,578
4.	Rice (*Basmati*) ..	1,900	2.96	5,624
5.	Sugarcane	2,019	2.00	4,038

B. Inputs

Just as the domestic values of crops, converted into accounting values, reflect the benefit to society from producing these crops, so the domestic values of inputs, converted into their accounting values, reflect the social cost incurred by society from using these inputs. All the inputs going into crop production, starting with labour, have been listed in Section II.

(a) Labour

We have a special conceptual problem when estimating the social cost of labour inputs, which in a labour-surplus economy might be considered a low cost, or even a costless input.[9] However, even in the so-called labour-surplus economy workers are still hired at certain peak periods—harvesting, sowing, etc. In this study, we assume that the wages paid to the workers reflect the value of their marginal product at market prices. Moreover, we assume that if family members did not contribute their labour on an un-paid basis, workers would be hired in their place. Thus, to calculate the social value of labour we multiply the number of man-days required for a crop by the market wage for casual labour. The marginal revenue product of labour calculated in this way is then translated into accounting values by applying the conversion factor for the relevant crop (see Table 3). The logic behind this is that labour's daily market wage (in an activity relating to a particular crop and its by-products) would understate its true social contribution if the domestic price for this crop were lower than its world market price.

(b) Management

For management the assumption is made, as in the case of family labour, that its remuneration in market prices does not accurately reflect its social contribution to production. Therefore, the ratio of the accounting price to the

9 It is assumed here that the cost of extra consumption to society resulting from employing one more worker is negligible.

domestic price of the crop and its by-products in which these managerial skills are employed is used to yield an estimate of the social marginal contribution of management.

(c) *Seed*

The domestic market value of seed has been converted into its accounting value, using the conversion factors for output shown in Table 3.

(d) *Bullock Power*

Bullock power is a non-traded input both domestically and internationally, and no domestic market price exists for hiring a pair of bullocks. Farmers do not customarily rent out bullocks. To derive the conversion factor for bullock power an indirect method of estimating the conversion factor for a non-traded good is used. The upshot of this procedure is to break the non-labour costs of a non-traded good into other non-traded and traded goods. The former can, if need be, again be broken down. These non-traded and traded goods are separately translated into accounting values. The conversion factor is the ratio of the sum of all these non-traded and traded goods in accounting prices to the same in domestic market prices. This procedure yields a conversion factor of 1.59 (see Appendix Table II) for bullock power.

(e) *Fertilizers, Insecticides and Farmyard Manure*

Fertilizers and insecticides sell in the domestic market at prices below world market prices because they are subsidized. Thus domestic prices need to be inflated by the extent of the subsidy to obtain the accounting prices. Information on import prices is available, and the difference between the import prices and the domestic selling price, allowing for marketing margins and transport costs, is the implicit subsidy. Table 5 below shows the conversion factors for these inputs.

Table 5

Conversion Factor for Insecticide and Fertilizer

Inputs	Units	Domestic Price	Import Price	Conversion Factor (Col. 4/Col. 3)
1	2	3	4	5
(I) *Fertilizer*				
(i) D. A. P.	Maund	75	169	2.25
(ii) Urea	Maund	75	138	1.85
(II) *Insecticide*				
(i) Oiazinon	Lb	1.28	3.84	3
(ii) Endrin	IG	19.95	59.85	3
(iii) Dimberon	IG	135.40	406.20	3
(iv) Azodrin	IG	83.82	251.46	3
(v) Malathion	IG	27.20	81.60	3

Source: Unpublished data obtained from the Government of the Punjab.

(*f*) *Water*

The market price of water is assumed to be its actual social value. However, since water is widely believed to be underpriced, the sensitivity of the 'residuals' using various assumptions about the social value of water has been tested. Columns g and h in Table 6 show that if water were priced at ten times its market value the 'residuals' accruing to land would be significantly different in the case of wheat, cotton and sugarcane.

However, for the purpose of this paper the issue of water pricing is bypassed. The complexity of this subject merits a separate study,[10] and prevents it from being dealt with adequately here.[11] Moreover, the pricing of tubewell water is not considered at all in this paper, a definite shortcoming since it has been estimated that 50 percent of the irrigation provided to wheat this year was supplied by tubewells.[12] Tubewell water would need to be priced separately since the capital cost of sinking tubewells and the operational costs have to be recovered.

(*g*) *Depreciation of Capital and Transportation*

When a non-traded input is an insignificant portion of the total cost, it is not worthwhile to estimate a separate conversion factor for it. The domestic value of such an input can be converted to value by the use of a standard conversion factor (SCF). The SCF is the weighted average of the proportions by which domestic prices (net of purchase and excise tax) of a representative sample of traded and non-traded goods differ from their accounting prices. Thus since expenditure incurred on both depreciation and repair of capital and on transport are such a small fraction of total costs of production, the use of the SCF is justified.[13]

(*h*) *Interest*

The farmer needs cash for the investment he makes when purchasing fertilizer, seed and insecticide. The average farmer is assumed to borrow this money around the time the crop is sown, and to pay it back after harvesting. He is required to pay interest on the amount borrowed and the expenditure on interest payment will vary with the amount of fertilizer, seed and insecticide bought.

The domestic value of interest has been calculated as 10 percent of all expenditure on seed, fertilizer and insecticide for a specified period of time.[14]

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[10] Mr. Ghaffar Chaudhry, Research Economist at the Pakistan Institute of Development Economics, is working on the relevance of water pricing to agricultural taxation in Pakistan. His study attempts to analyse the amount of tax and/or subsidy element involved in the charge levied by the Government.

[11] Pricing water at its market value presumably does not account for the heavy capital expenditures that were incurred while establishing the elaborate irrigation network in Pakistan with its massive dams, barrages and link canals. Should these past expenditures be reflected in current price policies ?

[12] *Pakistan Times*. May 22, 1975.

[13] Little and Mirrlees used an SCF of .63 for Pakistan in a social benefit-cost analysis of a rayon plant in Pakistan [8]. This SCF has been adopted from their work for this study.

[14] *See* Report [13].

Table 6

Estimates of the Social Return to Land per Acre from Different Crops

(Rupees per year)

Crop	Output (Domestic Value)	Output (Accounting Value)	Input (Domestic Value)	Input (Accounting Value)	Residual Private Return to Land (b)—(d)	Residual Social Return to Land (c)—(e)	Residual if Water Valued at Ten Times its Market Value	Percent Difference Between (g) and (h)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Wheat	924	1,360	603	1,120	321	740	646	13
Cotton	866	1,100	581	905	285	195	66	66
Rice (*Basmati*)	1,900	5,624	621	1,542	1,274	4,082	3,915	4
Rice (IRRI)	1,680	5,578	570	1,509	1,110	4,069	3,898	4
Sugarcane	2,019	4,038	1,545	2,897	474	1,159	839	28

Table 7

Summary of Input Costs in Domestic and Accounting Prices

Inputs	Wheat			Sugarcane			Cotton			Rice (*Basmati*)			Rice (IRRI)		
	D.P.	C.F.	A.P.	D.P.	C.F.	A.P.	D.P.	C.F.	A.P.	D.P.	C.F.	A.P.	D.P.	C.F.	A.P.
1. Labour (family)	214.45	2.02	433.18	457.54	2.00	915.08	114.11	1.27	144.92	236.42	2.96	699.80	202.16	3.32	671.17
2. Labour (hired)	37.80	2.02	76.36	22.40	2.00	44.80	84.00	1.27	106.68	49.00	2.96	145.04	49.00	3.32	162.68
3. Bullock Power	133.98	1.59	213.03	115.46	1.59	183.58	112.62	1.59	179.06	83.93	1.59	133.45	70.99	1.59	112.87
4. Management	27.00	2.02	54.54	60.00	2.00	120.00	95.00	1.27	120.65	30.00	2.96	88.80	30.00	3.32	99.60
5. Seed	40.00	2.02	80.80	400.00	2.00	800.00	9.00	1.27	11.43	4.50	2.96	13.32	4.00	3.32	13.28
6. Fertilizer : (*i*) D.A.P.	37.50	2.25	84.37	75.00	2.25	168.75	37.50	2.25	84.38	75.00	2.25	168.75	75.00	2.25	168.75
(*ii*) Urea	75.00	1.85	138.00	112.00	1.85	206.08	75.00	1.85	138.00	75.00	1.85	138.00	75.00	1.85	138.00
7. F. Y. Manure	—	—	—	120.00	1.93	231.60	—	—	—	6.00	1.93	11.58	6.00	1.93	11.58
Insecticide	—	—	—	18.39	3.00	55.17	21.00	3.00	63.00	29.50	3.00	88.50	26.00	3.00	78.00
Water	11.00	1.00	11.00	36.00	1.00	36.60	16.00	1.00	16.00	16.86	1.00	16.86	16.86	1.00	16.80
8. Capital (Depreciation and repair)	5.27	.63	3.32	5.50	.63	3.47	5.33	.63	3.36	4.00	.63	2.52	3.75	.63	2.36
9. Interest*	20.00	—	25.10	72.59	—	99.90	10.69	—	37.10	9.50	—	34.00	9.32	—	33.10
10. Transport	1.12	.63	.71	50.37	.63	31.73	1.12	.63	.71	1.50	.63	.95	1.50	.63	.95
	603		1,120	1,545		2,897	581		905	621		1,542	570		1,509

*For conversion of interest from domestic to accounting value, see Section II, B(h).

Note : D.P. = Domestic Price
C.F. = Conversion Factor
A.P. = Accounting Price

The interest rate in accounting prices is arrived at by applying the social rate of return on capital[15] to the social value of all expenditure on fertilizer and insecticide for the same time period.

(i) Taxes and Rent

Neither taxes nor rent figures in the accounting costs. Taxes are treated as a transfer payment. Rent has been ignored since it is part of the return to land which is being calculated. Table 7 summarizes all the input costs in domestic and accounting prices.

Social Returns to Agricultural Land

In the above two sub-sections all the relevant conversion factors for outputs and inputs have been derived. These conversion factors are used to convert the domestic market value of the outputs and inputs into their equivalent in accounting value as shown in Table 4 and Table 7. These two tables are brought together to arrive at the 'residuals' accruing to an acre of land used for the cultivation of selected crops. In effect, the accounting value of all the inputs in Table 7 is subtracted from the accounting value of the outputs (Table 4). Estimates of these residuals are shown in Table 6.

Since on a yearly basis some land in the Punjab is used only for sugarcane and some for combinations of wheat/cotton, wheat/IRRI rice and wheat/*basmati* rice, it is necessary to add the accounting returns to an acre of land for the latter three categories to arrive at the accounting or social returns per acre per year, which is the annual social cost of using the land. This is done in Table 8 below.

Table 8

Estimates of Annual Social Returns to Land per Acre

(Rupees per year)

Cropping Pattern	Private Return	Social Return
Wheat/Cotton	606	935
Wheat/*Basmati* Rice	1,595	4,822
Wheat/IRRI Rice	1,431	4,809
Sugarcane	474	1,159

III. Use of the Estimates: An Example

This section deals with how one would use these numbers to value land in a hypothetical development project. One point that needs to be recalled, however, is that our estimates pertain to the average value of land for the entire Punjab and, of course, the actual social return to land varies a great deal from one area to the next, depending on the cropping pattern and soil quality and so forth. One should normally estimate land values separately for these specific areas associated with a specific project.

[15] See Khan [4].

In our hypothetical example, a dam is to be built that will cover 4,000 acres of land previously used for agricultural purposes. This land which will be occupied by the lake has an alternative use which determines the social cost of converting it into a reservoir. To simplify matters, assume that the whole area is at present used for wheat cultivation in the *rabi* season and 2,000 acres each for cotton and *basmati* rice cultivation respectively in the *kharif* season. The social cost of using the land, for the first year in the life of the project, would be the average social return to land per acre for these three crops weighted by the total acreage under cultivation of these crops as follows :

Crops	*Annual Social Return to Land per Acre* (Rs.)	*Weights (Acres)*	*Average Returns per Acre* (Rs.)
Wheat/Cotton	935 ×	2,000/4,000	
Wheat/*Basmati* Rice	4,822 ×	2,000/4,000	
			2,879

Thus, for one year the social cost of using the land is Rs. 11.5 million (2,879 × 4,000). When computing social costs of the project, this annual return would be capitalized over the life of the project.

If yields per acre are expected to rise in the future due to improved technology, the present value of the land would have to be adjusted upward. Furthermore, if demand and supply forecasts suggest that relative price shifts will occur, for outputs and inputs, the anticipated price changes will need to be accounted for.

IV. Conclusion

Firstly, it can be seen from Tables 6 and 8 that the social returns to land for all the crops except cotton are greater than the private returns. This is so because the accounting value of output exceeds its domestic market value by an extent which is greater than the amount by which the accounting value of input costs are greater than their domestic value. For cotton, the reverse is true.

It is interesting to note that total input costs at domestic prices are, with the exception of sugarcane, fairly uniform, but input costs of accounting prices vary considerably due to the fact that the conversion factors for some of the major inputs, such as labour, are derived from the conversion factors for outputs which vary widely.

The social value of land differs according to the crop, but the ranking by profitability of different crops remains unaltered after conversion to accounting prices. Table 6 also indicates that wheat is more profitable than cotton to the farmer; when reckoned in social accounting terms, its relative profitability is even greater. The main reason for this is that the differential between the international and domestic price of wheat is greater than the differential for cotton.

Appendix

Table I

Conversion Factor for Sugarcane

A. (1) Accounting Return to Land in Sugarcane					
	Return to land (per acre)		*Weights**		
Wheat + Rice (IRRI)	740 + 4069 = 4809	x	.07	= 337	
Wheat + Rice (*Basmati*)	740 + 4082 = 4822	x	.18	= 870	
Wheat + Cotton	740 + 195 = 935	x	.75	= 701	
				1908	
plus (2) Accounting cost of Inputs for cane (Table 7)				= 2897	
	Total			= 4805	
B. (1) Private Return to land					
Wheat + Rice (IRRI)	321 + 1110 = 1431	x	.07	= 100	
Wheat + Rice (*Basmati*)	321 + 1274 = 1595	x	.18	= 287	
Wheat + Cotton	321 + 285 = 606	x	.75	= 455	
				842	
plus (2) Private Cost of Inputs into Sugarcane				= 1545	
	Total			= 2387	
C. A : B = 2.01 : 1					

* Weights derived from the acreage under cultivation of Rice (IRRI), Rice (*Basmati*) and Cotton.

Notes to Appendix Table I

The conversion factor for cane is the ratio of its social accounting to market private value. The accounting value of cane is the social opportunity cost of the land used in growing cane plus the social costs of other inputs going into cane production. Similarly, the market value of cane is the private opportunity cost of using land for growing cane plus the private costs of the goods and services used as inputs in cane cultivation.

The social opportunity cost of using land in the cultivation of cane is estimated as the average social return to a unit of land under alternative crops, rice, wheat and cotton, weighted by the observed cropping pattern in the Punjab. On this basis social cost of using land for cane cultivation is Rs. 1908 per acre as opposed to the private cost of Rs. 842.

To the social opportunity cost of land must be added the social cost of inputs. In order to value labour and seeds going into cane production and hence to estimate the social cost of inputs into cane, the accounting price of cane needs to be known. But this is, in fact, what we are trying to estimate in the first place. Thus an iterative procedure is used to derive the accounting price of cane. Starting with an arbitrary assumption that the social value of cane is twice its domestic value, the social cost of inputs into cane is Rs. 2897 as opposed to the private costs of Rs. 1545 (*see* Table 7).

Adding up all the social and private costs separately results in a ratio of 4805 : 2387 or 2.01:1. Thus the social value of cane is, in fact, twice its private value.

Appendix

Table II

Conversion Factor for Bullock Power (per crop)*

(Rupees)

Items	Domestic Price	Conversion Factor	Accounting Price
(1)	(2)	(3)	(4)
Depreciation	1.24	.63	.78
Medicine	.50	.63	.31
Fodder and Other feed	5.16	—	8.75
Labour	2.25	2.05	4.75
Interest	1.37	—	2.26
	10.52		16.71

*Based on a small survey conducted by the author in Multan and Sahiwal Districts.

The conversion factor for bullocks is 1.59, the ratio of the sum of column (4) to the sum of column (2). The various items included in the cost of using a pair of bullocks per acre (one acre is cultivated in one day under average conditions) are listed in column (1). The translation of each item into accounting value is explained below.

Depreciation per acre was estimated using the following formula :

$$D = \frac{P - SV}{T \times DY}$$

where D =Depreciation per acre,

P =Price of a pair of bullock,

SV =Scrap value,

T =Effective working life span of bullocks, and

DY =Number of days in one year worked by bullocks.

Thus from the price of the bullocks (Rs. 5,000) was subtracted 1/3 its value as scrap (meat and hide), and the remainder was divided by the effective working life (9 years) of bullocks multiplied by the number of days worked in one year by the bullock (300 days).

Depreciation per acre in domestic prices was converted to accounting prices by the SCF. Expenditure on medicine was similarly converted into accounting value.

Expenditure on feed is computed on the basis of the number of acres needed in the *rabi* and *kharif* seasons (1 acre each) to provide fodder for bullocks. Any additional expenditure (Rs. 250) on feed such as *gur*, dry fodder and fats is added on. The social cost of maintaining bullocks is the opportunity foregone as a result of using one acre in each season for growing fodder instead of other more socially profitable crops. Hence the average social returns from one acre of sugarcane, a wheat-rice combination and a wheat-cotton combination (*see* Table 6), weighted by the cropping pattern in the Punjab, was the annual expenditure on a pair of bullocks in accounting prices.

A quarter man-day of labour is required for the caretaking of a pair of bullocks. This labour is assumed to be withdrawn from other agricultural activities. The accounting price of this labour is one-quarter of the average social returns to a man-day employed in wheat, rice, cotton and sugarcane weighted by the cropping pattern in the Punjab.

Interest on capital investment for 9 years at 10 percent per annum amounts to Rs. 1.37 per day. To calculate the interest charges on accounting prices the social rate of return to capital of 16.5 percent is used.

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