Oxford Economic Papers 42 (1990), 135–159

TAX REFORM AND SHADOW PRICES FOR PAKISTAN

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1. Introduction

STANDARD models of the design or reform of indirect taxes for developed countries usually take the production sector to be undistorted. The problem is generally defined as the raising of a given revenue to finance government activities whilst causing as little discomfort to households as possible [see e.g. Atkinson and Stiglitz (1980, Lecture 12)]. However for developing countries, economists have been much concerned with the distortions which arise from various market imperfections and government actions which cause the incentives embodied in the relative market prices facing producers to be very different from the relative social opportunity costs. The purpose of this paper is to show, using data from Pakistan, how the appraisal of indirect taxes can take account of distortions on the production side by integrating shadow prices into the analysis of reform.

In so doing we extend our earlier work on India and Pakistan [Ahmad and Stern (1984) and (1986)] which developed and applied the theory of marginal tax reform, i.e. the appraisal of small movements from a given *status quo*, on the assumption that relative producer prices were equal to relative shadow prices. In that theory one computes the marginal social cost of extra revenue arising from different taxes and between any two possibilities chooses the one with the lower marginal social cost. The marginal social cost associated with any particular indirect tax is given by the welfare weighted impact on households of an increase in the tax, where the size of the increase is given by the amount required to raise an extra unit of revenue. The comparison of these marginal social costs allows us to evaluate constant revenue marginal shifts from one tax to another. The innovation in this paper is that we now look at changes which hold *shadow* revenue (defined below) constant. The theory behind this approach is based on Drèze and Stern (1987).

The information and calculations required to put the theory into practice involve consumption data by household, demand responses, a set of shadow prices (for the case where producer prices are assumed to be distorted) and a description of the existing tax system which allows one to identify the tax element in the final price of a good, the effective tax (for the case where producer prices are assumed not to be distorted). The provision of these ingredients involves a considerable amount of work and their use in this

We are very grateful for the advice of Jean Drèze and the research support of David Coady. Helpful comments were provided by Stephen Ludlow, Peter Sinclair, and three referees. The paper arises from a Programme of Research on Taxation in Developing Countries, funded by the Economic and Social Research Council (under grant B00222003-1) and the World Bank (RPO-673/13). The views expressed here and any errors are ours.

paper draws heavily on our earlier studies on effective taxes, shadow prices and demand for Pakistan.

Our purpose in these empirical results is not to produce a tax reform package for Pakistan—this we have done elsewhere [Ahmad and Stern (1990)]. It is rather to indicate how theory can be put to use to suggest possible directions of reform. The calculations and conclusions of this paper would be just one element in the arguments which lie behind the bundle of considerations and compromises which make up an overall package in practice. Our particular task in this paper is to compare an application of the theory which assumes producer prices are proportional to shadow prices, with one which acknowledges that there may be a number of distortions to producer prices and which takes account of the fact that an equal revenue adjustment may shift demands towards goods with high social costs. We shall see that the results can look very different.

We set out the relevant theory briefly in Section 2, the data and prior calculations, particularly of shadow prices, are presented in Section 3, the calculations are described and discussed in Section 4, and concluding comments are in Section 5.

2. The theory

A fairly general formulation [following Drèze and Stern (1987), which may be consulted for more detail] of the problem of reform may be presented as follows. We shall see marginal reform as a shift in certain parameters (we think here of indirect taxes) which were previously viewed as being fixed at given levels. As a result of the shift other variables, which we think of as endogenous, for example prices, will change. These endogenous variables may be seen as being adjusted by the government so as to satisfy the scarcity constraints that private sector excess demands (net household demands less supplies from producers), denoted by E, are equal to net public sector supplies z. There will generally be more than one set of adjustments which could satisfy the scarcity constraints and we shall suppose that government choices amongst them are made, and shifts evaluated, relative to a social welfare function $V(s, \omega)$ which depends on endogenous variables encapsulated in the vector s and other variables ω (called exogenous variables or parameters) set at predetermined positions. The endogenous variables are chosen so that $V(\ )$ is maximised subject to the scarcity constraints. Thus s is chosen for given ω and z to solve the problem P:

$$\left.\begin{array}{l}\text{Maximise } V(s, \omega)\\ \text{subject to the scarcity constraints}\\ E(s, \omega) = z.\end{array}\right\} \qquad \text{(P)}$$

It is possible, and this is a special case of the analysis, that the number of

endogenous variables is sufficiently small and the scarcity constraints sufficiently many that only one vector of endogenous variables is possible given ω and z. In that case, which is referred to as 'fully determined', the government has no real choice. When, however, there is choice, consistency requires that marginal reforms $d\omega$ should be evaluated with respect to the same criterion as used for the choice of s (and the same goes for projects dz).

The Lagrangean for the general problem may be written

$$L(s, \omega) = V(s, \omega) - \nu'[E(s, \omega) - z] \tag{1}$$

where the Lagrange multipliers associated with the optimal choice of s are ν. The shadow price of a good is defined as the increase in the value of the social welfare function when an extra unit of public-sector output is made available. This definition corresponds to the standard notion of social opportunity cost. We can see immediately that the constraints in (P) (with its Lagrangean (1)) have been written so that the Lagrange multipliers will be equal to the shadow prices (using the standard properties of Lagrange multipliers). Notice that this is also true, as a special case, for the fully determined problem.

The first-order conditions for a maximum are:

$$\partial L/\partial s = 0 \quad \text{or} \quad \partial V/\partial s - \nu' \, \partial E/\partial s = 0 \tag{2}$$

where $\partial L/\partial s$ and $\partial V/\partial s$ are the vectors $(\partial L/\partial s_j)$ and $(\partial V/\partial s_j)$ and $\partial E/\partial s$ is the matrix $(\partial E_i/\partial s_j)$. A reform may be seen as a change, $d\omega$, in the pre-determined variables, ω, such as taxes or quotas. The scarcity constraints $E(s, \omega) = z$ imply that

$$(\partial E/\partial \omega)\, d\omega + (\partial E/\partial s)\, ds = 0 \tag{3}$$

The total change in social welfare, dV, from (2) and (3), is

$$dV = \frac{\partial V}{\partial \omega} d\omega + \frac{\partial V}{\partial s} ds = \left[\frac{\partial V}{\partial \omega} - \nu' \frac{\partial E}{\partial \omega}\right] d\omega \tag{4}$$

Equation (4) tells us that the effect of a change, $d\omega_i$, in a predetermined variable, ω_i, may be evaluated by first looking at its impact $\partial V/\partial \omega_i$ on social welfare at *constant s*, and then subtracting the cost at shadow prices of the marginal change in demands (also at constant s), $\partial E/\partial \omega_i$, generated by the change. Thus the introduction of the shadow prices, ν, allows us to carry out the appraisal using partial derivatives in the knowledge that the shadow prices are summarising the general equilibrium ramifications of the change. The shadow prices are, then, very convenient sufficient statistics for rather complicated effects. An example may help to illustrate. Suppose a small old age pension is being considered where, previously, there was none. We appraise the proposal by first looking at the social value of the extra cash to the pensioners (at constant prices and other endogenous variables) and then subtract the cost at shadow prices associated with the extra demands arising

from the extra cash. If $[\partial V/\partial \omega_i - \nu' \partial E/\partial \omega_i]$ is positive then social welfare would be increased by a marginal increase in the pre-determined variable ω_i. Hence if the option to make such a shift becomes available it should be accepted. If ω_i becomes completely subject to government choice it should be including amongst the endogenous variables s and (2) then applies.

The following examples may help to clarify the role of exogenous and endogenous variables. Consider a model with price-taking producers facing prices p and producer rations or quotas $\bar{y}$ which, together with profit maximisation, determine their net supplies. Consumers face prices q which together with their lump-sum incomes (and utility maximisation) determine their behaviour. We abstract from consumer rations or quotas and government transfers. The government has previously thought of the indirect taxes $q - p = t$ as fixed but is now considering reform. The t are then amongst the exogenous variables ω. Corresponding to t (and any remaining arguments of ω) there will be a set of endogenous variables whose levels are chosen in the solution to (P). This will include those elements of p and $\bar{y}$ which may be relevant to the problem at hand. Suppose, for example, that production satisfies the assumptions of the non-substitution theorem (one non-produced factor, constant returns to scale and no joint production) so that the elements of p are fixed. Then the endogenous variables will be $\bar{y}$, i.e. the outputs of each of the (constant returns) production sectors, which must in equilibrium be set at the level which balances demand (this is the standard constant returns equilibrium interpretation but normally the $\bar{y}$ are implicit). The model would be fully determined.

Alternatively there may be diminishing returns to scale and the government may avoid quotas altogether. Then the endogenous variables would be p which would adjust to equilibriate supply and demand (we assume such an equilibrium exists). Again the model would be fully determined (if equilibrium is unique). The government may, however, decide to use producer quotas or rations which would be set, together with prices, subject to the scarcity constraints, to influence production and profits. If it decided to choose some combination of p and $\bar{y}$ then it may have substantial scope (or degrees of freedom) for its choice and from amongst the possibilities it is assumed, at the starting point of the reform, that the choice has been optimally made.

Given that the optimal choice of s has been taken, it should be noticed that for a marginal shift $\mathrm{d}\omega_i$ only local information around the initial position is necessary. Hence we need information only on current decisions of households and firms and local price responses and not full information on demand and supply functions over a substantial range. That is a major advantage of the approach of marginal reform. On the other hand the theory does not tell us about the appropriate size of a reform or how to choose amongst a number of different directions of reform, each of which is improving. Considerations outside the model, such as administrative feasi-

bility, political acceptability, confidence in our assumptions and so on would be required here.

It is also instructive to represent the shadow cost, $v' \partial E/\partial \omega$, of the extra demands in a different way. If y, q and p are as before, x is the vector of net demands from households and $E = x - y$, then we may write,

$$-v'E = v'(y - x) = (v - p)'y + (q - v)'x + p'y - q'x \tag{5}$$

The difference between $p'y$ (actual profits) and $q'x$, the expenditure of households, is the direct tax revenue of the government—it is the revenue from pure profits taxes less the lump-sum transfers made to households. Further $(q - v)$ may be thought of as 'shadow consumption taxes' with $(v - p)$ as 'shadow producer taxes'—if consumers face prices q which are much higher than the social opportunity costs v we would think of the taxation as heavy and similarly if producers receive prices p which are much lower than v. Then (5) may be rewritten

$$-v'E = R_v \tag{6}$$

where R_v is government revenue at shadow prices defined by the right-hand side of (5). Thus a reform, $d\omega$, from (4) and (6), causes a change in social welfare, dV:

$$dV = [(\partial V/\partial \omega + \partial R_v/\partial \omega)]\, d\omega \tag{7}$$

which is seen to be the direct change in welfare, $\partial V/\partial \omega$, plus the change in shadow revenue, representing the general equilibrium adjustments associated with the reform.

The ideas embodied in equations (1)–(4) apply to a very general class of models. In deriving (5)–(7) we have made some specific assumptions namely that consumers trade at prices q, producers at prices p, and that households receive their lump-sum income either from transfers/taxes from the government or the profits of firms. We can see immediately from (5), however, that the equating of $-v'E$ to shadow revenue would be valid if we allowed firm and consumer specific prices, p^f and q^h, and then we would have firm and consumer specific shadow taxes, $(v - p^f)$ and $(q^h - v)$. Hence equations (5)–(7) are also very general. Notice that we have not assumed that producers and consumers can buy and sell as much as they like at the going prices. There may be a number of rations and quotas in the system and the model so far certainly includes, for example, fix-price equilibria of the type often used in models of Keynesian unemployment. The rations and quotas form part of s if they are endogenous (e.g. the government may adjust quotas rather than prices to clear a market) or part of ω if they are not. We have excluded special constraints amongst the variables s, such as the linking of certain taxes or prices [for an analysis including these 'side constraints' see Drèze and Stern (1987)]. We can think of foreign trade as taking place entirely through a firm the profits of which represent net trade tax revenue and which accrue entirely to the government [again see Drèze

and Stern (1987) for further details]. Further discussion of foreign trade is contained in the next section.

In this paper the reforms we have in mind are increases in consumer prices or increases in final goods taxation. Thus we consider certain taxes on final goods as previously having been fixed but now being viewed as subjects for possible reform. Our $d\omega$ are then the shifts in these taxes and the partial derivatives associated with (7) hold other variables constant. The taxes on final goods produced by the complex system in operation in Pakistan we call "effective taxes" [essentially the tax element in the final prices of the good, see Ahmad and Stern (1986)]. For the moment we abstract from these complications and write the indirect taxes t simply as the difference between the consumer prices q and the producer prices p. The reforms then concern marginal increases, dt, in the indirect taxes. The partial derivatives in (7) hold constant producer prices, rations, quotas and government transfers. Hence they hold household lump-sum incomes constant. It must, of course, be remembered that of these variables held constant in the derivative $\partial/\partial w_i$ only the other elements of ω will be actually exogenous. Partial derivatives with respect to indirect taxes are the same as those with respect to consumer prices. The endogenous variables here are a subset of producer prices p and producer rations $\bar{y}$. It is not necessary in the analysis for us to be specific as to which subset but we do have to assume that if there is any choice open to the government it is taken optimally. The elements of $(p, \bar{y})$ outside the endogenous subset are exogenous.

The change in welfare from the shift in the exogenous vector, t, is

$$dV = [(\partial V/\partial t - v' \, \partial x/\partial t)] \, dt \tag{8}$$

which may be rewritten as

$$dV = \left[\frac{\partial V}{\partial t} + \frac{\partial}{\partial t}(q'x) - p' \frac{\partial x}{\partial t} + (p - v)' \frac{\partial x}{\partial t}\right] dt \tag{9}$$

with $\partial/\partial t \, (q'x)$ being zero, since the derivatives hold lump-sum incomes constant. This reduces to

$$dV = \left[\frac{\partial V}{\partial t} + \frac{\partial}{\partial t}(t'x) + (p - v)' \frac{\partial x}{\partial t}\right] dt \tag{10}$$

using $q = p - t$, since the derivatives are at constant p. The first term represents the direct effect of the tax change on households, the second the effect on tax revenues, and the third term is the difference between the market and shadow costs of meeting the additional demands.

If producer prices are proportional to shadow prices, $v = \lambda p$, then (8)–(10) may be rewritten

$$dV = \left[\frac{\partial V}{\partial t} + \lambda \frac{\partial}{\partial t}(t'x)\right] dt \tag{11}$$

If

$$\frac{\partial V}{\partial t_i} + \lambda \frac{\partial}{\partial t_i}(t'x) > 0 \tag{12}$$

then social welfare is increased by raising the ith tax. Any decline in household welfare (measured by minus $\partial V/\partial t_i$) is offset by the value of the extra revenue raised ($\lambda \partial(tx)/\partial t_i$). This involves knowing λ, the value in terms of social welfare of a marginal unit of revenue. However even if we do not know λ we can still use (11) to help identify improving directions of reform. We do this by defining λ_i the marginal cost in terms of social welfare of raising an extra unit of revenue through the ith tax, as follows.

$$\lambda_i = -\frac{\partial V/\partial t_i}{\partial R/\partial t_i} \tag{13}$$

where $R \equiv t'x$. The concept of λ_i has been used extensively in earlier work [see for example Ahmad and Stern, (1984)]. If $\lambda_k > \lambda_j$, then one increases welfare by switching a marginal unit of revenue from good k to good j, keeping overall revenue constant—from (11) we have

$$dV = \sum_i (\lambda - \lambda_i) \frac{\partial R}{\partial t_i} dt_i \tag{14}$$

so that if we make an equal revenue change, $[(\partial R/\partial t_k)dt_k + (\partial R/\partial t_j)dt_j = 0]$ we have $dV > 0$ if $dt_j > 0$ (assuming λ_j, λ_k, $\partial R/\partial t_j$, $\partial R/\partial t_k$ are positive).

Note that equation (13) above (see also (17) below) can be expressed as a combination of the distributional characteristic D_i $\left(= \sum_h \beta^h x_i^h \Big/ x_i\right)$, and a tax elasticity:

$$\lambda_i \equiv D_i \Big/ \left[\frac{t_i}{t_i X_i} \frac{\partial}{\partial t_i}(t'x)\right] \tag{15}$$

Where shadow prices are not proportional to producer prices, (10) holds, and the criterion for the evaluation of the directions for reform is based on λ_i^v where

$$\lambda_i^v \equiv -(\partial V/\partial t_i)/(\partial R_v/\partial t_i) \tag{16}$$

and R_v has been defined above as shadow government revenue. Thus a reform would be welfare improving at the margin, if for $\lambda_k^v > \lambda_j^v$ shadow revenue were shifted from sector k to j. Holding shadow revenue constant accounts for the full general equilibrium ramifications of the reform. As we have seen when shadow prices are proportional to producer prices, it is constant actual revenue that is relevant. This is an important lesson for it is common in public discussion to cost any reform (e.g. job creation packages and the like) in terms of impact on actual revenue and, as we have seen, this is correct only if producer and shadow prices are proportional.

To calculate the λ_i^v, we need to estimate $\partial V/\partial t_i$ and $\partial R_v/\partial t_i$. For H household groups ($h = 1, \ldots, H$),

$$\frac{\partial V}{\partial t_i} = -\sum_h \beta^h x_i^h \tag{17}$$

where β^h represent the social marginal utility of income for households, and are value judgements, and x_i^h is the demand for commodity i by household h. The second term, $\partial R_v/\partial t_i$, may be written as

$$\frac{\partial R_v}{\partial t_i} = x_i + \sum_j t_j \frac{\partial x_j}{\partial t_i} + \sum_j (p_j - v_j) \frac{\partial x_j}{\partial t_i} \tag{18a}$$

which is as $\partial R/\partial t_i$ but with an extra term corresponding to the difference between producer and shadow prices. Alternatively we may write it as

$$\frac{\partial R_v}{\partial t_i} = x_i + \sum_j (q_j - v_j) \frac{\partial x_j}{\partial t_i} \tag{18b}$$

which is as $\partial R/\partial t_i$ but with shadow consumer taxes replacing the t_i. Most simply, it is expressed as

$$\frac{\partial R_v}{\partial t_i} = -\sum_j v_j \frac{\partial x_j}{\partial t_i} \tag{19}$$

Equation (19) simply takes us back to (8) so that for calculations of λ^v we need v but not the (effective) taxes t. Our purpose in this paper is to contrast the results which arise from assuming that shadow prices are proportional to producer prices with those which follow from allowing relative shadow and producer prices to differ. We shall do this by comparing the rankings of λ_i and those of λ_i^v.

3. Effective taxes, shadow prices and household behaviour

The data requirements to calibrate equations (15), (16), (17) and (19) include tax collections by commodity group and input–output information to calculate effective taxes and shadow prices, estimates of aggregate demand responses, and information on household expenditures (for the welfare weights β^h see Section 4). The empirical analysis is based on data from Pakistan for the mid-1970s and is consistent with our previous work including estimates of directions of reform based on the assumption that producer prices were proportional to shadow prices. The construction of the main data requirements has required a considerable amount of effort, and we have described how the various estimates were derived in previous papers [see Ahmad and Stern (1986), Ahmad, Coady and Stern (1988), and Ahmad, Ludlow and Stern (1988)].

The 1976 Micro-Nutrient Survey (MNS), conducted for the Planning Commission, was used to provide the household consumption levels needed for (17). The MNS was also used to estimate demand responses using an extended linear expenditure system with cross-section data [for a description of the method see Ahmad, Ludlow and Stern (1987)]. We use this level of aggregation (13 commodities) for the empirical analysis. The demand system was estimated separately for urban and rural households, and household characteristics were included as influences on consumption of

different goods. The rankings of λ_i and λ_i^v below were fairly insensitive to the precise specification we used and note that it is only *aggregate* demand responses which enter the analysis, since for (17) we use actual demands by households.

The effective tax or tax element in the price of final goods, including the tax levied on a commodity and the cascading effects of the taxation of inputs, and into inputs, and so on, arising from the various tax instruments (customs, excises, sales taxes and subsidies) were calculated for 87-sectors, for domestically produced commodities, using an input–output table for 1975/6 [see Ahmad and Stern (1986)]. The sectoral classification is described in Table 1. The vector of effective taxes for the 87-sectors is merged (see Table 1) to correspond to the (13-good) classification of the estimated demand derivatives and is presented in Table 2. These are used for the t_j in equation (15). The data available do not permit a separation of consumption into domestic and imported elements. We are supposing in using the effective taxes in (15) that the effective tax on domestic production also represents the tax associated with an imported good, or alternatively that marginal consumption falls on domestically produced goods.

The shadow price estimates are based on an 87-sector input–output table, also for the same year as the household data [see Ahmad, Coady and Stern (1987)]. A Little–Mirrlees (1974) method of calculation was used, with goods being classified as importable, exportable or non-traded at the margin. Importables are valued at border prices c.i.f., exportables f.o.b. and non-traded goods at shadow marginal costs of production. Valuing traded goods at border prices is a fairly robust rule but the social marginal cost rule for non-tradables is less so [see, e.g. Drèze and Stern (1987)]. The classification depends, in part, on government policy since a quota on a good that can be imported would imply that the good should be treated as non-traded. Moreover, given the level of aggregation of the input–output categories, there may be a combination of traded and non-traded goods within a given sector. Thus, to introduce sensitivity with respect to different assumptions about policy, as well as to allow different possible interpretations, Ahmad, Coady and Stern (1988) presented shadow prices for three cases (see Table 1): Case C corresponding to the maximum set of sectors classified as non-traded (49); Case A with the fewest number of sectors classified as non-tradeable (35); and Case B an intermediate with 39 non-traded sectors, and closest to the *status quo*. We present results mostly based on Case B in the following sections, and refer only occasionally to the results from Cases A and C.

In estimating shadow prices of non-tradeables, we require shadow valuations for factors, in addition to the shadow prices of tradeables based on border-price valuations. The input–output table indicates only total value-added in an industry and does not separate it into components. Using a variety of extraneous information we constructed a breakdown into payments to labour, land (where relevant), assets and a residual. The

TABLE 1

Commodity Classifications and Shadow Prices

87-Sector I–O		Shadow Price Cases A	B	C	13-Sector Mapping
01	Wheat	M	N	M	1
02	Rice	X	X	X	2
03	Cotton	X	X	X	—
04	Sugarcane	N	N	N	8
05	Tobacco	M	M	M	13
06	Oilseeds	M	M	M	7
07	Pulses	N	N	N	3
08	Other Crops	M	N	M	6, 12
09	Livestock	M	N	M	4, 5
10	Fishing	X	X	X	4
11	Forestry	N	N	N	10
12	Mining & Quarrying	M	N	M	10
13	Grain Milling	N	N	N	1
14	Rice Milling	N	N	N	2
15	Edible Oils	M	M	M	7
16	Sugar	M	M	N	8
17	Gur & Khandsari	N	N	N	12
18	Tea Blending	M	M	N	9
19	Fishing	X	X	X	4
20	Confec. & Bakery	N	N	N	12
21	Other Food Inds.	X	M	X	12
22	Beverages	M	M	M	12
23	Tobacco Pdts. (LS)	X	X	X	13
24	Bidis	N	N	N	13
25	Cotton Yarn	X	X	X	11
26	Cotton Ginning	N	N	N	11
27	Cotton Text. (LS)	X	X	X	11
28	Cotton Text. (SS)	X	X	X	11
29	Silk & Synth. Text.	M	M	N	11
30	Woollen Text.	M	M	N	11
31	Other Text.	M	M	M	11
32	Carpets & Rugs	X	X	X	10
33	Made-up Garments	X	X	X	11
34	Footwear	X	X	X	11
35	Wood, Cork & Furn.	M	M	N	10
36	Paper & Pdts.	M	M	N	13
37	Printing & Pub.	N	N	N	13
38	Leather & Pdts.	X	X	X	11
39	Rubber Footwear	X	X	X	11
40	Rubber Pdts.	M	M	N	13
41	Pharmaceuticals	M	M	N	13
42	Fertilizers	M	M	M	—
43	Perfumes & Cosm.	M	M	N	13
44	Paints & Varn.	M	M	M	—
45	Soaps & Dets.	M	M	M	13
46	Chemicals	M	M	N	10
47	Plastic Pdts.	M	M	M	10
48	Petroleum Pdts.	M	M	N	10
49	Cement	X	X	X	—
50	Glass & Pdts.	M	M	M	10
51	Non-Met. Mins.	M	M	M	13

TABLE 1
(*Continued*)

87-Sector I–O	Shadow Price Cases A	B	C	13-Sector Mapping
52 Basic Metals	M	M	M	—
53 Metal Pdts.	M	M	M	13
54 Iron & Stl. Rmg.	N	N	N	—
55 Agric. Mach.	M	M	M	—
56 Oth. Non-Elect. Mach.	M	M	M	13
57 Elect. Mach.	M	M	M	13
58 Bicycles	N	N	N	13
59 Transp. (LS)	M	M	N	13
60 Ship Building	N	N	N	—
61 Transp. (SS)	M	M	N	13
62 Office Eqpt.	M	M	N	13
63 Sports Goods	X	X	X	13
64 Surgical Insts.	X	X	X	13
65 Oth. LS. Mfg.	X	X	X	13
66 Oth. SS. Mfg.	N	N	N	13
67 Low Cost Res. Bldg.	N	N	N	—
68 Lux. Res. Bldg.	N	N	N	—
69 Rural Bldg.	N	N	N	—
70 Factory Bldgs.	N	N	N	—
71 Public Bldgs.	N	N	N	—
72 Roads	N	N	N	—
73 Infrastructure	N	N	N	—
74 Ownership Dwells.	N	N	N	10
75 Electricity	N	N	N	10
76 Gas	N	N	N	10
77 Whole. & Ret. Trade	N	N	N	13
78 Road Transp.	N	N	N	13
79 Rail Transp.	N	N	N	13
80 Air Transp.	N	N	N	13
81 Water Transp.	N	N	N	13
82 Television	N	N	N	13
83 Radio	N	N	N	13
84 Phone Teleg., Post	N	N	N	13
85 Banking & Ins.	N	N	N	13
86 Government	N	N	N	13
87 Services	N	N	N	13

Source: Ahmad, Coady and Stern (1988)

Notes: (i) The table shows the classifications of goods for the calculation of shadow prices (M is importable, X exportable and N non-traded) and the translation of the 87 input–output categories to the 13 categories for which demand responses have been estimated.

(ii) Where more than one input–output category corresponds to a given sector from the 13-commodities list, accounting ratios have been merged using 87-sector consumption weights.

(iii) The 13-commodities list is: (1) Wheat; (2) Rice; (3) Pulses; (4) Meat, Fish and Eggs; (5) Milk and Products; (6) Vegetables, Fruits and Spices; (7) Edible Oils; (8) Sugar; (9) Tea; (10) Housing, Fuel and Light; (11) Clothing; (12) Other Foods; and (13) Other Non-Food.

(iv) A (—) indicates that the sector in question does not enter into final consumption.

(v) LS denotes large-scale, SS small-scale and I–O input–output.

TABLE 2

(*a*) *Accounting Ratios—13 Sectors*

		Case B				*Case A*	*Case C*
	WCF =	*0.9*		*0.75*		*0.9*	
	ACF =	*0.75*	*0.5*	*0.75*	*0.5*	*0.75*	*0.75*
1	Wheat	0.795	0.761	0.726	0.692	1.336	1.335
2	Rice	1.059	1.028	1.042	1.011	1.058	1.058
3	Pulses	0.773	0.751	0.704	0.682	0.887	0.886
4	Meat/Egg	0.758	0.746	0.687	0.676	0.983	0.983
5	Milk	0.747	0.735	0.674	0.662	0.982	0.982
6	Vegetables	0.744	0.730	0.670	0.657	0.576	0.576
7	Ed. Oils	0.949	0.946	0.940	0.937	0.949	0.949
8	Sugar	0.696	0.686	0.652	0.642	0.703	0.652
9	Tea	0.949	0.948	0.945	0.944	0.949	0.544
10	Housing	0.827	0.777	0.767	0.718	0.852	0.818
11	Clothing	1.003	0.996	0.998	0.991	1.003	1.047
12	Oth. Food	0.738	0.725	0.677	0.664	0.644	0.644
13	Non-Food	0.760	0.722	0.702	0.664	0.759	0.749

Note: Accounting ratios are defined as shadow prices divided by consumer prices. WCF and ACF represent the wage and asset conversion factors used in calculating the shadow prices. See Table 1 for a sectoral clasification for cases A, B and C.

(*b*) *Shadow Consumption Taxes and Effective Taxes*:

		Case B				*Case A*	*Case C*	
	WCF =	*0.9*		*0.75*		*0.9*		*Effective*
	ACF =	*0.75*	*0.5*	*0.75*	*0.5*	*0.75*		*Taxes*
1	Wheat	0.205	0.239	0.274	0.308	−0.336	−0.335	−0.038
2	Rice	−0.059	−0.028	−0.042	−0.011	−0.058	−0.058	0.042
3	Pulses	0.227	0.249	0.296	0.318	0.113	0.114	0.020
4	Meat/Egg	0.242	0.254	0.313	0.324	0.017	0.017	0.006
5	Milk	0.253	0.265	0.326	0.338	0.018	0.018	0.005
6	Veg. etc	0.256	0.270	0.330	0.343	0.424	0.424	0.007
7	Ed. Oils	0.051	0.054	0.060	0.063	0.051	0.456	0.135
8	Sugar	0.304	0.314	0.348	0.358	0.297	0.348	0.137
9	Tea	0.051	0.052	0.056	0.056	0.051	0.456	0.112
10	Housing	0.173	0.223	0.233	0.282	0.148	0.182	0.103
11	Clothing	−0.003	0.004	0.002	0.009	−0.003	−0.047	0.081
12	Oth. Food	0.262	0.275	0.323	0.336	0.356	0.356	0.021
13	Non-Food	0.240	0.278	0.298	0.336	0.241	0.251	0.085

Note: Shadow consumption taxes, $(q - v)$, are the differences between consumer prices and shadow prices [see equation (5)] expressed as a proportion of consumer prices (here taken to be one).

payments to labour were weighted by a wage conversion factor (or WCF) and those for assets by an asset-conversion factor (or an ACF). The WCF encapsulates the arguments involved in the standard Little-Mirrlees shadow wage including any discrepancy between marginal product and wage, valuation of any income increases to workers on employment and the extent to which marginal products are overvalued at market prices. The conversion factor for payments to assets involves in principle separating and evaluating monopoly rents from factor rentals and any discrepancy between shadow and market prices for the assets themselves. In Ahmad, Coady and Stern (1988), we assumed a plausible range for the valuation of factors: 0.9, 0.75 and 0.5 for labour; and 0.75, 0.5 and 0.25 for assets; providing a wide range of alternatives corresponding to a number of models which could be used to describe the markets for labour and capital goods in Pakistan. There were thus nine sets of shadow prices per case. In this paper we consider only four—WCF (0.9, 0.75) and ACF (0.75, 0.5). The lower range for the ACF (as compared with WCF) was used since capital goods are subject to particularly heavy taxation in Pakistan. The conversion factor for land was 0.9 throughout. The numeraire for the evaluation of shadow prices, following Little and Mirrlees, is foreign exchange in the hands of the government.

The shadow prices are presented, together with the effective taxes, in Table 2. The shadow price calculations are discussed in Ahmad, Coady and Stern (1988) and we comment on them only briefly here. They are expressed in terms of accounting ratios which are shadow prices divided by market prices. Units of quantities are chosen so that consumer prices are one. One way of focussing on the source of differences between social marginal costs of shadow revenue, λ_i^v, and social marginal costs of revenue, λ_i, is to compare the effective taxes used in the calculations of λ_i based on (15) and the shadow consumption taxes, see (18b). Both are presented in Table 2 and we can see that they are very different.

The examples of wheat and rice are instructive. Wheat is subsidised and this is reflected in the negative effective tax for wheat (Table 2b). However in case B wheat is treated as a non-traded good (during the mid-late 1970s there were some years of exports and some of imports) so that the shadow producer taxes on its inputs become translated into a shadow tax on wheat (Table 2b). This does not apply in cases A and C where wheat is treated as an importable (and with a domestic price held substantially below the world price). Rice on the other hand has an effective tax (Table 2b) of 4.2% based on taxes on its inputs (it is not subsidised). It is, however, subject to an export tax which makes the domestic price lower than the world price and so gives an accounting ratio (shadow price divided by consumer price) less than one and a shadow consumer subsidy. The export tax is ignored in the effective tax case since those calculations are based on a simple model where goods are non-traded, there are fixed coefficients and only one factor. This yields mark-up pricing and shadow prices equal to market producer

prices. The model may be satisfactory for some simple revenue calculations which focus on non-traded goods and for indicating some of the cascading effects of input taxes. It is not appropriate where trade, trade distortions and factor market distortions are central issues. It is precisely for this reason that we use a different model as a basis for the shadow price calculations and wish to compare the results with those of the simpler model.

The model for the shadow price calculations is, as in Little and Mirrlees (1974) not fully articulated. It is based on the two simple rules for traded and non-traded goods which we have stated. This raises the standard, but subtle, problem involved in most uses of shadow prices. If shadow prices are, indeed, solved out from the fully articulated model then they are redundant—one simply recomputes the equilibrium in the model with the reform and compares the welfare level with and without. This indicates that we have to think of shadow prices in a different way than as somewhat useless additions to a computable general equilibrium model. They are summary statistics from a model which is not fully articulated but which usually contains levels of detail which are not practicable in a fully computable model. The good methods (such as the Little and Mirrlees used here) look for rules (such as world prices for traded goods) which are applicable in a large class of models.

The summary statistics (the shadow prices), are of much less dimension than a fully articulated computable general equilibrium (CGE) model and there would usually, therefore, be many possible models consistent with a given set of shadow prices. This allows them to be used much more subtly than a CGE model. For example, we can suppose that the labour market functions in some changed way and guess that the main effect would be to give a lower shadow wage rate. Such thought experiments will often be impractical if CGE's are the only tools available. We are, in the paper, using shadow prices in this spirit. This is the same approach as used in project evaluation and we have simply transferred it to tax reform.

It is clear that the calculations presented here are based on a considerable collection of data analyses and assumptions. At a number of points in our earlier work [see, for example, Ahmad and Stern (1984), (1986), 1987)] we have discussed sensitivity of results to those assumptions and the data. Our concentration in this paper is on the introduction of shadow prices into the analysis and therefore our sensitivity analysis here is focussed on this aspect (see Sections 4 and 5).

4. Directions of reform

Where shadow prices are proportional to producer prices improving directions of reform may be characterised through the effects of tax changes on households and on government revenue. We defined λ_i as the marginal cost of government revenue in terms of social welfare [see equations (13) and (15) above], and appropriate directions of reform arise from a switch in

taxation from a good with a higher λ_i to one with a lower. The data requirements have been discussed in the previous section. However, we need to specify the welfare weights, β^h [see equation (17)], and this can be done in a number of ways. As in our previous work [see Ahmad and Stern, (1984)], we use the function

$$\beta^h = (I^1/I^h)^e \tag{20}$$

where I^h is the per-capita expenditure of the hth household.

The β^h are normalised so that the welfare weight for the poorest household (number 1) is unity. Thus β^h represents the marginal social value of a unit of expenditure to household h relative to household 1. For $e > 0$, we see that $\beta^h < 1$, so that a marginal expenditure by the rich is seen as less valuable than that by the poor. One may think of e as an inequality aversion parameter: for example, $e = 0$ implies that a unit of income to the richest is seen as equivalent to a unit received by the poorest; $e = 1$ indicates that if I^h is twice I^1 then a marginal unit to h is worth half that to household 1; $e = 5$ implies that where $I^1 = 0.5I^h$ a unit of income to household 1 is worth 32 times that to houshold h. In this paper we choose values of e of 0, 0.5, 1, 2 and 5 to cover a broad range of attitudes to distributional issues.

Notice that the scaling of the β^h is irrelevant to the ranking of the λ_i. Where we work with shadow prices and R_v and use government revenue as numeraire then our normalisation involves the assumption that a unit of government revenue is equal in value to a unit of income for the poorest household.

4.1. *Directions of reform, using* λ_i

The social marginal cost of government revenue from the ith commodity, λ_i, corresponding to various levels of inequality aversion for the thirteen commodity groups are presented in Table 3a, with the ranks in Table 3b. Commodities ranked higher are preferred to commodities ranked lower as candidates for additional taxation. Interpretation of the determination of the ranks is provided using (15) where λ_i may be seen as the ratio of the distributional characteristic and a tax elasticity term.

At low levels of inequality aversion, specifically $e = 0$, commodities such as wheat and pulses are relatively attractive candidates as sources of extra revenue, ranking 10 and 8 respectively. The distributional characteristic is 1 for all goods and λ_i is determined only by the tax elasticity. However, even with moderate inequality aversion, $e = 1$, the rankings change dramatically, with wheat at rank 1 (the least attractive candidate for additional taxation) and pulses at rank 3; and for $e \geq 2$, these two commodities rank 1 and 2 respectively. On the other hand, a commodity such as 'housing, fuel and light', which ranks fairly low (2) as a choice for marginal taxation at $e = 0$, appears increasingly attractive as inequality aversion increases, and ranks 10th for $e = 5$.

TABLE 3
Social marginal costs of revenue, λ_i, with effective taxes

(a)	*The λ_i*				
	$e = 0$	*$e = 0.5$*	*$e = 1.0$*	*$e = 2.0$*	*$e = 5.0$*
Wheat	1.036	0.765	0.585	0.374	0.162
Rice	1.050	0.737	0.535	0.312	0.111
Pulses	1.047	0.762	0.576	0.362	0.154
Meat/Egg	0.999	0.655	0.446	0.232	0.068
Milk	1.023	0.705	0.502	0.281	0.090
Veg. etc	1.012	0.690	0.409	0.276	0.096
Edible Oils	1.122	0.786	0.572	0.335	0.123
Sugar	1.103	0.776	0.564	0.329	0.116
Tea	1.094	0.781	0.578	0.351	0.138
Housing	1.109	0.750	0.527	0.289	0.093
Clothing	1.078	0.736	0.521	0.290	0.098
Oth. Food	1.037	0.726	0.527	0.308	0.113
Non-Food	1.099	0.718	0.487	0.251	0.073

Note: The λ_i represent the marginal social cost of a unit of government revenue from the ith good, and e is an inequality aversion parameter. See text [equations (13) and (15)] for definitions. See equation (20) for a definition of e.

(b)	*Ranks for λ_i*				
	$e = 0$	*0.5*	*1.0*	*2.0*	*5.0*
Wheat	10	4	1	1	1
Rice	7	7	6	6	7
Pulses	8	5	3	2	2
Meat/Egg	13	13	13	13	13
Milk	11	11	10	10	11
Veg. etc	12	12	11	11	9
Edible Oils	1	1	4	4	4
Sugar	3	3	5	5	5
Tea	5	2	2	3	3
Housing	2	6	8	9	10
Clothing	6	8	9	8	8
Oth. Food	9	9	7	7	6
Non-Food	4	10	12	12	12

Note: Ranking number 1 represents the lowest priority as a source of extra taxation—see Table 3a above.

The changing pattern of ranks for λ_i for different values of e is reflected in Table 5(a), which presents Spearman Rank Correlation Coefficients. We observe that the λ_i for $e = 0$ are only weakly correlated with those for $e \geq 1$. However, once inequality aversion is above the (moderate) level, $e = 0.5$ say, the ranks of λ_i are strongly correlated—the rank correlation for pairs of e each above 0.5 are all above 0.8. And the rank correlation coefficient for

the λ_i for moderate inequality aversion, $e = 1$, and those for $e = 5$, is as high as 0.96. This is an indication of the predominant effect played by the distributional characteristic in determining the λ_i [see equation (15)]. Thus, in determining the appropriate directions for reform, the precise specification of the inequality aversion parameter is less important than broad indications as to whether the policy makers are (i) not at all concerned with distributional aspects in their decision making, (ii) only moderately influenced, or (iii) primarily concerned with distribution. The dominant role of the distributional characteristic is reassuring since empirically we can be

TABLE 4a
The social marginal cost of shadow revenue

	e = 0	*0.5*	*1.0*	*2.0*	*5.0*
	WCF 0.9; ACF 0.75				
Wheat	1.236	0.913	0.698	0.446	0.194
Rice	1.045	0.733	0.533	0.310	0.111
Pulses	1.248	0.909	0.686	0.431	0.183
Meat/Egg	1.333	0.874	0.595	0.309	0.091
Milk	1.297	0.894	0.636	0.356	0.114
Veg. etc	1.332	0.908	0.644	0.363	0.127
Ed. Oils	1.106	0.776	0.564	0.331	0.122
Sugar	1.317	0.927	0.674	0.393	0.139
Tea	1.127	0.804	0.596	0.361	0.142
Housing	1.211	0.819	0.575	0.316	0.102
Clothing	1.064	0.726	0.514	0.286	0.097
Oth. Food	1.298	0.908	0.659	0.385	0.141
Non-Food	1.330	0.869	0.589	0.304	0.088
	WCF 0.75; ACF 0.5				
Wheat	1.370	1.012	0.773	0.495	0.214
Rice	1.112	0.780	0.567	0.330	0.118
Pulses	1.382	1.007	0.760	0.478	0.203
Meat/Egg	1.499	0.983	0.669	0.348	0.102
Milk	1.449	0.998	0.711	0.397	0.127
Veg. etc	1.502	1.025	0.727	0.410	0.143
Ed. Oils	1.147	0.804	0.585	0.343	0.126
Sugar	1.439	1.012	0.736	0.429	0.151
Tea	1.175	0.838	0.621	0.377	0.148
Housing	1.389	0.939	0.660	0.362	0.117
Clothing	1.101	0.751	0.531	0.296	0.100
Oth. Food	1.434	1.004	0.729	0.426	0.156
Non-Food	1.532	1.001	0.679	0.350	0.101

Note: (i) The social marginal cost of shadow revenue, λ^v, is defined in equations (16)–(19). The index of 'aversion to inequality', e, is presented in equation (20). The conversion factors WCF and ACF are used in the calculation of shadow prices—see Section 3.

TABLE 4b
Ranks for the λ_i^y

	Ranks				
	WCF 0.9; ACF 0.75				
	e = 0	*0.5*	*1.0*	*2.0*	*5.0*
Wheat	8	2	1	1	1
Rice	13	12	12	10	9
Pulses	7	3	2	2	2
Meat/Egg	1	7	8	11	12
Milk	6	6	6	7	8
Veg. etc	2	5	5	5	6
Ed. Oils	11	11	11	8	7
Sugar	4	1	3	3	5
Tea	10	10	7	6	3
Housing	9	9	10	9	10
Clothing	12	13	13	13	11
Oth. Food	5	4	4	4	4
Oth. Non-Food	3	8	9	12	13

	WCF 0.75; ACF 0.5				
	e = 0	*0.5*	*1.0*	*2.0*	*5.0*
Wheat	9	3	1	1	1
Rice	12	12	12	12	9
Pulses	8	4	2	2	2
Meat/Egg	3	8	8	10	11
Milk	4	7	6	6	7
Veg. etc	2	1	5	5	6
Ed. Oils	11	11	11	11	8
Sugar	5	2	3	3	4
Tea	10	10	10	7	5
Housing	7	9	9	8	10
Clothing	13	13	13	13	13
Oth. Food	6	5	4	4	3
Oth. Non Food	1	6	7	9	12

Note: Ranking number 1 represents the lowest priority as a source of extra taxation—see Table 4a above.

much more sure of the distribution of consumption than of the tax elasticity (see equation (15)).

4.2. *Directions of reform: using* λ_i^y

Where shadow prices are not proportional to producer prices, directions of reform are evaluated here keeping shadow revenue, rather than actual revenue, constant. The λ_i^y encapsulate the general equilibrium ramifications of tax changes including the effects of shifts in demand towards goods

with high or low shadow prices—see equations (16)–(19) for definitions. The λ_i^v for the two sets of shadow price vectors, corresponding to (WCF, ACF) combinations (0.9;0.75) and (0.75;0.5), are presented in Table 4a. Ranks for each set and level of inequality aversion are shown in Table 4b and it is clear that the ranks differ strongly between λ_i and λ_i^v (see Table 3b).

The rankings of the λ_i^v are determined by the interplay of three aspects—the distributional characteristic, the demand responses, and the shadow prices [see equations (16)–(19)]. This interplay is illustrated in Figs. 1(a)–(c). On the horizontal axis we have plotted the rank with respect to the λ_i—for $e = 0$ [Fig. 1(a)], $e = 1$ [Fig. 1(b)] and $e = 5$ [Fig. 1(c)]. The rank by λ_i^v is plotted on the vertical axis. Hence the 45 degree line represents the case where shadow prices are proportional to producer prices. From Fig. 1(a) we see that when distribution is not an issue ($e = 0$) the ranking by λ_i^v bears little relation to the ranking by λ_i. This reflects the sharp differences in effective taxes and shadow taxes that we saw in Table 2b. On the other hand as the aversion to inequality increases the ranking by λ_i^v gets closer to the 45 degree line—see Figs. 1(b) and (c). Even for very high inequality aversion (Fig. 1(c)), however, the difference in ranking for λ_i and λ_i^v does not disappear. The figures (and tables) illustrate that the differences between λ_i

TABLE 5a

Spearman Rank Correlation Coefficients for Reform Directions Across Inequality Aversion Parameters

e	*0*	*0.5*	*1.0*	*2.0*	*5.0*
(*i*) *Effective Taxes*, λ_i					
0	1.000				
0.5	0.698	1.000			
1.0	0.330	0.885	1.000		
2.0	0.291	0.857	0.989	1.000	
5.0	0.220	0.808	0.961	0.978	1.000
(*ii*) λ_i^v, $WCF = 0.9$, $ACF = 0.75$					
0	1.000				
0.5	0.632	1.000			
1.0	0.500	0.950	1.000		
2.0	0.170	0.813	0.906	1.000	
5.0	−0.100	0.582	0.764	0.934	1.000
(*iii*) λ_i^v, $WCF = 0.75$, $ACF = 0.5$					
0	1.000				
0.5	0.654	1.000			
1.0	0.489	0.923	1.000		
2.0	0.330	0.863	0.950	1.000	
5.0	−0.022	0.643	0.775	0.890	1.000

Note: The 5% significance level of the correlation coefficient for 13 elements is 0.57.

TABLE 5b
Correlations of Ranks Across λ_i^v's and λ_i for Various e's

	λ^v		
	(a)	(b)	λ_i
$e = 0$			
(a)	1.000		−0.478
(b)	0.939	1.000	−0.363
$e = 0.5$			
(a)	1.000		−0.027
(b)	0.928	1.000	−0.154
$e = 1.0$			
(a)	1.000		0.368
(b)	0.961	1.000	0.225
$e = 2.0$			
(a)	1.000		0.648
(b)	0.928	1.000	0.423
$e = 5.0$			
(a)	1.000		0.874
(b)	0.961	1.000	0.758

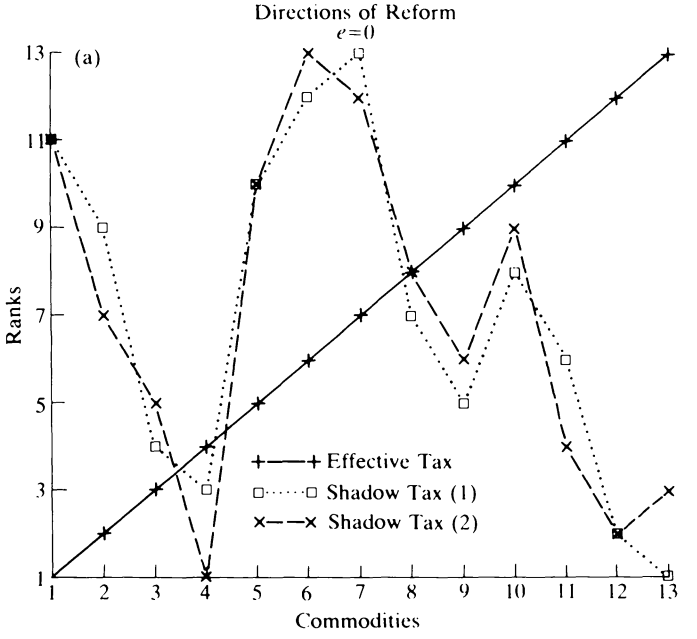
Note: (a) indicates a WCF of 0.9 and an ACF of 0.75. (b) indicates a WCF of a WCF of 0.75 and an ACF of 0.50. (c) The 5% significance level of the correlation coefficient for 13 elements is 0.57.

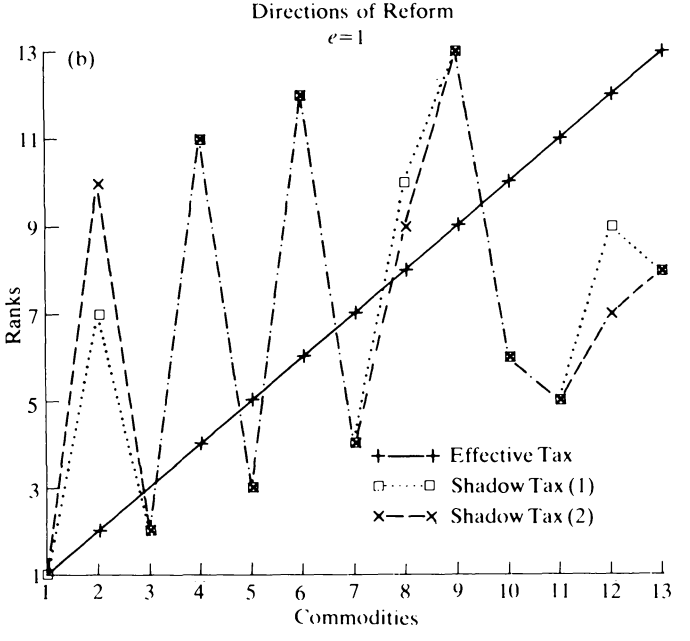
and λ_i^v are substantially greater than those associated with the differences amongst the λ_i^v for different shadow price systems.

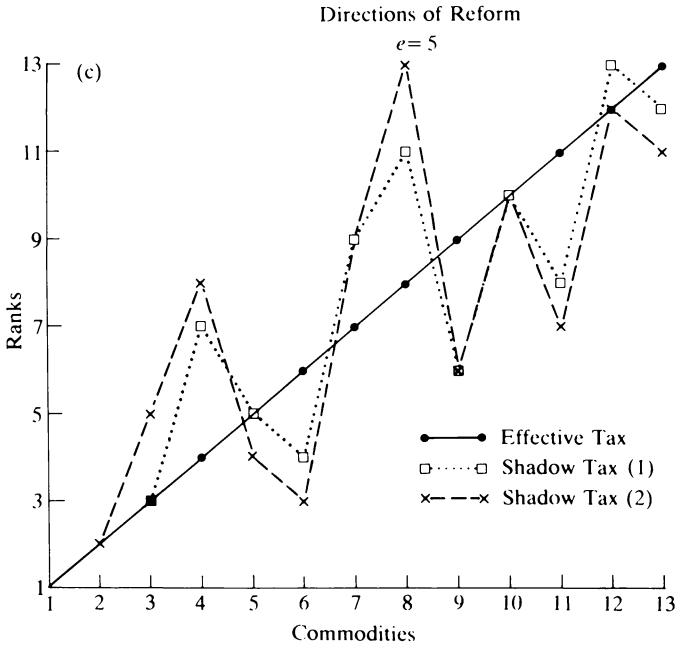
From Table 4 the ranks of the λ_i^v suggest that, as with the λ_i, items of general consumption which also form a large proportion of the consumption of the poor, such as 'wheat' and 'pulses' (ranking 8 or 9, and 7 or 8 respectively, for $e = 0$) are attractive candidates for additional taxation only at low levels of inequality aversion. However, for $e \geq 1$, 'wheat' ranks 1 and pulses 2 for both shadow price combinations considered here, indicating that these commodities are the last ones that should be considered when extra revenues are required. Hence the distributional characteristic continues to play a major role in determining the rankings for $e \geq 1$.

The differences in rankings between λ_i and λ_i^v for given e arise from the effects of switches of demand from and to goods with high and low shadow taxes. The switches in rank between λ_i and λ_i^v revealed in Tables 3b and 4b (see also Table 5b) may be understood using the shadow taxes shown in Table 2. The case of 'meat, fish and eggs' is instructive, since this sector has the highest own-price elasticity (−1.11) and a low distributional characteristic. For the (WCF; ACF) combination (0.9; 0.75) this sector switches from

FIG. 1. (See p. 159 for "Notes for Figures".)







the lowest ranking λ_i^v at $e = 0$, to the highest at $e = 5$. Thus, at low levels of inequality aversion, the high price elasticity makes this an undesirable candidate for additional taxation. At higher levels of inequality aversion, the effects of the distributional characteristic predominate. A similar, though less marked contrast, is seen for this sector for the (WCF; ACF) combinations (0.75, 0.5). Note that, with the λ_i's (Table 3b), this sector ranks (13) or as the most desirable item for additional taxation (for all $e = 0, \ldots, 5$). The effective tax here is very low (see Table 2b) so that the large price elasticity does not, in this case, lead to worries about revenue loss from increased taxation. The shadow tax on the other hand is substantial hence shadow revenue losses are significant giving the low rank for λ_i^v when $e = 0$. If the government's preferences are such that $e = 0$, then ignoring effects operating through shadow taxes would yield misleading results. The aggregate price elasticities are presented in Table 6.

The example of rice also illustrates the role of the differences between effective taxes and shadow prices in generating the differences between λ_i and λ_i^v. For $e = 1$, (WCF; ACF) = (0.75; 0.5) for example, the rank changes from 6 to 12 as we introduce shadow taxes. Thus it becomes one of the top two candidates for extra taxation. The reason (as we saw in Section 3) is that it has a high shadow price (and a low shadow tax) so that we want to discourage domestic consumption of this valuable commodity. The reason its shadow price is high (relative to the market price) in this system of

TABLE 6
Uncompensated Own and Cross-Price Elasticities

	Wheat	*Rice*	*Pulses*	*Meat*	*Milk*	*Veget*	*EdOils*	*Sugar*	*Tea*	*House*	*Cloth*	*OthF*	*OthNf*
Wheat	−0.236	−0.004	−0.003	0.002	−0.012	−0.002	−0.006	−0.005	−0.002	−0.001	−0.009	−0.005	0.005
Rices	−0.068	−0.600	−0.011	0.007	−0.039	−0.007	−0.021	−0.016	−0.006	−0.003	−0.030	−0.015	0.017
Pulses	−0.032	−0.006	−0.299	0.003	−0.018	−0.003	−0.010	−0.007	−0.003	−0.002	−0.014	−0.007	0.008
Meat	−0.150	−0.029	−0.024	−1.115	−0.087	−0.016	−0.047	−0.035	−0.014	−0.008	−0.066	−0.033	0.037
Milk	−0.078	−0.015	−0.012	0.008	−0.690	−0.008	−0.024	−0.018	−0.007	−0.004	−0.034	−0.017	0.019
Veg, F, S	−0.114	−0.022	−0.018	0.012	−0.066	−0.908	−0.035	−0.026	−0.010	−0.006	−0.050	−0.025	0.028
EdOils	−0.081	−0.016	−0.013	0.009	−0.047	−0.009	−0.693	−0.019	−0.007	−0.004	−0.036	−0.018	0.020
Sugar	−0.059	−0.011	−0.009	0.006	−0.034	−0.006	−0.018	−0.476	−0.005	−0.003	−0.026	−0.013	0.015
Tea	−0.065	−0.012	−0.010	0.007	−0.037	−0.007	−0.020	−0.015	−0.547	−0.003	−0.028	−0.014	0.016
Housing	−0.117	−0.022	−0.019	0.012	−0.068	−0.013	−0.036	−0.027	−0.010	−0.917	−0.051	−0.025	0.029
Clothing	−0.085	−0.016	−0.014	0.009	−0.049	−0.009	−0.026	−0.020	−0.008	−0.004	−0.708	−0.018	0.021
Oth. Fd.	−0.066	−0.013	−0.011	0.007	−0.038	−0.007	−0.020	−0.015	−0.006	−0.003	−0.029	−0.581	0.016
Oth. Nf.	−0.148	−0.028	−0.024	0.015	−0.085	−0.016	−0.046	−0.034	−0.013	−0.007	−0.065	−0.032	−1.115

Source: Ahmad, Ludlow and Stern (1987), p. 9.

Notes: (1) Commodity titles correspond to those listed in Table 1, note (iii), above. (2) The elasticities are those calculated by Ahmad, Ludlow and Stern (1987) for all Pakistan using the Micro-Nutrient Survey (1976) and a modified version of the Linear Expenditure System.

shadow prices is that it is an exportable. Similar results apply for edible oils (rank changes from 4 to 11 as we introduce shadow taxes) and clothing (9 to 13) and tea (2 to 10).

5. Concluding Comments

Policy suggestions which arise from the rankings should not be taken too literally. There are five main ingredients for the calculations: consumption patterns, demand responses, effective taxes, shadow prices, welfare weights. They can only be specified after many assumptions and the data themselves are not necessarily reliable. Further much important detail has been omitted. We have not explored in this paper sensitivity to the assumptions involved in all the major ingredients. We have focussed here on the role of shadow prices (the main innovation in the tax reform analysis in this paper) and distributional values. Elsewhere [Admad and Stern (1984), (1986), (1987)] we have provided some discussion of the robustness of the results to other elements in the analysis. It would be interesting in further work to treat the lack of certainty about the parameters and model in a more formal way which would lead to probabilistic statements about policy. This, however, would be a major (though important and interesting) exercise which would take us beyond the scope of this paper.

We have seen that each of the ingredients plays an important role in the evaluation of overall directions for reform. Other things being equal we are less likely to want to increase taxes on a good the more it is consumed by the poor, the less responsive is revenue to the tax increase and the lower its shadow price. Ignoring any of these elements can produce misleading results. The distributional aspects have appeared to be of particular importance in our calculations provided there is some reasonable concern with inequality. The principal aim of this paper, however, has been to bring out the role of the divergence between market and shadow prices, and we have seen that the effect on the rankings of goods as candidates for extra taxation may be strong. Goods with high shadow prices are valuable and the tax system should take this into account in discouraging their consumption. These are all important lessons which should be integrated with the other basic considerations, including administration, evasion and political acceptability, in designing and assessing practical packages for tax and price reform.

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Notes for Figures

The ruling on the horizontal axes in Figs 1(a), 1(b) and 1(c) is that associated with the ranking of the social marginal costs of revenue when producer prices are proportional to shadow prices. The corresponding commodities are:

Figure 1(a)	*Figure 2(b)*	*Figure 3(c)*
(1) Edible Oils	(1) Wheat	(1) Wheat
(2) Housing	(2) Tea	(2) Pulses
(3) Sugar	(3) Pulses	(3) Tea
(4) Non-Food	(4) Edible Oils	(4) Edible Oils
(5) Tea	(5) Sugar	(5) Sugar
(6) Clothing	(6) Rice	(6) Other Food
(7) Rice	(7) Other Food	(7) Rice
(8) Pulses	(8) Housing	(8) Clothing
(9) Other Food	(9) Clothing	(9) Vegetables
(10) Wheat	(10) Milk	(10) Housing
(11) Milk	(11) Vegetables	(11) Milk
(12) Vegetables	(12) Non-Food	(12) Non-Food
(13) Meat/Eggs	(13) Meat/Eggs	(13) Meat/Eggs

The ruling on the vertical axis is that associated with the ranking of the social marginal costs of shadow revenue using three separate shadow tax vectors, i.e. effective taxes, shadow taxes (1) generated using (WCF; ACF) = (0.9; 0.75) and shadow taxes (2) generated using (WCF; ACF) = (0.75; 0.5). The rankings are those presented in Tables 3(b) and 4(b). Ranking number 1 represents the lowest in priority as a source for extra taxation.