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Shadow Pricing and Macroeconomic Analysis: Some Illustrations from Pakistan

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INTRODUCTION

Shadow prices are being used increasingly in the economic analysis of projects. The purpose of this paper, however, is to argue that shadow prices are equally relevant for certain types of analysis at the macro-economic level. In theory, macroeconomic issues can be properly analyzed, if at all, only in general equilibrium framework. Quantification then requires the solution of an appropriate model. But, estimable general equilibrium models can seldom include many variables, and the level of aggregation must remain high. They are general only in the very partial sense of simultaneous solution of a limited set of aggregated endogenous variables. On the other hand, some of the issues addressed by shadow pricing involve quite disaggregated variables, and, of course, project analysis itself often requires very detailed estimations.

The shadow pricing system[1] used in this paper seeks a way between the horns of the eternal dilemma posed by the fear that partial analysis may leave out important repercussions and the frequent impossibility of applying formal modelling procedures (and the occasional incredibility of the results if they are applied). It constitutes a relatively informal attempt to capture general equilibrium effects and embody them in the particular "national parameters" (as the main shadow prices at the country level are sometimes called).

Thus, an estimate of the social value of public income is an explicit attempt to capture some of the general equilibrium effects of changes in public sector expenditure. Similarly, the consumption conversion factor (CCF) captures a variety of gen-

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[1]See Little and Mirrlees [5]. A brief description of the Little-Mirrlees method is presented in Section I.

eral equilibrium effects, including multiplier effects, arising from private expenditure.[2] Although the analysis remains partial in some respects, it approximates to general equilibrium analysis to the extent that the national parameters (e.g. the social value of public income, the CCF, etc.) can be assumed to be independent of the policy change under review. Clearly, the reasonableness of this assumption will vary with the policy being considered. But it can, in any case, be argued that, where macro-economic issues have been conventionally analyzed in partial equilibrium terms, shadow pricing is immediately relevant; and it improves on traditional analysis in that the shadow pricing system used incorporates general equilibrium effects which are frequently absent from traditional partial equilibrium analysis.

Apart from this, shadow pricing also instills a way of thinking about economic issues which may often be helpful. For example, the "gap" view of external financing requirements leads to an analysis of foreign borrowing in terms of a residual and not in terms of the economic rationality of foreign borrowing. Similarly, advice such as "It is desirable to restrict the external gap to the amount of assistance that can be raised on concessional terms," also abstracts from the economic rationality of foreign borrowing. Closely related to this is the view that remittances offer an immediate and direct means of improving the balance of payments, without adequate consideration being given to the resulting increase in private consumption (which will cause increased imports and reduced exports) or to the foregone output (and hence loss of foreign exchange) of the emigrating labour.

Another dimension of the shadow pricing system used here is its explicit treatment of value judgments with respect to both the interpersonal and intertemporal distribution of consumption. The former is captured in the parameter described as the social elasticity of the marginal utility of consumption (n) and the latter in the consumption rate of interest (CRI). Society's concern with the distribution of consumption is reflected in many policy decisions, but is particularly obvious when the policy in question has as its immediate goal some direct change in consumption. For example, consumption subsidies on basic foods have as their primary objective an improvement in the welfare of the poor. Similarly, domestic borrowing by the public sector may be seen as a means of reallocating private sector consumption through time. It is argued here that issues such as these can be analyzed more consistently if the underlying value judgments are made explicit. The value judgments relevant for project analysis are thus equally relevant for macro-economic analysis.

Objectives

In this paper we do not attempt to produce a detailed set of shadow prices for Pakistan. Instead our objective is to show how the shadow pricing framework could be used to analyze some of the issues discussed above. In particular, we look explicitly at the following questions:

(i) Under what circumstances should Pakistan marginally expand borrowing from abroad?

(ii) Is domestic borrowing by the public sector at current interest rates socially desirable?

(iii) Should Pakistan continue to subsidize wheat consumption? and

(iv) Under what circumstances is marginal emigration in the short and the long-run socially beneficial for Pakistan?

Since we have not estimated a complete set of shadow prices, our analysis of these issues is not definitive. Moreover, the estimated prices are based on an unusual period (the early 1970s to mid-1970s) and it may be unwise to assume too readily, particularly in Pakistan's case, that the future will be like the recent past. Furthermore, there were serious informational gaps in the data used for the study, none of the authors being familiar with Pakistan and its data base.

It follows that the policy recommendations derived from the shadow prices presented in this paper should be treated with some reserve. Nevertheless, if the assumptions we make are close to the truth, our analysis does have implications for policy. Firstly, provided the accounting rate of interest (ARI) exceeds 4 percent, borrowing abroad at commercial terms is socially beneficial. Secondly, domestic borrowing by the public sector is socially profitable at current interest rates provided the ARI exceeds 3 percent. Thirdly, at the margin wheat subsidies are shown to be socially profitable provided the value of public income in alternative uses is less than 1.05 times the value of average consumption. And, fourthly, in the short run, although marginal emigration probably produces a small balance-of-payments gain, it is not socially beneficial. In the long run, however, when unskilled labour can be trained for export, emigration appears to have a high net social benefit.

The paper is organized as follows. In Section I we discuss the appropriate range of values for the social elasticity of the marginal utility of consumption (n), the CRI and a set of interpersonal distribution weights. We also briefly comment on estimates of the standard conversion factor (SCF) and the CCF. Other shadow prices are not explicitly estimated but are handled by means of sensitivity analysis. In Sections II through V we present our analysis of foreign borrowing, domestic borrowing, wheat subsidies and emigration respectively. Section VI contains some concluding remarks.

I. SOME SHADOW PRICE ESTIMATES

In this section we briefly outline estimates of some of the shadow prices used in subsequent analysis. We stress that the estimates are not rigorous; our intention is to give some indication of the likely quantitative magnitude of the major shadow prices in order to give substance to our policy analysis.

[2] This point is demonstrated in Blitzer, Little and Squire [1].

Our analysis is conducted in the Little-Mirrlees framework of project evaluation, the salient features of which are:

(i) The use of public income as numeraire. Private sector consumption and savings are then related to public income by means of a set of distribution weights and premia; and

(ii) the use of border prices as shadow prices for tradable goods. The shadow prices of nontradables are then obtained by application of specific or general conversion factors to their market prices.

For future reference, we outline below the estimation of the consumption rate of interest, interpersonal distribution weights, the standard conversion factor and the consumption conversion factor. We also comment briefly on the likely value of the accounting rate of interest, which, given the public income numeraire, is the appropriate rate of discount in the Little-Mirrlees system.

Consumption Rate of Interest

The consumption rate of interest (CRI) indicates the rate of fall over time in the value of the marginal utility of consumption evaluated at the average level of per capita consumption. Some economists call this the social discount rate. If the present social (welfare) value, $W_{\bar{c}}$, of a marginal increment in consumption at the average level of consumption in period t is

$$W_{\bar{c}} = \bar{c}_t^{-n} e^{-pt}$$

where n is the elasticity of marginal utility of consumption, and p is the rate of pure time preference; then, differentiating with respect to time we obtain

$$CRI = i = ng + p,$$

where g is the rate of growth of average consumption.

Of the three elements of the CRI, only the past growth rate of real per capita consumption can be estimated relatively objectively. For the period FY72 to FY77, total private consumption at constant prices grew at an annual rate of 4.5 percent, implying an average growth rate of real per capita consumption of 1.5 percent. With regard to the more subjective parameters, Pakistan's draft Fifth Plan makes it quite clear that growth is the primary aim of the next few years, although equity is not neglected. This suggests a zero or very low value for the rate of pure time preference (0 – 1%), because an increase in this parameter reduces, other things being equal, the extent to which the weighting system favours growth. It also suggests a positive, but not large, value for the social elasticity of the marginal utility of consumption (n). It must be positive in order to reflect some degree of concern for income distribution.

But it should not be taken to be very large, since the higher its value the higher is the consumption rate of interest (CRI).

As our best judgment we set the rate of pure time preference equal to 0, and choose a value of 2 for the social elasticity. But throughout we also experiment with a value of 1 percent for pure time preference and n = 1. Table 1 presents the range of values for the CRI implied by the above. Within the resulting range ($1.5\% \leq CRI \leq 4.0\%$), our best estimate for the CRI is 3.0 percent.

Table 1

Range of Consumption Rate of Interest

Social Elasticity of the Marginal Utility of Consumption (n)	Rate of Pure Time Preference %	
	0	1
1	1.5	2.5
2	3.0	4.0

Interpersonal Distribution Weights

The system of interpersonal distribution weights used here has two defining characteristics. Firstly, the rate of decline of the weights as consumption increases is determined by the social elasticity of the marginal utility of consumption (n). Secondly, given the public income numeraire, the base for the weights is defined as that point on the income distribution scale at which private consumption and public income (the numeraire) are considered equally valuable. This point is known as the critical consumption level (CCL).

More formally,[3] the marginal utility of consumption to the ith consumer is written as

$$u_i = c_i^{-n}$$

Distribution weights relating different levels of private sector consumption can be defined by setting the weight at the average level of consumption equal to one. That is,

$$d_i = [\bar{c} / c_i]^n$$

for the ith consumer. If $c_i > \bar{c}$, then $d_i < 1$ as required. And *vice versa* if $c_i < \bar{c}$.

[3]This section is based on Squire and van der Tak [8, pp. 63–68].

The numeraire in our system, however, is public income. We need, therefore, to divide the distribution weights calculated above by the value of public income relative to marginal utility of consumption at the average level of consumption. Let this value be v. From our work on Pakistan we arrived at rough estimates of v of about 1.2.[4] Using this value, plus vlaues of n = 1 and n = 2, we calculated the set of distribution weights reported in Table 2.

Table 2

Interpersonal Distribution Weights by Population Quintile

Population Quintile	Distribution Weight $(d/v)^1$	
	n = 1	n = 2
0 – 20	1.2	1.9
21 – 40	1.0	1.4
41 – 60	0.9	1.1
61 – 80	0.8	0.8
81 – 100	0.5	0.3

Source: Jain [3].

[1]The weights are computed at the mean income level in each quintile.

Two points are worthy of note. First, the range of the distribution weights is not great even for n = 2. This reflects the relatively egalitarian distribution of personal income in Pakistan. Second, we can use the CCF (estimated below) to identify the CCL. Since the CCF (= 0.8) reflects the real resource cost of a unit of private consumption, the transfer of 0.8 units of public income to the private sector increases private sector consumption by one unit at market prices. Thus, the CCL, the point of indifference between public income and private sector consumption, occurs at that point where d/v exactly equals 0.8, which, from Table 2, is seen to fall in the fourth population quintile for n = 1 and n = 2. This consumption level also happens to be almost exactly equal to average per capita consumption (Rs. 1,620 p.a. in FY77). Thus consumption by those above the national average is considered socially less valuable than public income ($d/v < 0.8$), while that of those below the national average is considered more valuable ($d/v > 0.8$).

[4]See Squire, Little and Durdag [9, Appendix I, para. 26]. The estimate is based on the value of different types of public expenditure, only one of which, wheat subsidies, is reported here.

Accounting Rate of Interest (ARI)

The ARI is defined as the rate of fall over time in the welfare value of public sector income. It can be calculated through the formula

$$ARI = CRI - \frac{dv}{dt} \cdot \frac{1}{v}$$

The formula is intuitively transparent. The CRI is by definition the rate of fall in the value of private consumption, and the ARI the rate of fall in the value of public income. Therefore, their difference measures the rate of fall in the value of public income relative to private consumption.

The ARI is normally the rate of discount that should be applied to public investments whose inputs and outputs have been valued at shadow prices. We do not, however, attempt here to make a definite estimate of the ARI for Pakistan because of data constraints, particularly in estimating the return to past public investment. There are nonetheless clear indications that if the recent past experience is taken as a gauge, it should be quite a low rate. Firstly, the low rate of growth of income over the last several years suggests a low CRI, for which we in fact have a best estimate of 3 percent. Secondly, the value of v was most probably increasing rather than declining, which normally would be the case, because the rate of return to public industrial investment was probably recovering from its low ebb. On the other hand, if Pakistan is seriously committed to an improved programme of project formulation and selection, then as a part of that programme, it would be appropriate to use a higher ARI than that calculated on the basis of experience of the recent past, since the purpose of the ARI is to weed out inferior projects. Accordingly, we experiment here with ARIs ranging between 2 percent and 8 percent.

Standard Conversion Factor

We have stated at the beginning that the value to the economy of traded goods is measured by border prices and that of non-traded goods by the border-price equivalents of their domestic prices, both sets of prices being stated in local currency. What is needed, therefore, is some general conversion factors to turn domestic prices into border prices, or *vice versa*, in the cases where constraints on information, time, etc. may preclude estimation of border prices or where, as for some minor non-traded goods, no specific conversion factors are available. Two such general conversion factors, namely, the standard conversion factor(SCF) and the consumption conversion factor (CCF), are of particular importance for this paper.

Ideally, the SCF should represent some average or typical value of the conversion factors of individual goods. Since these factors reflect the ratios between the

domestic and border prices of traded goods,[5] including those entering into the social value of non-traded goods, the SCF is largely determined by the foreign trade policies of the Government. Therefore, we shall, as a first approximation, estimate the SCF through a weighted average of import and export tariffs (net of subsidies), the weights being the shares of imports and exports in total trade. Thus, we may approach the calculation of the SCF through the following formula:

$$SCF = \frac{M + X}{(M+T_m)+(X-T_x)},$$

where M is the c.i.f. value of imports, X is the f.o.b. value of exports, and T_m and T_x are the net values of taxes on imports and exports, respectively.

Table 3 gives the yearly values of the necessary data to calculate the SCF for the fiscal years 1974, 1975 and 1976. We also calculated the SCF by using the three years' averages of trade and tax data. Taxes on imports include import duties and sales tax on imported goods but exclude the license fees of up to 2 percent of the

Table 3

Estimation of Standard Conversion Factor, FY74 – FY76

(million rupees at current prices)

	1973-74	1974-75	1975-76	3 Years' Average
Imports, c.i.f. (M)	16,305	22,988	23,176	20,823
Exports, f.o.b. (X)	10,098	9,682	11,514	10,431
Total trade (M + X)	26,403	32,670	34,690	31,254
Taxes on imports	2,758	4,639	5,259	4,219
Subsidies on imports	1,034	1,662	1,217,	1,304
Net taxes on imports (T_m)	1,724	2,977	4,042	2,915
Taxes on exports	1,906	1,057	687	1,217
Refunds on exports	30	15	35	27
Net taxes on exports (T_x)	1,876	1,042	652	1,190
Standard Conversion Factor (SCF)	1.006	0.944	0.911	0.947

Sources: Various publications of the Pakistan Government.

[5]Individual conversion factors are not necessarily just ratios of prices; where necessary, allowance must be made for inelasticities and externalities.

value of imports because of lack of data and their relatively small size. Import subsidies comprise those for wheat, fertilizer and edible oil (there was a subsidy on edible oil imports only in 1973-1974 and 1974-1975). To calculate subsidies on a similar basis to tariff revenue, the unit subsidy should be expressed as the difference between the unit import cost and the ration shop price and be multiplied by the import volume of the commodity in question.[6] The available data, however, allowed this approach to be used only for the calculation of the wheat import subsidy; for edible oil and fertilizer[7] subsidies we took the actual amounts given in the Government accounts.

The SCF thus calculated, i.e. .95, makes no allowance for distortions other than those caused by tariffs. Since the SCF should also capture other distortions in the non-tradable sector, including those in the labour market, we have assumed arbitrarily that the likely range of the SCF should be .85 to .95, and that within this range the most likely value is taken as .90.

Consumption Conversion Factor

The CCF is used to convert the value at market prices of the consumption goods basket, representing the consumer's marginal consumption pattern, to that at shadow prices. The marginal consumption pattern differs from one consumer to the other at the same income level as well as for the same consumer at different income levels. However, with the help of expenditure surveys, we may be able to calculate sufficiently accurate CCFs for broad income groups and for urban and rural consumers.

For Pakistan we have estimated CCFs for urban and rural households by using the *Household Income and Expenditure Survey, FY1972* [7], and by assuming that the commodity composition of the incremental consumption was the same as that of aggregate household consumption. A further breakdown by income class was also possible but, since inspection revealed that income elasticities were not greatly different from unity, this refinement was not pursued. Table 4 shows the percentage shares of some major items and categories of goods in urban and rural consumption. These consumption shares for goods are used as weights in averaging the corresponding conversion factors to arrive at the CCFs for urban and rural households.

The conversion factors in Table 4 have been estimated on the basis of the tariff and subsidy rates calculated for FY77 and FY78. It is assumed that the domestic

[6]We adopt this approach instead of taking the full amount of subsidy on particular import goods, because the subsidy amount in the Government budget shows the difference between the sale revenue and total cost of supplying the particular good in question which may include transportation and other domestic costs as well as the trade margins of various government agencies and private traders. The approach taken here implies that only that part of the unit subsidy which is above the domestic cost component of the unit cost is regarded as a subsidy towards the import cost of the good in question.

[7]Because of the data constraint, we could not ascertain what part, if any, of the fertilizer subsidy was arising from the consumption of domestically produced fertilizer.

Table 4

Consumption Conversion Factor

Commodity	Conversion Factor	Urban		Rural	
		Weight[1]	Product	Weight[1]	Product
Wheat	1.43	7.65	10.94	12.26	17.53
Tea	0.68	1.19	0.81	1.06	0.72
Edible Oil	1.00	3.56	3.56	1.53	1.53
Rice	1.43	1.74	2.49	2.10	3.00
POL	1.00	5.36	5.36	4.81	4.81
Consumer Importables	0.65	20.30	13.20	23.82	15.48
Raw Material Importables	0.65	13.41	8.72	12.02	7.81
Consumer Exportables	1.00	10.94	10.94	11.17	11.17
Labour	0.70	18.77	13.14	16.83	11.78
Tax	0.00	3.67	0.00	2.38	0.00
TOTAL		100.00	77.88	100.00	81.64

[1]We have made the following adjustments to the original data:
(a) the "unspecified" category has been removed on the assumption that the conversion factor for unspecified consumption is the same as that for specified consumption;
(b) the "miscellaneous" category has been arbitrarily allocated as 40 percent to importables and 60 percent to non tradables, and
(c) an allowance has been made for trade margins by assuming that 30 percent of the retail price of wheat represents transport, milling and other trade margins, and a 20 percent mark-up is assumed for the remaining importables and for "Consumer Exportables" which are largely rice and clothing.

price of imports at the dockside (Karachi) equals the c.i.f. price plus tariff. To obtain the conversion factors at any other location, appropriate allowance would have to be made for transport and other costs associated with wholesaling and retailing. In the case of government subsidized commodities (wheat and fertilizer), however, the estimation of the tariff rate (negative) already includes an element of distribution costs, since the government handles distribution itself. To achieve consistency, the distribution margins must be netted out of the subsidy rates for wheat and fertilizer. Since imported wheat is presumably milled in or around Karachi we take the port-to-mill distribution margin as 10 percent of the c.i.f. price. For fertilizer, which is presumably distributed throughout the country through government outlets, the distribution margin is taken as 15 percent. A similar approach is used for exportables; as such the resulting conversion factor allows only for export duties; no allowance is made for transport and other trade margins.

No information is available on distribution margins; the assumptions made are reported in the footnote to Table 4. Nor is information available on the cost structure of consumer services and distribution. We have, therefore, assumed that on average non-tradables entering consumption comprise 5 percent taxes, 35 percent labour, 10 percent POL, 25 percent other raw materials and 25 percent capital goods.[8] This allocation is reflected in the weights reproduced in Table 4. The resulting consumption conversion factor is 0.78 for urban households and 0.82 for rural households. A national consumption conversion factor may be derived by weighting the urban and rural conversion factors by their respective consumption shares. This procedure yields a national consumption conversion factor of 0.81, which we round to 0.80.[9] Given the similarity of the CCF for different groups, throughout the paper we use 0.80 for all groups.

II. FOREIGN BORROWING

In this section we investigate whether the public sector should expand its expenditure by borrowing abroad. Let the value of a marginal unit of public sector expenditure in terms of average consumption be v and assume initially that v is constant over time. The cost of foreign borrowing is given by the NPV of the resultant debt servicing. If, at the margin of borrowing, a loan has a grace period of t years, matures after T years, and carries an interest rate which implies annual debt servicing in the period after the waiver of s%, it is economically rational to expand public sector expenditure if

$$v > [vs \sum_{1}^{T-t} (1+i)^{-T} (1+p)^{-T}] (1+i)^{-t} (1+p)^{-t}$$

or if

$$1 > \frac{s}{i+p} [1-(1+i+p)^{-(T-t)}] (1+i+p)^{-t}$$

[8]These proportions are based loosely on other studies of this kind in different countries. They should obviously be revised if additional data are forthcoming.

[9]The weights are 0.66 for rural consumption and 0.34 for urban consumption and were obtained on the basis of information on the urban-rural distribution of population [2], and on household consumption expenditure [7].

where i is the consumption rate of interest, and p is the expected rate of inflation or Pakistan's imports and exports.[10]

The above result is derived on the assumption that the value of public income relative to consumption remains constant over time. It may well be the case, however, that over time the value of public income changes. Since the rate of change over time in the value of public income relative to consumption is defined by the difference between the ARI and the CRI, it follows that if we redefine i in the above inequality as the ARI, we have an expression which allows explicitly for the need to discount (by the CRI) as well as the need to allow for a changing value of v.[11]

Since FY74, over 15 percent of annual borrowing has been at rates of interest in excess of 6 percent. Taking the value of loans as weights, the average cost of such borrowing (loans with interest rates higher than 6 percent) is 8.4 percent for the period FY74–FY77 inclusive, the maturity period (T) is 14.6 years and the grace period (t) is 3.1 years. Using the estimated FY77 and the projected FY78 and FY79 values of imports and exports as weights, the expected rate of inflation for the period of FY78–FY85 is porjected as 6.26 percent.[12] If our projection is in error by, say, ∓15%, the likely range of inflation rates is 7.2 percent to 5.3 percent. The significance of these alternative assumptions concerning the rate of inflation is tested through the sensitivity analysis in Table 5.

The sensitivity analysis of the value of foreign borrowing considers two types of loan. The first is roughly equivalent to the loans from donor governments and international development institutions as obtained by Pakistan in the recent past as calculated above. The second is more typical of hard commercial borrowing. Only if the value reported in the table is less than one, should an additional unit of borrowing with the given specifications be used to expand public sector expenditure. It is clear that the first type of loan will have a positive present value provided the inflation rate exceeds 5 percent p.a. for the next 15 years even if the ARI is as low as 2 percent. If such loans are fully fungible, then, at an expected rate of inflation of over 6 percent, there is little risk that they will not be socially beneficial. On the other hand, the harder type of loan would have a negative present value at 5 percent inflation rate unless the ARI were as high as 6 percent. If the rate of inflation was as high as 6 percent p.a. for the next 10 years, then the present value would just be positive with an ARI of 4 percent.

[10]We assume that during the grace period interest is not paid, but is compounded to the end of the grace period and the resultant sum is repaid in equal installments over subsequent years without any additional "interest on interest".

[11]In his analysis on foreign borrowing, Lal [4] essentially assumes that v remains constant over time and thus arrives at the result that the CRI, and not the ARI, is the crucial element in determining the desirability of foreign borrowing.

[12]These estimates are based on the price indices for petroleum, developed countries' manufactured exports to all destinations, and developing countries' exports other than petroleum, as reported in "Commodity Price Forecast", World Bank, 1977. The Pakistan data are from the Government's official publications, and the weights are: 0.57 for non-oil imports, 0.10 for oil imports, and 0.33 for exports.

Table 5

The Present Social Cost of Foreign Borrowing[1]

Accounting Rate of Interest (ARI)	Inflation Rate (Percent Per Annum)			
	5.00	6.00	7.00	8.00
	(a) *15 – Year Maturity, 3 – Year Waiver, 8% Interest*			
2	0.99	0.92	0.85	0.78
4	0.85	0.78	0.73	0.67
6	0.73	0.67	0.63	0.58
8	0.63	0.58	0.55	0.51
	(b) *10 – Year Maturity, 2 – Year Waiver, 10% Interest*			
2	1.17	1.11	1.05	0.99
4	1.05	0.99	0.94	0.89
6	0.94	0.89	0.85	0.80
8	0.85	0.80	0.76	0.73

[1]The matrix figures are the value of the RHS of the second inequality in Table 4.

III. THE SOCIAL VALUE OF DOMESTIC BORROWING, SAVING AND LENDING TO THE GOVERNMENT

We investigate the value of one rupee of private saving which is lent to the Government forever at an r interest rate. There are two effects to consider. The first is the resultant redistribution of consumption through time. There is social loss from reduced consumption equal to d_i/v (the social weight attaching to consumption of the ith person). The person's consumption rises in the future by r. The social present value of this is $(\frac{r}{CRI})\, d_i/v$, assuming no change in the future distribution of income, or the weighting system. The net social loss is, therefore, $(1 - \frac{r}{CRI})\, d_i/v$. This assumes that no tax is paid on r.

The second effect is the resource cost. The Government gains in the present an amount equal to the CCF. In the future it loses r.CCF, which has a social present value of $\frac{r}{ARI}$ CCF. The net gain is, therefore, $(1 - \frac{r}{ARI})$ CCF. Putting the two effects together we have a gain of

$$(1 - \frac{r}{ARI})\ CCF - (1 - \frac{r}{CRI})\ d_i/v$$

Real rates of interest on savings deposits were negative for a period until recently; they have now been restored to about 3 percent, however. This is also our best estimate of the CRI. If, as would be reasonable, the government intends that real interest rates on savings deposits should remain equal to the CRI the second term vanishes. The social value of private savings lent to the government is then positive or negative depending on whether the ARI exceeds r (net of tax), or *vice versa.* We have earlier noted that if the recent experience is taken as a gauge, the ARI should be quite a low rate. In consequence, for an estimate of the ARI of 2 percent, the social value of private savings lent to the government is negative, at least for persons below the income tax limit. Indeed, the expression would remain negative up to quite high marginal tax rates. Thus a high proportion of private savings lent to the government would result in social loss. However, we are experimenting here with the ARIs ranging up to 8 percent and for those values of the ARI above 3 percent (higher in the case of income-tax payers) private savings lent to the government have a positive social value.

The Value of Private Savings Invested in Private Enterprise

We shall merely try to establish whether such savings have a positive or negative social value. For this purpose, we can, as before, assume that the whole of the yield is consumed (reinvestment would merely magnify the negativeness or positiveness of the result).

The social loss resulting from the changed intertemporal consumption pattern is now $(1 - \frac{r_p}{CRI}) \frac{d_i}{v}$ where r_p is the private financial rate of return. It seems very probable that $r_p > CRI$, so that this expression is very probably negative, i.e. there is a social gain.

In terms of resources, the cost of a rupee spent on investment is given by the capital goods conversion factor. The annual return is R, signifying the social internal rate of return to private investment. This should be discounted by the ARI, and converted to border prices by the SCF. The gain in resources is, therefore,

$$(R/ARI)\ SCF - \text{Capital Goods Conversion Factor}$$

Although we have not estimated R, it is conceivable that it exceeds even the highest estimate of the ARI on our experimental range of 2 percent to 8 percent. The SCF is also estimated to be greater than the Capital Goods Conversion Factor [9, Appendix III]. There is, therefore, good reason to suppose that private savings which result in increased private investment are socially beneficial.

IV. THE SOCIAL VALUE OF WHEAT SUBSIDIES

Subsidizing wheat (an important staple) represents an effort by the government to protect consumers from rising import prices. The benefit of the transfer (that is,

the increase in welfare enjoyed by wheat consumers) is measured by the quantity consumed times the subsidy per unit of consumption times the relevant distribution weight (d — which related the particular level of consumption to the average). The cost of the transfer (that is, the reduction in public income in terms of foreign exchange equivalents) is given by the subsidy times the consumption conversion factor times the value of public income (v).

The calculation of benefits is set out in Table 6. In columns 1 and 2 we present the percentage of urban households by income class. The analysis is confined to urban consumers since rural households are believed to rely mainly on own-consumption. To the extent that rural households buy and consume subsidized wheat and to the extent that rural households are poorer than urban households, the estimate presented here will understate the true value of the subsidy. Dividing total household consumption expenditure (column 3) by household size yields the per capita consumption level reported in column 5, which are used to arrive at the weights (d) shown in columns 6 and 7 by means of the formula, $d_i = (\bar{c} / c_i)^n$, where c is average per capita consumption, n is the social elasticity of the marginal utility of consumption, and c_i is the ith consumption level. Finally, the value of the subsidy (columns 8 and 9) was obtained by multiplying the proportion of wheat consumption (shown in parentheses in column 4) by the appropriate weight for each consumption class and summing over all percentiles. The resulting value of the transfer is 0.88 for n = 1 and 0.84 for n = 2.

In evaluating this result several possible limitations should be kept in mind. Firstly, the subsidy may have been introduced for some reasons other than the transfer of income to wheat consumers. However, a recent assessment of the wheat subsidy describes it as an effort "to insure low income consumers — especially those in major urban areas — access to nominally priced grain products especially *atta* (a whole wheat flour)"[6]. Secondly, the effect of the wheat subsidy may have differed from the government's intentions. Money wages, for example, may have been reduced (or may not have increased as quickly) as a result of the subsidy. In the short run, however, it is probably safe to conclude that the benefits accrued to wheat consumers especially if the analysis is confined to FY74 to FY76 when subsidies were increased dramatically in response to the rising import price. Thirdly, some of the benefit to wheat consumers may have resulted in additional saving rather than additional consumption. According to the Household Income and Expenditure Survey FY72, however, on average urban households saved only 1 percent of their income. It is unlikely, therefore, that any major error has been introduced on this score. Fourthly, since the subsidy scheme works by means of ration shops, it may be more appropriate to calculate the value of the subsidy on the assumption that subsidized wheat consumption per person is the same for everybody and is determined by the government rationing policy. This assumption, however, does not significantly change the value of the subsidy as calculated above, indicating a very low income elasticity of wheat consumption.

Table 6

Value of Wheat Subsidies[1]

Income Class	Percentage of Total HH	HH Consumption Expenditure	HH Consumption of Wheat[2]	Per Capita Consumption	Weights[3]		Value of Subsidy[4]	
					n = 1	n = 2	n = 1	n = 2
Rs./month		Rupees per month						
<50	0.2	121.06	19.84 (0.10)	40.35	1.14	1.31	–	–
50 – 99	2.7	88.59	15.92 (1.19)	34.07	1.35	1.83	0.02	0.02
100 – 149	10.0	134.44	23.19 (6.44)	36.34	1.27	1.61	0.08	0.10
150 – 199	15.5	180.32	26.80 (11.58)	40.98	1.13	1.27	0.13	0.15
200 – 249	16.5	229.16	30.57 (14.06)	44.93	1.03	1.05	0.14	0.15
250 – 299	12.6	275.11	36.19 (12.67)	46.63	0.99	0.98	0.13	0.12
300 – 399	17.7	341.71	40.25 (19.80)	51.77	0.89	0.79	0.18	0.16
400 – 499	8.9	438.26	45.84 (11.39)	58.43	0.79	0.62	0.09	0.07
500 – 749	8.9	585.47	50.67 (12.57)	68.88	0.67	0.45	0.08	0.06
750 – 999	2.9	826.01	53.74 (4.36)	94.94	0.49	0.24	0.02	0.01
1,000 – 1,499	2.3	1,083.51	55.03 (3.56)	127.47	0.36	0.13	0.01	–
1,500 – 1,999	0.9	1,535.26	48.85 (1.19)	189.54	0.24	0.06	–	–
>2,000	0.9	2,693.93	49.38 (1.29)	313.25	0.15	0.02	–	–
Mean: 360.53		356.12	35.56	60.36		Total	0.88	0.84

[1]All data from [7] and refer solely to urban households.

[2]The figures in parentheses show the proportion of total urban wheat consumption by income class.

[3]The weights are calculated from the formula: $d_i = (\bar{c}/c_i)^n$ where $\bar{c}$ is set equal to the average per capita consumption for Pakistan of Rs. 46.12 per month.

[4]Calculated by multiplying the proportions reported in parentheses in column 4 by the weights shown in column 6.

Finally, it is possible that high income consumers do not patronize the ration shops and instead purchase higher quality flour on the free market. This appears to be the most important objection to our procedure. We, therefore, recalculated the benefit of the transfer on the assumption that the top 10 percent of the population do not consume subsidized wheat. Proceeding in the same fashion as before, we arrive at measures of the benefit of 0.96 if n = 1 and 0.95 if n = 2.

The cost to the public sector is given by the CCF (0.8) times v, the value of public income. We have not made a direct estimate of v here, but it is clear that the subsidy is socially beneficial provided the benefit of the transfer divided by the CCF is greater than v. With CCF = 0.8, the subsidy is socially beneficial provided $v < 1.10$ $(0.88 \div 0.8)$ for n = 1 and 1.05 $(0.84 \div 0.8)$ for n = 2. If it can be argued that the subsidy is chosen optimally, the method allows us to estimate v, since, by definition, the cost of the subsidy then exactly equals to the ensuing benefit. That is, v = 1.10 for n = 1 and v = 1.05 for n = 2.[13]

V. EMIGRATION

Country economic studies usually assume that emigration is a net social benefit, and also that it benefits the balance of payments. These assumptions are probably correct, but they clearly need not be so in all circumstances, especially, of course, where the emigrants are skilled. For this reason and also because of the wide interest in this subject, we have attempted a cost-benefit analysis of *marginal* emigration. We take an artisan as being the typical recent emigrant to OPEC, and examine the repercussions of expanding the flow by one person for one year both in the short-run, when the supply is *ex-hypothesi* fixed, and in the long run in which more artisans may be trained.

Short-run Analysis of Emigration

Based on the evidence on rates of emigration and wage rates for skilled and semi-skilled artisans in the construction sector, wage determination for such labour is assumed to be subject to the forces of supply and demand. Since there are no constraints on emigration, it is also assumed that at the margin an artisan is indifferent between emigrating and remaining in Pakistan. Hence, there should be no change in the welfare of the marginal migrant and his family.[14]

The social benefit (B) or shadow wage rate (SWR_m) of a migrant is taken to be the remittances generated, plus the net social benefits of the changes caused in consumption and savings in the domestic economy. The social cost (C) of a migrant is

[13]Our reported estimate of v of about 1.2 was, in fact, obtained by looking at alternative uses of public income in this fashion.

[14]At the margin it is reasonable to assume that the *private* costs and benefits to the migrant are equal. In the subsequent analysis, we make the further assumption that society accepts the individual's assessment of the costs and benefits of migration and thus assigns no change in welfare to the individual migrant of his family. As a result, the social analysis focuses on changes in real resource flows and changes in welfare elsewhere in the economy.

equated with the fall in domestic output, plus or minus the social value of any resultant change in the wage rate.

In estimating the social benefit, remittances are straightforward, but the changes caused in domestic consumption and savings are almost entirely a matter of guesswork. If we assume that remittances are entirely consumed, then the social benefit of "an additional" migrant is given by

$$B = SWR_m = R - (R - W)\ CCF,$$

where r is remittances, R – W is the increase in consumption resulting from migration, and CCF is the consumption conversion factor.

For FY77 average remittances from emigrants in OPEC are estimated to be Rs. 17,028.[15] By December, the mid-point of FY77, the daily wage for masons and carpenters in Karachi was Rs. 41, which, on the assumption of a 26-day working month, yields an annual wage income of Rs. 12,792. The CCF for urban households was estimated to be approximately 0.8. On this basis, the SWR for migrants works out at 1.07w.

However, the assumption of zero savings from remittances is objectionable on two grounds. Firstly, since most emigrants presumably expect to return, one can imagine them to have a considerable part of remittances saved as a nest-egg. Secondly, it would be surprising if the emigrant deliberately increased the standard of living of the family left behind by as much as the above figures suggest. A more reasonable assumption might be to suppose that the emigrant's family maintained the same standard of living as when the emigrant was at home. In this case, there are savings and it becomes necessary to make a further assumption about how these savings are used. For example, if they are lent to the Government, then the distribution of consumption over time will be altered. Family savings will equal (R – W) plus (a W), where (a) is the proportion of the wage previously consumed by the now-absent migrant. If the real return on government savings is r, the net present value of consumption generated by one unit of savings may be approximated by r/ARI, and so the social benefit of migration in this case can be written as

$$B = [R + aW\ CCF] - [R - W(1 - a)]\ CCF\ r/ARI$$

where the first term on the RHS is the increase in resources from remittances and reduced current consumption, and the second term is the resource cost of future consumption. The formula reveals that the benefits of emigration increase as the ratio r/ARI decreases; in the special case where r = ARI, the formula reverts to that considered previously. In the recent past, the real return on government savings (r) has

[15] It is estimated that 250,000 Pakistani emigrants were residing in OPEC in FY77 and that they remitted about $430 m. during the year.

been about 3 percent. For ranges of the ARI from 2 percent to 8 percent and of (a) from 0.2 to 0.4, B varies from Rs. 10,920 to Rs. 18,315. Alternatively, the savings could be used for direct investment. Rather than experiment further, however, we choose $SWR_m = W$, i.e. Rs. 12,792, as the best estimate, but note that the margin of error could be quite high. Clearly, further empirical research is required on the use of remittances.

We next look at the cost of drawing an artisan from domestic employment. If we assume that labour is drawn from a variety of sectors, both tradable and non-tradable, it is probably most appropriate to identify the value of output foregone with the market wage multiplied by the standard conversion factor (SCF). The shadow wage of domestic labour (SWR_D), therefore, is given by

$$SWR_D = W \cdot SCF$$

Our estimate of the SCF is 0.85, so that the opportunity cost of labour drawn from domestic employment is 85 percent of the market wage.

In the short-run analysis, the emigration of one artisan leads to an increase in the wage rate which implies a transfer of income from employers or consumers to employees. The increase in the wage multiplied by the number employed (i.e. the total transfer) is given by W/N_d where N_d is the labour demand elasticity in the domestic market. Let the distribution weight for artisans be d_a/v and that for employers or consumers be d_e/v. We can now express the social cost (C) of emigration through the following formula:

$$C = W \cdot SCF + \frac{W}{N_d}\left[\frac{d_e - d_a}{v}\right]$$

where the term in brackets is the social cost per rupee of the income transfer implied by a change in the wage rate.

The balance of payments effect can be investigated by setting $d_e = d_a$, which yields the simple expression

$$B - C = W\left(\frac{SWR_m}{W} - SCF\right)$$

Our best estimate of $\frac{SWR_m}{W}$ exceeds that of the SCF (.85), so that B–C is positive. In other words, this suggests a small positive balance of payments effect from marginal emigration. But it is far less than remittances, being surely no more than a small fraction of the wage, whereas remittances are larger than the wage. However, total benefit should not be equated with balance of payments benefit. Including income distribution considerations, net benefits are given by

$$B - C = W \left[\frac{SWR_m}{W} - SCF - \left(\frac{d_e - d_a}{v N_d} \right) \right]$$

This formula reveals that the significance of the income distribution effect depends crucially on the elasticity of labour demand. In the extreme case, if $N_d \to \infty$, the income distribution effect disappears. It also disappears if the income transfer is between groups which are equally rich (i.e. $d_e = d_a$). In either of these cases, the social benefit of emigration is given by the balance of payments effect.

Unfortunately, neither of these simplifications is defensible. Given the recent rapid rise in the wages of artisans, labour demand is probably quite inelastic. We, therefore, experiment with values of N_d between 0.5 and 1.5. In addition, we previously stated that the income of artisans in FY77 was Rs. 12,792. If we assume that artisans households have the same demographic structure as households in the fourth population quintile, then average household size is 6.9 and each household possesses 1.7 earners.[16] Assuming that the other 0.7 earners are unskilled workers with an annual income of Rs. 4,704,[17] total family income is Rs. 16,085 and per capita income is Rs. 2,331. The distribution weight (d_a/v) appropriate for such an income is 0.57 if n = 1 and 0.40 if n = 2.[18]

Next we need the income distribution weight for those losing income. If we assume that wage increases in the non-tradable construction sectors are passed on to consumers, as a first approximation we can say that as a result of higher prices of construction services consumers throughout the economy suffer a loss of real income. If this is assumed to be in proportion to their existing income, then, using the summary income distribution parameter [8, p.67], the weight (d_e/v) to be attached to the loss of income is 0.80 if n = 1 and 1.08 if n = 2. In fact, expenditure on construction services is likely to be distributed more unevenly than total expenditure. On the basis of the above arguments, and in the absence of any more concrete information, we choose to experiment with values for d_e/v of 0.70 for n = 1 and 0.90 for n = 2. Since these figures indicate that the income transfer constitutes a net social cost (i.e. $d_a < d_e$), total net social benefits will be lower than in the balance of payments analysis.

Given the uncertainty of our estimates, we present in Table 7 below two sensitivity analyses of the B/C ratio of emigration. The first is for the balance of payments effects, and the second for all benefits. The sensitivity tests are conducted

[16] Calculated for urban households from [7]. "Population" refers to households and not individuals.

[17] Calculated assuming a wage of Rs. 19.6 per day in FY77 and 20 working days per month.

[18] Calculated from the formula $d = (\bar{c}/c)^n$, with v = 1.20 and the average per capita consumption ($\bar{c}$) of Rs. 1,614 in FY 77.

Table 7

Sensitivity Analysis of Social Benefit – Cost Ratio of Emigration

$\frac{SWR_m}{W}$	Distributional Effect				
	n = 0	n = 1		n = 2	
	(Balance-of-Payments Case)	0.10	0.30	0.30	1.00
0.80	0.94	0.84	0.70	0.70	0.43
0.90	1.06	0.95	0.78	0.78	0.49
1.00	1.18	1.05	0.87	0.87	0.54
1.10	1.29	1.16	0.96	0.96	0.50

with respect to the two variables which are most uncertain — SWR_m and the composite variable $[d_e - d_a]/vN_d$. For SWR_m/W we examine values in the range 0.80 to 1.10 and for $[d_e - d_a]/vN_d$, in the light of the discussion above, we use a range of 0.10 to 0.30 for n = 1 and 0.30 to 1.00 for n = 2. SCF = 0.85 throughout.

The upshot is that there is probably a small balance of payments gain from emigration, but that if income distribution is allowed for there is a distinct possibility of quite a heavy net social cost to emigration. However, in the longer run the very sharp rises in artisan wages which have occurred in recent years, and which have worsened the distribution of income because artisans earn far more than average incomes, could be reversed as the supply increases.

The Long-Run Analysis of Emigration

Pakistan can meet increased demand for labour by expanding supply. We turn now, therefore, to a calculation of the long-run SWR for artisans. Essentially, this involves calculating the social cost of taking one worker from the ranks of the unskilled and training him to the appropriate skill level. The SWR for an artisan in this instance may be written as

$$C = SWR_u + \Delta W (CCF - \frac{d}{v}) + T,$$

where SWR_u is the shadow wage rate of an unskilled worker, ΔW is the increase in wage income resulting from training, CCF is the consumption conversion factor, $\frac{d}{v}$ is the social value of the increased earnings, and T is the public expenditure on training evaluated at border prices.

If the labour is required for a period of one year, T may be interpreted as K, total investment cost per trained worker, less K/(1 + ARI); that is, if, after one year, the worker is available for employment elsewhere, the economy can then afford to train one less worker, so that the training costs implied by the use of an artisan for one year are given by

$$T = \frac{K \cdot ARI}{1 + ARI}$$

ΔW is given by the difference between an artisan's annual wage income (Rs. 12,792) and an unskilled worker's annual wage income (Rs. 4,707); that is, ΔW = Rs. 8,085. $\frac{SWR_u}{W_u}$ is estimated to be 0.80 if n = 1 and 0.75 if n = 2 [9, Appendix II, paras, 52–54], so that SWR_u = 3,766 if n = 1, and 3,530 if n = 2. If the family of the unskilled worker comprises 1.27 wage earners and 4.12 family members,[19] per capita income before training is Rs. 1,451 and Rs. 3,412 after training. Using the formula for non-marginal changes in income [8, pp. 65 and 137], the relevant distribution weight ($\frac{d}{v}$) is computed to be 0.57 if n = 1 and 0.44 if n = 2. We retain the value of 0.8 for CCF.

Government-borne costs for training workers to a semi-skilled or skilled stage are estimated to be Rs. 3,561 per worker.[20] In addition, the removal of one worker from unskilled employment leads to the hiring of another worker which involves a cost equal to SWR_u. If the ARI is thought to be in the range of 2 percent to 8 percent, SCF = 0.85, and training is assumed to last one year, we can calculate T as

$$T = [3{,}561 \times SCF + SWR_u] \frac{ARI}{1 + ARI}$$

$$\left.\begin{array}{l} = 133.2 \text{ if } n = 1, \text{ and} \\ = 128.6 \text{ if } n = 2. \end{array}\right\} \text{ with ARI} = 2\% \qquad \left.\begin{array}{l} = 503.6 \text{ if } n = 1, \text{ and} \\ = 486.2 \text{ if } n = 2 \end{array}\right\} \text{ with ARI} = 8\%$$

Using the SWR equation for an artisan (C), we can now arrive at the following estimate of the $\frac{SWR}{W}$ for artisans. First, if n= 1, $\frac{SWR}{W}$ = 0.45 to 0.48; second, if n = 2, $\frac{SWR}{W}$ = 0.51 to 0.54. On the basis of this estimate it is clearly profitable to produce artisans, since the short run marginal social benefit of an artisan was estimated earlier to be exactly equal to W (that is, the SWR for artisans if supply is perfectly inelastic).

[19] As estimated for urban households in the bottom four quintiles. See [7].

[20] This is taken from a recent World Bank report on Pakistan (unpublished). It excludes labour's opportunity cost, and it is not clear how long the training is supposed to last.

The favourable result arises in part because, unlike in the short-run analysis, in this case income distribution is improved. It is of some interest, therefore, to investigate the effect of emigration in the long-run on the balance of payments (i.e. when the income distribution effect is suppressed). For this analysis, we have

$$C = SWR_u + \Delta W \text{ CCF} + T$$

where SWR_u/W_u is now measured exclusive of income distribution effects and equals approximately 0.8 [9, Appendix II] which is the same as in the above analysis for n = 1. Thus, setting SWR_u = Rs. 3,766, and retaining the other assumptions, the cost of long-run emigration as far as the balance of payments is concerned is 0.81W, if ARI = 2% and 0.84W if ARI =8%. Compared to the benefit of emigration (1.0W), the balance of payments effect is thus seen to be positive but much smaller than the total measure of new benefits inclusive of income distribution effects.

It can be concluded that, for a very wide range of assumptions, training is likely to be a good investment either specifically for migration, or to increase the supply of artisans assuming that a proportion of them migrate as determined by the demand elasticities. However, both results depend on the foreign demand for Pakistan labour being sustained. If demand tapers off, an expansion in training programme could result in falling domestic wages for artisans, and this has not been allowed for. As with any export activity, a careful assessment of foreign demand is essential in analyzing the emigration issue.

VI. CONCLUSIONS

The issues addressed above are frequently the subject of discussion in macroeconomic analysis. In contrast to their usual treatment, however, our approach has emphasized the role of shadow prices in addressing them and in arriving at policy conclusions. In particular, we have suggested that an adequate treatment of the issue of Government borrowing requires an estimate of the ARI. Similarly, our analyses of emigration, wheat subsidies and domestic saving were based on prior estimates of the CCF, distribution weights, the CRI and shadow wage rates. While the list of issues addressed here is clearly not exhaustive, we have, nevertheless, made use of virtually all the shadow prices which are usually required for project analysis. As we stressed in the Introduction, neither our shadow price estimates nor our policy analyses can be considered definitive; our intention has been to demonstrate an approach which we think is potentially useful and to stimulate discussion on some important issues currently facing Pakistan. In particular, we have argued that a rigorous analysis of macro policy issues is essential and that the shadow pricing framework, although usually confined to project analysis, is the most useful form of applied welfare economics currently available for the analysis of such issues.

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