NBER WORKING PAPER SERIES

TAXATION AND PRICING OF AGRICULTURAL AND INDUSTRIAL GOODS

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Working Paper No. 1338

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 1984

The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #1338
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ABSTRACTS

This paper presents an analysis of price reform and of optimal pricing and taxation of agricultural and industrial goods in modern-day LDCs. Our analysis is based on a general equilibrium paradigm with a multitude of goods and income groups. It is consistent with several alternative institutional structures within the agricultural and the industrial sectors, as well as with alternative hypotheses concerning unemployment and migration of labor across the two sectors. This approach differs substantially from the standard tax literature with regard to the structure of the economy and the set of admissible taxes.

The rules of price reform which we derive are quite simple to implement, requiring only the knowledge of observable parameters such as price elasticities of demand and supply. The determination of optimal prices (and taxes) requires, in addition, the relative welfare weights on individuals' incomes and on investment. We show that it is desirable, in general, to levy import and export taxes. Among new results are those presenting conditions under which all of the goods belonging to certain categories (such as all purchased agricultural inputs or all agricultural outputs which are not consumed) should be either taxed or subsidized.

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I. INTRODUCTION

In most LDCs, governments play an active role in setting the food prices received by farmers and the prices paid by city dwellers. They do this through a variety of mechanisms, such as agricultural marketing boards, which often have a monopoly on the purchase of certain goods from farmers and their sale to consumers, price regulation authorities, which control the prices at which private traders can sell, explicit food subsidies, sometimes accompanied by rationing, and by export and import taxes and subsidies.[1] Their objectives in attempting to alter the prices which would emerge in the absence of government intervention are several. In the present paper we focus on the following of their objectives:

- o They seek to increase the income of peasants who are often among the poorest in the economy.
- o They seek to subsidize the poorer city dwellers. In most LDCs direct income subsidies are not feasible, and food subsidies may be thought to be an effective way of helping the poor.
- o They seek to tax the agricultural sector to capture resources for investment, and for public goods creation.[2]
- o They seek to attain some level of self-sufficiency in specific goods, to avoid excessive dependence on the international market.[3]
- o They seek to use taxation and pricing to counteract the effects of rigidities in the economy, such as the shortage and surplus in labor and goods markets and the country's lack of access to a free international trade and borrowing environment.[4]

Often, the stated objectives of governments seem at variance with the policies which they adopt. Though they may claim that the food subsidies to city dwellers are meant to help the urban poor, the government in fact may not subsidize the grain consumed by the poor (millet, for example), but rather the grain consumed by those relatively better off (rice, for example). In other cases, the government may fail to achieve its objectives due to corruption and incompetence. Though the intended objective of marketing boards' bureaucrats is to help producers and consumers, in some cases they may actually harm both groups by running excessively costly and inefficient operations, and by collecting rents for themselves.

Moreover, in many cases, there appears to be some confusion in the objectives of the government. It attempts to subsidize everyone, to increase the prices received by farmers and to lower the prices paid by city dwellers, without articulating who is paying for the subsidies, and indeed, without a clear view of the full incidence of the complicated set of taxes and subsidies which are levied. This confusion is further compounded in those countries in which many different agencies set prices of different goods. Often these agencies act independently of one another, under contradictory assumptions concerning what the society's objectives are, and what the constraints on the economy are.[5]

Different agricultural pricing policies have markedly different effects on the welfare of farmers and city dwellers, and on the revenue available to the government for investment. These effects can be assessed only within a general equilibrium model, in which the demands and supplies of different groups in the economy, and how these demands and supplies are altered by

changes in pricing policy, are taken into account, and in which the overall constraints facing the economy - its balance of trade constraint, the government's revenue constraint, etc. - are also taken explicitly into account. We develop here a model within which the effects of pricing and taxation policies can be evaluated, which enables us not only to identify circumstances in which changes in a pricing policy can make all of the major groups in the society better off, but also to characterize the qualitative aspects of the optimal pricing policy.[6]

We begin our analysis with an exceedingly simple model. This model has the advantage that it focusses our attention on the critical trade-offs involved in pricing decisions. Moreover, as we shall see, it is surprisingly easy to extend this model to deal with more complex situations. We present many important extensions. The number of possible extensions which can be explored, however, is enormous, and we have not attempted to be comprehensive. It is necessary, therefore, to bring to bear the detailed knowledge of the particular country under study to arrive at the formulation which is most appropriate.

II. A SIMPLE MODEL

Consider an economy in which there are two commodities and two sectors: food and related products, produced in the agricultural sector (Sector 1) and a generalized industrial good, which can be used either for consumption or for investment, produced in the industrial sector (Sector 2). Both goods are freely traded; international price of the agricultural good in terms of the

industrial good is denoted by P.

Agricultural Sector: Agricultural land is owned equally among peasants; they decide on how much labor to supply, on the basis of the prices at which they can sell their surplus. We denote this price (in terms of the industrial good) by p. Clearly, the level of utility which they attain is a function of this price; we write the utility level of a representative peasant by $V^1(p)$.[7] Some of the agricultural goods are consumed within the agricultural sector; we shall be concerned with the surplus quantity Q which each peasant sells to the industrial sector or abroad. This quantity is a function of the price the peasants receive. We denote the price elasticity of the surplus by

$$(1) \qquad \varepsilon_{Qp} = \frac{\partial \ell nQ}{\partial \ell np} .$$

Although economic theory puts no constraints on the sign of ε_{Qp} (there may be a backward bending supply schedule of the marketed output of peasants), we focus here on the case where an increase in the price increases the marketed surplus. There appears to be some empirical evidence in support of this hypothesis[8].

We assume that the government has very few policy instruments to control peasants' behavior. In particular, the government can not directly control the output, consumption and the surplus of peasants. This, we believe, is the correct representation of most LDCs, since much of the farming in these economies is done in numerous small plots, and the ability of the government to monitor the actions of any peasant seems sufficiently limited that only indirect incentives are administratively feasible. This view is also supported by the past experience of some of the socialist economies in which

the attempts to control agricultural quantities have not been particularly successful. In any event, our present analysis does not deal with a collectivist agriculture or with an agriculture based on government managed parastatals.

Common experience also suggests that complex incentive schemes are usually infeasible. For example, if the government attempts to implement non-linear pricing, that is, schemes in which the price (per unit) paid to peasants depends on the amount they sell, then peasants would have an incentive to establish underground (unaccounted) markets. We therefore, restrict ourselves to the simplest incentive structure, which is a piece rate system entailing a common price to all peasants regardless of the quantities they transact.

Industrial Sector: In contrast to the agricultural sector, we assume that there exist enough policy instruments in the industrial sector so that the distinction between direct and indirect control can be virtually ignored. This is partly because the government is often a large, if not the overwhelmingly large, industrial employer in developing economies. In addition, the governments can tax corporate profits and control producers' prices and quantities. Also, the factory system enables the employer to monitor their workers relatively more easily.

For simplicity, we ignore the intra-sectoral income distribution at present, and assume that the number of hours which industrial workers work is fixed[9]; the government takes the wage, w, it pays workers as given; the marketing board controls the price, q, that it charges for food in the industrial sector. Thus, we write the welfare of an industrial worker as $V^2(q, w)$.

Given their income w and the price q, industrial workers decide on how much food to consume. If x^2 denotes this quantity, then $x^2 = x^2(q, w)$. We let ε_{xq} denote the price elasticity of the demand (as a positive number) of the urban consumption of food:

$$(2) \qquad \varepsilon_{xq} = -\frac{\partial \ell n x^2}{\partial \ell n q} .$$

Investment: We can calculate the amount available to the government for investment. This is simply the difference between the industrial output and the industrial wage payments; plus the net revenue of the marketing board:[10]

$$(3) \qquad I = N^2(Y - w) + (P - p)\, N^1 Q + (q - P)\, N^2 x^2$$

where N^1 is the number of peasants and N^2 is the number of industrial workers. Y is the output per industrial worker.

III. PRICING POLICIES

Price Reform: There are three identifiable groups in our model, the peasants, the industrial workers, and the government (representing future generations through its control of investment). For each value of p and q, we can calculate the feasible combinations of V^1, V^2, and I (see Figure 1).

We first show that: certain price changes can make all groups in society better off.

Note that an increase in rural food price makes the peasants better off, but it does not affect the industrial workers. Also, investment increases

with an increase in p if[11]

$$(4) \qquad p < P/(1 + 1/\varepsilon_{Qp}) \equiv \hat{p}.$$

Thus, if the price of food in the agricultural sector is less than $\hat{p}$, then an increase in it is unequivocally desirable, since it will increase the surplus available to the government for investment, and it will also improve the welfare of peasants, while leaving the situation of industrial workers unchanged.

Similarly, a decrease in the urban food price makes the industrial workers better off, and it does not affect the peasants. Also, it increases investment if[12]

$$(5) \qquad q > P/(1 - 1/\varepsilon_{xq}), \text{ and } \varepsilon_{xq} > 1.$$

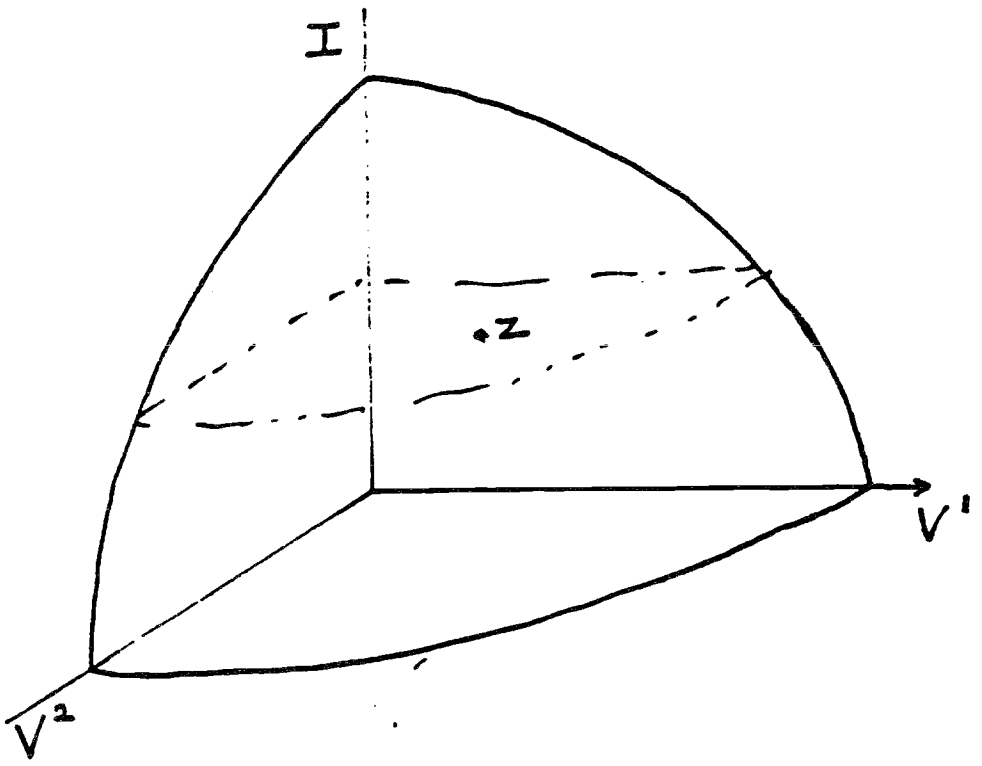

Figure 1

The utility possibilities schedule gives the maximum value of investment consistent with any level of utility of peasants and industrial workers. If the existing prices are at inefficient points such as Z, then a change in prices can make every group in the society better off.

Thus, if (5) is satisfied then a decrease in the urban food price is unequivocally desirable for the society.

The above rules of price reform, therefore, identify a lower limit of what the rural food price should be, and an upper limit of what the urban food price should be. A highly useful feature of these rules is that they can be applied with very little information. Apart from the world price, the only data required to use them are the demand and supply elasticities.

What is additionally attractive about these rules of price reform is that their validity is not restricted to the specific model considered above. The only conditions required for the two rules of reform, (4) and (5), to hold are that

$$(6) \qquad \frac{\partial V^1}{\partial p} > 0, \text{ and } \frac{\partial V^2}{\partial q} < 0,$$

respectively. Now, interpret V^1 and V^2 as representing the aggregate welfare of the entire group of peasants and industrial workers, respectively. Then (6) implies that the aggregate welfare of peasants increases if the price of their output is increased, and that the welfare of industrial workers decreases if the food price they face is increased. So long as these (rather mild) conditions are satisfied, our rules of price reform will hold.

For instance, the rule for reform in the urban food price holds regardless of the distribution of income among industrial workers. Similarly, the rule for reform in the rural food price holds no matter how agricultural land is distributed among peasants, so long as not many peasants are significant net buyers of food. Also, the same rules of reform apply (with slight modifications) even when there is migration between the two sectors.

Optimal Pricing Policies: We showed above, how, in a variety of circumstances, only the knowledge of the supply and demand elasticities is sufficient for one to weed out inefficient pricing policies. But still, there are numerous pricing policies which are efficient. A choice among these policies necessarily entails trade-offs; between the interests of peasants, industrial workers, and future generations (investment). In this section, we show how one can attempt to think systematically about the nature of these trade-offs. First, we express the aggregate social welfare as

$$(7) \qquad H = N^1 W(V^1) + N^2 W(V^2) + \delta I,$$

in which δ is the social value of marginal investment.[13] H gives the value of social welfare as a function of the welfare of peasants and industrial workers, and the level of investment. Conceptually, this allows us to draw social indifference curves, i.e., those combinations of V^1, V^2, and I among which the society is indifferent. The government, then, should choose that point on the utility possibilities surface (Figure 1) which is tangent to the social indifference curve.

This point of tangency, representing the optimal pricing scheme, can be expressed as:

$$(8) \qquad p = \frac{P}{1 + (1 - \frac{\beta^1}{\delta}) \frac{1}{\varepsilon_{Qp}}}, \text{ and}$$

$$(9) \qquad q = \frac{P}{1 - (1 - \frac{\beta^2}{\delta}) \frac{1}{\varepsilon_{xq}}},$$

where λ^i is the private marginal utility of income to a worker in sector i, and $\beta^i = \lambda^i \partial W/\partial V^i$ is the social (weight) marginal utility of income to a worker in sector i.[14] We have thus obtained explicit expressions of a remarkably simple form for the optimal prices in terms of the welfare weights and the price elasticities.

Qualitative Results: Our formulae are not only simple, but also their prescriptions are intuitively understandable. The optimum price in the agricultural sector depends only on the social weight on the income of peasants (relative to investment) and on the price elasticity of agricultural surplus; similarly, the optimum price in the industrial sector depends only on the social weight on the income of industrial workers and their price elasticity of demand for agricultural goods.[15]

In the (normal) case where investment is socially valued more than consumption, peasants receive less than the international price of food and city dwellers pay more than the international price of food. Also, a higher elasticity of agricultural surplus corresponds to a higher price paid to peasants; a higher demand elasticity of food in the industrial sector corresponds to a lower price charged to city dwellers (this is because when government raises the price, it loses more intra-marginal tax revenue as a result of the decreased demand). Further, the smaller the social weight on peasant's income, the lower the price in the agricultural sector; the smaller the social weight on city dwellers' income, the higher the price paid by them.

Implicit Tax Rates: The optimal pricing formulae derived above can be usefully restated in terms of the commodity taxes. Let $t = (P - p)/p$. Then t is the tax rate on the output of peasants; it can also be interpreted as the

rate of subsidy on their consumption. Denote the food output and the consumption of a peasant by X and x^1 respectively. Then,

$$(10) \qquad Q = X - x^1$$

Further, define

$$(11) \qquad \varepsilon_{Xp} = \frac{\partial \ell n X}{\partial \ell n p}, \text{ and } \varepsilon_{xp} = -\frac{\partial \ell n x^1}{\partial \ell n p}$$

as the price elasticities of food output and consumption of a peasant.[16] Then the surplus elasticity, can be expressed as $\varepsilon_{Qp} = (1 + \alpha)\varepsilon_{Xp} + \alpha\varepsilon_{xp}$, where $\alpha = \frac{x^1}{Q}$ is the ratio of peasants' consumption to their marketed surplus. Using these definitions, the optimal tax rate is obtained from (8) as

$$(12) \qquad t = (1 - \frac{\beta^1}{\delta}) \frac{1}{(1 + \alpha)\varepsilon_{Xp} + \alpha\varepsilon_{xp}}$$

The tax rate in the present case has some features in common with the traditional tax literature, but there also are some differences. According to (12), the magnitude of the tax rate is inversely proportional to the price elasticities of output and consumption. This dependence is heuristically the same as the one which was posited in some of the earliest writings on taxation, i.e., those by Frank Ramsey (1927) and by A.C. Pigou.[17]

However, there is a basic difference between the present policy problem, and the standard taxation problem in which production and consumption decisions are made by corporations and consumers respectively. In the latter

case, the relative roles played by output and consumption elasticities depend very much on the government's corporate tax policy; the output elasticity does not appear in the tax formula, for example, if the corporate profit is entirely taxed away.[18]

In the present policy problem, in contrast, it is nearly impossible for the government to be able to administratively distinguish between producers and consumers within the agricultural sector; since peasants are simultaneously producers as well as consumers. The key elasticity therefore is the elasticity of marketed surplus. Even though this elasticity can be restated in terms of output and consumption elasticities, as in (12), it is the combined effect that matters.

IV. EXTENSIONS

The simplicity of the above model has enabled us to obtain results which are intuitive. We now extend our analysis in many ways. Our approach here is to study one extension at a time; this facilitates clearer insights into the considerations which are most relevant in the determination of optimal prices.

A. Many Income Groups

The formulae derived earlier can be used in the case of many income groups by simply interpreting β as the "average" social weight on the incomes of individuals in a sector.

To see this, consider an agricultural sector in which there is a continuum of land ownership ranging from large landlords to landless workers.[19] Denote an individual by the superscript h, whose marketed surplus

is Q^h (which can be negative) and whose net labor supply (i.e., the labor hours supplied by this person minus the labor hours used on his farm) is ℓ^h. Denote the rural wage per hour by w^1. Since this wage is determined in the rural labor market, it depends on the price of agricultural surplus, p. We define

$$(13) \qquad \varepsilon_{wp} = \frac{\partial \ell n w^1}{\partial \ell n p}$$

as the elasticity of rural wage with respect to p. Further, let Q denote the average marketed surplus, i.e., $Q = \sum_h Q^h/N^1$.

Then it is easily verified that (8) is still the optimal pricing rule, with the modification that now

$$(14) \qquad \beta^1 = \sum_h \beta^{1h}(Q^h + \frac{w^1 \ell^h}{p} \varepsilon_{wp})/\sum_h Q^h ,$$

where β^{1h} is the social weight on the income of individual h. The interpretation of β^1 as the average social weight on rural incomes is obvious. Expression (14) defines a weighted average of the social weights on the income of different individuals. The weight for an individual is his surplus plus his gain (or loss) due to price induced change in the rural wage.[20]

Two points are worth noting here. First, the average social weight we have derived above takes into account the general equilibrium effects of prices on wage incomes. Similar social weights developed in the earlier tax literature have typically ignored such effects.[21] Second, our pricing formula is largely independent of the specific form of economic organization within the agricultural sector. Specifically, it does not depend on the nature of

the labor market (for example, on whether the labor market is competitive or not). We further discuss the organization of the agricultural sector in a later section.

The same approach applies to the industrial sector. With wage (income) differences among city dwellers, (9) is the optimal pricing formula, with a modification that

$$(15) \qquad \beta^2 = \sum_h \beta^{2h} x^{2h} / \sum_h x^{2h} ,$$

where β^{2h} is the social weight on the income of the city dweller h, who consumes x^{2h} units of food. Once again, it is obvious from (15) that β^2 is the average of the social weights on the incomes of different city dwellers.[22]

B. Disaggregation of Goods

The multitude of goods with which the agricultural sector deals can be divided into some distinct categories. Among the goods produced in the agricultural sector, for example, are those which are consumed by peasants and also sold to outsiders (like food grains), those which are inputs to agricultural production itself (like manure and irrigation wells), and those which are produced solely for selling them to outsiders (like rubber and fibers). Similarly, the agricultural sector buys some goods from outside for consumption (like textiles, transistor radios and movies) and other goods for their use as inputs in production (like fertilizers and tractors).[23]

All of these goods can be incorporated within our earlier model. What one needs to do is to interpret Q as a vector, of which an element Q_i represents the net supply of this (ith) good to the outsiders. Q_i is positive

or negative, depending on whether peasants are net sellers or buyers of this good. For those goods which are produced and utilized solely within the agricultural sector, Q_i is zero. We assume that the government can influence the prices of only those goods which cross the border between the two sectors.[24] Stated differently, the taxation of those goods for which Q_i is zero is not feasible.[25]

Naturally, p, P and t are now vectors. From (3) and (7) one can obtain a characterization of the optimal prices.[26] For a unique interior optimum, the optimal prices are solutions to the following set of equations.

$$(16) \qquad \sum_j (P_j - p_j) \frac{\partial Q_j}{\partial p_i} = (1 - \frac{\beta^1}{\delta}) Q_i \ ,$$

where i = 1,..., denotes various goods, and the sum is taken over all goods except the numeraire. The above expression can be alternatively stated as

$$(17) \qquad \sum_j t_j \varepsilon^U_{ij} = [1 - \frac{\beta^1}{\delta} - \sum_j (P_j - p_j) \frac{\partial Q_j}{\partial M}] \ ,$$

where $\varepsilon^U_{ij} = \frac{\partial \ell n \ Q^U_i}{\partial \ell n p_j}$ is the elasticity of the compensated net supply of good i, with respect to the price of good j;[27] and $\frac{\partial Q_j}{\partial M}$ is the response of the net supply of good j with respect to a (hypothetical) lump sum transfer of income to a peasant.

Expression (17) generalizes the Ramsey tax rule to the context in which individuals are simultaneously producers, consumers and traders.[28] Heuristically, it states that the percentage change due to pricing in the (compensated) net supply of each good with which the agricultural sector deals should be the same; regardless of whether the good is a surplus consumption

good, a purchased farm input, a farm output to be sold as an industrial input, or a good which serves several different purposes.

Now consider a somewhat hypothetical situation in which the cross price effects on the uncompensated net supplies are negligible. Denoting the uncompensated elasticities as $\varepsilon_{ij} = \frac{\partial \ell n\ Q_i}{\partial \ell n\ p_j}$, and assuming that $\varepsilon_{ij} = 0$ if $i \neq j$, expression (16) implies

$$(18) \qquad t_i = (1 - \frac{\beta^1}{\delta}) \frac{1}{\varepsilon_{ii}} .$$

That is, the optimal pricing rule obtained in the simpler case of one aggregate agricultural good, (12), holds in the present case for each of the goods traded by peasants.

The above expression provides some useful insights into the problem of pricing. What (18) says is that <u>if cross price effects are negligible, and if the own price elasticity has the same sign within a category of goods, then each member of this category should have the same sign of tax</u>. That is, if one good in the category is taxed, then all goods should be taxed; or, if one good in the category is subsidized, then all goods should receive a subsidy.

Consider, now, the category of goods consisting of agricultural production inputs which peasants buy from outside, like fertilizers and tractors. In the standard case of a farm household facing a fixed rural wage, we know that $\varepsilon_{ii} < 0$ for all production inputs. In the present case, there is an indirect effect of prices on the rural wage (or imputed wage) which in turn might affect the quantity of input. For the standard sign to be reversed, however, the indirect effect would have to be not only positive, but also large enough so that it dominates the standard effect. Assume for a

moment that this is not so, i.e., the direct own price effect prevails. The expression (18) then implies that, in the normal case, all purchased agricultural inputs should be priced higher than their international prices.

A similar argument applies to the category of goods which peasants produce solely for selling them to outsiders (like rubber and fiber products). In this case, $\varepsilon_{ii} > 0$, provided the indirect price effect (through wage) does not reverse the direct response. Then, in the normal case, the prices of goods in this category should be lower than their international prices.

What is additionally interesting about the above results is that they do not depend on what income distribution exists within the agricultural sector, provided the induced price effects are not significant.

The above results are important not because we believe that the cross price effects are negligible, or that the indirect effects of price changes are either negligible, or are of a nature that the standard responses are preserved. These results are important because we have isolated the reasons why the sign of taxes might differ among goods belonging to specific categories. By the same token, if these reasons do not exist then, for many goods, we can prescribe what the sign of taxes should be.

Specifically, we often see in practice that the above prescriptions are violated. For example, we find that a fertilizer is being subsidized, while a pesticide is being taxed, or vice-versa. Or, that cotton is being subsidized while jute is being taxed. It is obvious from our analysis that the justification for such taxation must lie in the presence of large cross price effects or in the presence of such induced effects (through rural wage changes) that the standard price responses are reversed. If it is found from

empirical analysis that such is not the case, then a violation of the above prescriptions would suggest that the existing tax structure is not optimal and that it can be improved upon.

This analysis also raises some doubts on an oft given advice that, on the grounds of equity, some agricultural inputs (like tractors) should be taxed since they will be used primarily by rich farmers, while other inputs (like fertilizer) should be subsidized since they could be used by poor as well as rich farmers. The above analysis suggests that such policies might not be justified on the ground of equity alone; the primary justification for them should come from the importance of cross price effects and of the effects of prices on rural wage.[29]

C. Allocation of Public Investment

An important part of policy making in the early phases of economic development is the decision on how investment (and public goods creation) should be allocated between the two sectors. Though a full discussion of this allocation problem will take us too far afield, a few comments might be useful. First, recent development experiences have shown that the capital allocation decisions need to be visualized in broader terms than the simple choice between industrial plants versus tractors; as it was in much of the earlier literature on economic growth.[30] One needs to consider public investment in human capital formation, in raising land's productivity, in technology development, and in fostering the adoption of newly developed inputs and techniques.

Second, it is apparent that many of the possible public investments in the agricultural sector do not require a shipment of industrially produced

goods to the agricultural sector, but in fact entail creating public goods (such as irrigation and transportation networks) using inputs drawn primarily from this sector itself.

Formally, the model with disaggregated goods presented earlier is easily enlarged to incorporate the production and the allocation of investment goods. What we need to specify additionally is the extent to which (and the mechanism through which) the government collects fees from the potential beneficiaries of public investments. As an example, we need to know what the irrigation water charges are, and whether they depend on the quantity of water used or whether they are flat fees depending on the proximity of users to the water source. At a more general level, of course, the choice of fee schedules for the use of publicly created goods should in itself be determined concurrently with the pricing and the investment allocation policy.

The nature of pricing rules would not, however, undergo a substantial revision in the presence of allocation decisions, except that they would now correspond to a situation in which public investments are optimally allocated and also that the pricing rules will now include their effects on the revenue collection from public fees. For example, in the basic model, if the government allocates the capital good to the two sectors, then the expressions (8) and (9) continue to represent the optimal pricing rules, provided there is no public fee.[31]

D. International Trade Environment

Some researchers, like Newbery (1972), have argued that the correct model to describe the present-day LDCs is that of a small open economy. This might be a rather extreme position, since the access of many LDCs to specific trade

markets is often limited (a fact reflected in the routine bilateral and multilateral quantity negotiations, like those between EEC and LDCs). Also, the objective of self-sufficiency is prevalent in many economies, and this objective is often reflected in restrictions which are imposed on the quantities of certain imports.

A better approach, therefore, is to examine the issue of pricing within a general framework in which the sensitivity of pricing decisions to the characteristics of the international trade environment can be explicitly assessed. This is what we have attempted to do in Sah and Stiglitz (1983b). For brevity, however, we limit ourselves here to a discussion of certain limited aspects of this more general approach.

Self-sufficiency Objective: Suppose that the government wishes to achieve a certain degree of self-sufficiency in the agricultural good (a self-sufficiency objective for industrial good can be treated in parallel manner). One way to express this objective is as a constraint that the quantity of food imported can not exceed a certain pre-specified fraction of its urban consumption. Obviously, such a constraint influences pricing decisions only when it is binding. But once it is binding, the two prices (p and q) can not be varied independently of one another.

Further, the self-sufficiency objective may result in higher food prices for both the peasants and the city-dwellers. This is because the government, with self-sufficiency in mind, may use the price policy to increase the surplus from peasants, and also to curtail urban food consumption. In this case, then, peasants would be relatively better-off, and the city-dwellers relatively worse-off, compared to a situation in which there are no self-sufficiency objectives.

Foreign Sales Constraints: Quantity constraints on a country's exports can be treated in a manner similar as above. We need to consider only those cases in which the foreign sales constraints are binding. If the agricultural good is being exported, then a constraint on its foreign sale might lead to a lower (optimal) price to both the peasants and the city dwellers, since one of the reasons to pay a higher price to peasants, and to charge a higher price from city dwellers, is to increase the export quantity of this good. This reason does not exist any more when the foreign sales constraint is binding.

Non-Traded Goods: Many of the goods discussed earlier are non-traded goods, such as infrastructure and inputs into human capital formation. In addition, a large number of ordinary consumption and industrial goods produced in LDCs have virtually no international markets, because of their low quality, even though these goods are traded domestically.[32] In fact, many of these goods do not have a market even in the intra-LDC trade. For the purpose of policy making, therefore, these goods must also be viewed as non-traded goods.

The treatment of a traded versus a non-traded good entails a difference which is conceptually simple. The shadow price for a traded good is its international price, whereas the shadow price of a non-traded good is determined endogenously (and contemporaneously with the determination of optimal prices) based on its social scarcity value.[33]

Despite this difference, our earlier discussion of the qualitative properties of optimal taxation remains valid for non-traded goods as well. For traded goods, we had defined taxes as the differences between the international prices and the prices faced by consumers and producers. Taxes for non-traded goods can be defined correspondingly with respect to the shadow prices. This redefinition, however, does not change the expressions for the

optimal tax rates. Our discussion on taxation thus holds for non-traded goods as well.[34]

E. Migration and Unemployment

Recent development economics literature has focussed on the importance of labor mobility across sectors. In particular, it has been pointed out that migration from the agricultural to the industrial sector might increase industrial unemployment indirectly, because only some of the migrants can find industrial employment. This possibility has important consequences for public policy. The following extension of the basic model incorporates some of these consequences in the context of pricing.

Consider three population groups: peasants, industrial workers and unemployed workers. One would expect that, for those peasants who are net sellers of food, a lower rural food price will decrease the attractiveness of living in the agricultural sector, compared to living in the industrial sector. The same effect would arise if the urban food price is lower. Further, if peasants are migrating to the industrial sector, for one reason or another, then the level of unemployment in the sector will increase which, in turn, will discourage further migration.

The modification required in the analysis of pricing policy, then, is that we need to calculate the consequences of the induced migration. First, we need to redefine the elasticity of agricultural surplus to take into account the fact that the rural population itself is sensitive to prices. Second, an outward migration from the agricultural sector reduces the population pressure (congestion) on agricultural land which, in turn, increases the welfare of those living in this sector. Also, a change in the congestion influences the government revenue from taxation by affecting the

quantity of the marketed surplus. Third, migration has direct welfare effect as well, since workers move from one group to another which, in general, have different levels of utility.

In a highly general model of migration which we have proposed elsewhere,[35] the formula for the optimal rural food price is obtained as[36]

$$(19) \qquad p = \frac{P + \phi}{1 + (1 - \frac{\beta^1}{\delta}) \frac{1}{\hat{\varepsilon}_{Qp}}}, \text{ where}$$

$$(20) \qquad \hat{\varepsilon}_{Qp} = \frac{\partial \ell n(N^1 Q)}{\partial \ell n p}$$

is the redefined price elasticity of agricultural surplus (taking into account the effect of price on rural population), and ϕ represents the welfare effects of price-induced migration.[37] Under plausible circumstances, it appears that $\hat{\varepsilon}_{Qp}$ exceeds ε_{Qp}, and that ϕ is positive.[38]

Now compare the above expression for the optimal price, (19), to the corresponding expression (8) when there is no migration. The effect of migration in the normal case is to increase the numerator and decrease the denominator. Heuristically, this implies that the effect of migration is to increase the price paid to peasants for their surplus. This makes some intuitive sense since by paying a higher price to peasants, the government can reduce the pressure of migration to cities and can, thus, curtail the resulting urban unemployment which otherwise will cause loss of society's welfare. This insight appears to be particularly relevant to some cities in LDCs (for example, Bangkok, Cairo and Mexico city) in which the in-migration from the rural sector has led to serious social degradation in urban areas.

In an important special case of the above formulation, migration continues to the point where the expected utility of the marginal migrant

(taking into account the probability of being unemployed) is equal in the two sectors, and where the marginal productivity of a worker in the rural sector is fixed. Then our pricing formula becomes[39]

$$p = \frac{P}{1 + (1 - \frac{N\lambda^1}{N^1\delta})\frac{1}{\hat{\varepsilon}_{Qp}}}, \tag{21}$$

where recall that λ^1 is the private marginal utility of income to a rural worker.

This has an interesting implication. In the early stages of development, when the social weight on investment is expected to be quite large and when the fraction of the population in the agricultural sector is large, then the price paid to peasants should be less than the international price. But as the economy develops, the price paid to peasants should increase, and it is quite possible that it should even exceed the international price.[40]

F. Organization of The Industrial Sector

Public Control in Industrial Sector: Though we have assumed thus far that the government can exercise direct control in the industrial sector, our analysis remains essentially unchanged even if the industrial sector is decentralized. Consider, for example, an industrial sector consisting of public sector firms. If the government instructs its public sector managers to maximize profits (based on whatever prices they face) then the optimum described earlier can be implemented in a decentralized manner by setting excise taxes at appropriate levels.

The same approach also holds, with slight modification, in an industrial sector consisting of both private corporations as well as public sector

enterprises. In this case, the main additional effect one needs to consider is the impact of pricing on the tax revenue from private corporations, and on the allocation of post-tax profits of these corporations. In the polar case in which 100 per cent profit tax is imposed on private corporations, our earlier formulae apply without any change.

Determination of Industrial Wage: Clearly, our earlier assumption that industrial wage is fixed (in terms of industrial goods) was made solely for simplicity. There are many hypotheses in the literature concerning industrial wage determination. Some recent hypotheses, for instance, have postulated relationship between industrial wages, industrial output and the level of unemployment in the economy. According to these theories, the output of an industrial firm (net of hiring and training costs) depends on the wage that it pays to its workers, since this wage has effects on workers' productivity, quality and turnover.[41] Employers (public or private), therefore, take into account these effects while determining the wages they pay, which in turn determine the level of employment.

Elsewhere, we have developed a unified framework for industrial wage determination which can not only be specialized to many of the new theories (as well as to the traditional approaches to industrial wage determination), but which also takes into account the interaction between the wage setting mechanism and migration.[42] For brevity, we do not present this general approach here and, instead, discuss a few highly special cases.

(i) If the government can control the industrial wage, then (under our assumption that labor supply in the industrial sector is inelastic) a reduction in the optimal wage is equivalent to a lump sum tax. Thus, it is not surprising that the wage should be set such that the marginal social weight on the income of industrial workers equals the social weight on

investment, i.e., $\delta = \beta^2$. Accordingly, there should be no commodity tax in the industrial sector, i.e.

(22) $q = P$.

The formula for the optimal price in the agricultural sector remains unchanged.

(ii) Suppose that the trade union demands are such that they impose a constraint on the level of welfare which the government provides to its members; that is, unions do not suffer from money illusion; they know that an increase in the price of food represents a worsening of their welfare in the same way that a reduction in their wage would. Then, Pareto optimality entails the government lowering (or raising) w to satisfy the union demand, while maintaining (22) for pricing. The substitution of a lump sum tax for equal utility distortionary tax generates increased revenue for the government.

(iii) Alternatively, if the wage productivity hypothesis holds, that is the wage rate affects workers' productivity, then efficiency may entail paying high wages in the industrial sector, and also real wages may be relatively insensitive, for instance, to the unemployment rate. In the existing models based on wage-productivity effects, relative prices are taken as fixed; but here, we are concerned with the determination of relative prices. A natural hypothesis then is that the productivity of a worker is a function of his wage as well as the relative prices he faces. That is[43]

(23) $Y = Y(q, w)$.

In this case, the government will take into account the fact that as it increases q, productivity will decline; this will decrease the optimal price in the industrial sector. The optimal price is given by

$$(24) \qquad q = \frac{P}{1 - (1 - \frac{\beta^2}{\delta} + b)/\varepsilon_{xq}},$$

Where, $b = \frac{\partial Y}{\partial q}/x^2 < 0$ captures the effect of price on output.[44] Not surprisingly, if we can control both industrial wages and prices, we again do not want to impose a distortionary tax in the industrial sector, but we do want to take into account the effect of an increase in income on the productivity of industrial workers.

V. REMARKS AND DISCUSSION

Though we have analyzed many important extensions, they clearly do not represent the entire range of circumstances one might encounter in different countries. But, then, an analytical study of the present kind - with its emphasis on identifying critical trade-offs - is probably not the best approach to examine every possible detail. What we do in this section, therefore, is to take another look at the assumptions made in this study, and to see how the qualitative features of the analysis might change if these assumptions are modified. At the same time, we point out some of the important questions we have not addressed in this paper.

Structure of the Economy: The major components of the economy in our analysis are: the organization of the agricultural sector and the industrial sector, the migration mechanism, and the international trade environment.[45] As regards the agricultural sector, we began our analysis with a basic model

consisting of homogeneous land-owning peasants, which we then generalized to heterogeneous land ownership, and an endogenous determination of agricultural wage.

The formula which we obtained earlier for the heterogeneous agricultural sector [expressions (8) and (14)] also applies to other forms of organization within agriculture. For example, in a sharecropping agriculture, all we need to do is to interpret Q^h as the net surplus of an individual after paying the landlord's share, or after receiving the share from the tenant. Further, if the share contract is endogenously determined, then the individuals' surplus elasticity will be based in part on the elasticities of equilibrium shares with respect to price.

Another aspect of sectoral organization which deserves our attention is the internal composition of households. This aspect, though ignored in much of the standard tax literature, is highly important since we know that the households in any economy have heterogeneous demographic characteristics. Its significance in LDCs should be obvious; not only do we observe that extended households constitute an important institution, but also we find that often there are systematic differences in the demographic characteristics of households in different regions (rural and urban, for example), and in different income groups. Its primary implication on pricing formulae, like (8) and (14), is as follows. The social weights β^{ih} would now be determined not only by the income of the households and by the social aversion to inequality, but also by the demographic composition of the households. Moreover, the computation of households' response to prices would now be based on a model of households which explicitly takes into account the intra-household allocation.[46]

Rigidities in the Economy: The particular rigidity on which we have

focussed is the one in the labor market. Our approach posits that the wage has an effect on the output (through labor productivity and other effects), and that migration decisions are based on expected utility (which includes a probability of remaining unemployed). The equilibrium market wage (that is, the wage which employers would pay at their optimum) is, therefore, such that there is unemployment.

An important consequence of this approach is that the market wage would change if the tax policy changes (as we explained earlier, our use of the assumption of fixed industrial wage in many parts of this paper is solely for brevity in exposition). A related consequence is that the government would not, in general, be able to eliminate unemployment through taxes and subsidies.[47]

Two other points concerning rigidities are as follows. First, an obvious extension of rigidity in the labor market is to some other markets (of goods and factors) which do not clear. This, of course, has been an issue of study in the recent literature on temporary Keynesian equilibria,[48] and it might have significant implications in the context of taxation and pricing in LDCs.

Second, our present analysis has abstracted from the possibility that the adjustments in the economy, particularly in the labor market, might be lagged. In such a case, there are possible intertemporal consequences of taxation policies, and a myopic taxation policy (based on this period's consequences alone) might be different from the one in which the dynamics of adjustment is taken into account.[49]

Feasibility and Efficacy of Tax Instruments: Often there is a tendency among policy analysts to borrow results from the standard tax literature and prescribe them to LDC conditions, without examining the premises of the former. Such an approach overlooks what we consider to be a fundamental

difference between LDCs and industrial economies, namely, which tax instruments can the government use, and which instruments it can not use. Furthermore, among the central issues which the recent tax literature[50] has attempted to understand are: (i) what are the constraints on the government's ability to tax, (ii) how are these constraints related to the information and transaction costs, and (iii) how are these constraints related to the design of tax policy.

In the context of peasant agriculture, for example, it is virtually impossible to tax labor input. This inability to tax can be viewed as an information problem: though the concept of labor income is a perfectly well defined economic concept, a tax system must be based only on those variables which are quantitatively ascertainable by an outside party. The importance of this constraint can be seen in the following.

Our formulae seem to contradict the oft quoted result of Diamond and Mirrlees (1971) that the producers' prices should be the same as the shadow prices. Any rural tax or subsidy, that is any difference between p and P, violates this result. How do we reconcile our results with theirs?

The answer is quite simple. The Diamond-Mirrlees model assumes that the government can levy taxes on all factor inputs. In contrast, as we argued above, a labour input tax is nearly impossible to implement in LDCs. As a consequence, the Diamond-Mirrlees result does not hold in the present case; it is incorrect, therefore, to borrow this result out of its context and use it as a basis for agricultural pricing.

There are other differences as well between the policy problem examined in this paper and the standard tax literature. First, as we pointed out earlier, it is quite difficult to implement different producers' and consumers' prices for food in the peasant sector (since peasants are both

consumers and producers), unlike in the standard tax model in which the government can differentiate between the two sets of prices.

Second, all consumers face the same price in the standard tax model, whereas we have analyzed in this paper an economy in which the city dwellers face different prices from what peasants face. The case where the government can not (or does not wish to) maintain a tax border between the agricultural and the industrial sectors can be analyzed in a parallel manner; the detailed results would obviously be different.[51]

Third, all profits are taxed away in the standard tax model. Its counterpart in the agricultural sector implies that the government can impose a 100 percent tax on land rent. For obvious reasons (e.g., government's inability to distinguish returns from land and labor), such a tax is rarely imposed.[52]

The issue of land tax, in fact, provides a good example of the constraints on tax instruments. This tax has been most highly recommended by conventional theory since David Ricardo.[53] A major constraint on the use of land tax, however, is as follows. If land tax is based on land area, irrespective of quality, then it is viewed as unfair. On the other hand, basing land tax on land quality is inherently difficult, since the effect of land quality from that of other inputs is not easily disentangled. It is not surprising therefore that negligible use is made of the land tax in most of today's LDCs and, moreover, its use has steadily declined over time (probably because the use of coercion required to administer such a tax is less feasible today than it was in earlier times).

More generally, what we have attempted to argue here is that for a tax analysis to be relevant, it must be based on only those instruments which are feasible, which in turn depends on the information and transaction costs which

different instruments entail. In particular, it should not be surprising that much of the taxation in LDCs is based on indirect instruments and, indeed, it is these instruments which should form the core of analysis in developing economies. Further, these economies often employ a variety of non-price instruments (such as various kinds of rationing and queuing schemes) which have yet not been investigated sufficiently in the public economics literature.[54]

Taxation and the Use of Markets: A key characteristic of most tax instruments is that the tax is actually imposed on the (formal) market transactions (for example, on a consumer's purchase of a good from a trader, or an employer's payment of wage to his employee). What is often ignored in the conventional tax analysis is that transactions also take place (to varying degree) outside the formal market in which middlemen's services are employed to a substantially lesser extent.

The formal market is costlier than the informal market since it entails middlemen's cost, but the former also economizes on large transactions. Clearly then, the use of markets would shift from one to another depending on the tax policy. Moreover, this shift would be different for different individuals; this in turn, has efficiency and equity effects which have thus far not been examined in the literature.

This issue is important in LDCs for at least two reasons. First, a large proportion of transactions take place informally because formal markets are often nonexistant in many areas (due perhaps to the small size of transactions). Second, the widespread prevalence of corruption and tax avoidance can be viewed as an additional division of the formal market into a regular and an irregular (underground) market. The latter market, while economizing on transactions and entailing middlemen's costs, avoids taxation,

often with the connivance of the tax bureaucracy. Presumably, however, it has some disadvantages over the formal regular market, otherwise everyone would switch to the irregular market and no tax revenue would be collected. Clearly, then, a full analysis of taxation in LDCs needs to take into account the shifts among these various markets.

Political Economy of Pricing and Taxation Often the most important rationale which governments provide for their pricing policies is the redistribution from rich to the poor. On the other hand, actual public policies sometimes seem to do just the opposite. This apparent contradiction raises some issues which need to be clarified.

Assume, for a moment, that redistribution is indeed a key government objective. A basic question we then need to answer is: how much redistribution is possible, given a set of policy instruments? Note that this is a positive question rather than a normative one, and that it can be posed quantitatively by devising several possible ways of measuring redistribution.

Much of the tax literature has focussed on a normative question, namely, what are the analytical properties of optimal redistributive taxes, given a set of tax instruments. Surely, this is an important question and its answer, as is well known by now, depends on the society's aversion to inequality and on the nature of responses of individuals.

An exclusive concern with the latter question, though, can create an incomplete picture. Suppose it turns out that very little redistribution can be achieved, say, through pricing of goods (which happens to be the only instrument a government can employ). Then, the discourse on tax policy is modified in at least two ways. First, the redistributive objective of government loses its practical consequence (given the set of available

instruments), since very little redistribution can be achieved regardless of what the stated objectives of the government are.[55] By the same token, it becomes clear that if the government indeed wants redistribution, then it must enlarge the set of instruments.

The question of how much redistribution is possible has been examined by Sah (1983) in the context of a simple model with heterogeneous individuals, in which the only instruments available to the government are taxation (pricing) of goods. The analysis shows that, under certain plausible conditions, the redistribution that can be achieved is meager. The analysis clearly needs to be extended to more general models such as the present one, in which not only do consumer groups face different prices but also there are significant rigidities in the economy.

Now, assume that redistribution is not the objective of taxation; instead, taxation is used by the more powerful groups in the society for their own advantage. It is obvious that the analytical apparatus developed in this paper applies to this case as well. For example, if the city dwellers control the political system and they maximize their own welfare, then the prices they will set will correspond to the formulae we developed earlier, where the social weight on income of peasants is set at zero.

Empirical studies have hitherto not provided much guidance on which one of these two polar assumptions concerning the government's objective is more correct or what particular combination of these two cases is most realistic. More casual observation suggests nevertheless that the latter objective (in which tax policies are employed by some groups against others) might be playing an important role.

Some of the most important historical conflicts, for example, have been associated with one group of individuals attempting to use discriminatory

policies against other groups. Among the landmarks are: the conflicts associated with corn laws in England, the discord between the North and the South in the United States leading to the civil war, and the conflicts between the advocates of peasants versus those of industrial workers in the pre-collectivization USSR.

It is quite plausible, then, that the domination of one group by another is an important factor determining present-day pricing policies (specially in countries with significant regional specialization in crops). Therefore, whether an analysis such as the present one would serve to improve the equity and efficiency in an economy, or whether it will used by some groups of people to discriminate against others, is a question of some concern to us.

FOOTNOTES

1. Pricing and taxation of goods appear to be, by far, the most important policy instruments employed by the governments in LDCs as well as in many socialist economies. For some details on the magnitudes involved, see Bale and Lutz (1979).

2. There is a long tradition, cutting across ideological boundaries, of viewing the agricultural sector as the desirable source of public revenue. In the Marxist tradition, this approach was advocated by many leaders of the October Revolution in what came to be known as the "Soviet Industrialization Debate". Our paper on price scissors (1984) clarifies and corrects a number of positions advanced in this debate and it also analyzes the issue of price scissors in the context of present day LDCs. In the classical laissez faire tradition, on the other hand, the agricultural sector has been viewed as the ideal source of public revenue ever since David Ricardo claimed that the land tax is the best form of taxation.

3. Economists are typically reluctant to deal with so-called "non-economic" objectives such as self-sufficiency. The fact of the matter is that in many countries (for example, in India and South Korea), a drive towards self-sufficiency is an unambiguously stated national policy. A useful approach, therefore, is to include these objectives in policy analysis, while also pointing out the economic costs of pursuing such objectives.

4. Among other objectives are, for example, to stabilize prices faced by

consumers and producers [see Newbery and Stiglitz (1981)], and to redistribute income away from middlemen towards consumers and producers.

5. Price intervention is extremely widespread in industrial economies too. Some of the bitterest controversies among the EEC members, for example, arise due to their disagreements on farm pricing policies. Many of the objectives of these governments are similar to those discussed earlier, but some of them are different. The U.S. government, for example, sometimes pays its farmers to reduce their output.

6. Despite the importance of these questions, they have not received much attention in the literature. Among the exceptions are Dixit (1969, 1971), Dixit and Stern (1974) and Newbery (1974). Also, some researchers have analyzed agricultural pricing using approaches based on consumer surplus; for example, Tolley, Thomas and Ming (1982). See Sah (1982b) for a discussion of the limitations of this approach.

7. We are abstracting from migration and capital flows. With migration, as we shall see later, the utility of the peasant is also a function of the number of peasants in the agricultural sector. If there is capital flow, then the utility is also a function of the interest rate at which they can borrow and lend.

8. See Sah and Stiglitz (1984) for a brief discussion of this evidence.

9. This assumption can be easily relaxed by modelling endogenously determined labor hours.

10. Here we assume that the quantities of the agricultural and industrial goods traded with the rest of the world change in response to the change in domestic prices. The situation in which this is not the case can be worked out according to the methodology developed in Sah and Stiglitz (1983a).

11. To see this, obtain the following from (3). $\frac{dI}{dp} = N^1 Q[\frac{(P - p)}{p} \varepsilon_{Qp} - 1]$. Then, $\frac{dI}{dp} > 0$ if (4) holds.

12. From (3), $\frac{dI}{dq} = - N^2 x^2 [\frac{(q - P)}{q} \varepsilon_{xq} - 1]$. Then, $\frac{dI}{dq} < 0$ if (5) holds.

13. W is increasing and concave in V. H is the Hamiltonian giving the instantaneous value of the time discounted additive social welfare.

14. The expressions (8) and (9) are the first order conditions of optimality with respect to p and q. To obtain these we have made use of workers' budget constraints and of the investment equation (3). Also, we have used Roy's formula:

$$\frac{\partial V^1}{\partial p} = \lambda^1 Q \text{ , and } \frac{\partial V^2}{\partial q} = - \lambda^2 x^2 .$$

Clearly, one needs to verify that the second order conditions are satisfied; they can not be taken for granted [see Atkinson and Stiglitz (1980, p. 374)]. An internal optimum might be particularly problematic for q, since it requires (in the present model) $\beta^2/\delta > 1 - \varepsilon_{xq}$, which need not be satisfied, for example, if $\beta^2 \to 0$, and $\varepsilon_{xq} < 1$. In part,

this unrealistic possibility arises because (for simplicity) we have not as yet taken into account some important constraints, such as those due to the wage-productivity relationships. We return to this issue later.

15. These and other conclusions presented in this paper hold at any point in time. A separate issue is to trace the time path of prices and other variables; this is beyond the scope of the present paper.

16. Recall, however, that the choice of peasants' labor hours is endogenous in the present problem, and also that the value of their output is influenced by a change in p. These elasticities, ε_{Xp} and ε_{xp}, therefore, are not the standard partial elasticities.

17. In Pigou's formulae, the magnitude of the tax rate is proportional to $\frac{1}{\varepsilon_{Xp}} + \frac{1}{\varepsilon_{xp}}$. See, Atkinson and Stiglitz (1980, p. 467).

18. See the reference cited in the last footnote.

19. Differences in the ownership of assets other than land can be incorporated by building in the markets for these assets. Also, we consider here a single type of agricultural labor. Its generalization to a multitude of skill types is straightforward.

20. The sum of weights in the numerator adds up to the denominator since, from the rural labor market clearing condition, $\sum_h \ell^h = 0$. Obviously, $\ell^h = 0$, in the special case in which everyone is identical.

21. See the weights proposed by Feldstein (1972), Diamond (1975) and Atkinson and Stiglitz (1976). The difference arises because these papers assume that the government can impose wage taxes, so the wages received by individuals need not depend on commodity taxes.

22. Further, by contrasting (14) and (15), note that the wage elasticity term does not appear in (15). This is simply because at present we are assuming that industrial wages are fixed. In more general models, such as those discussed later in Section IVF, there would be wage elasticity terms in the expressions analogous to (15).

23. At present we are abstracting from the differences between capital inputs and intermediate inputs and between traded and non-traded goods. We return to these issues later. Also, note that the same good sometimes belongs to more than one category; for example, tractors are employed in agricultural production as well as in personal transportation.

24. In practice, there are some ambiguities in the precise geographical definition of such a border, since agricultural activities are sometimes undertaken on the fringe areas of cities which fall under cities' tax jurisdiction.

25. This somewhat overstate the constraints on the government. The government can (and frequently does) attempt to impose taxes and marketing controls on intrasectoral transactions. One of the implications of such intervention is to encourage individuals to avoid making use of formal markets, so that the taxes can thus be avoided.

This implication is discussed later in Section V.

26. In (3), Y would now denote the value of the entire set of industrial outputs, measured at the international prices. Also, the numeraire good here is any one of the pure consumption goods produced in the industrial sector, of which the quantity consumed by a peasant is y^1. The expansion of x^2 and q as vectors should be obvious.

27. The superscript U denotes that the quantity under consideration is a compensated quantity. The Slutsky relationship in the present context is $$\frac{\partial Q_i^U}{\partial p_j} = \frac{\partial Q_i}{\partial p_j} - Q_j \frac{\partial Q_i}{\partial M} .$$

28. It can be further extended to deal with the intra-sectoral income distribution by following the approach discussed earlier.

29. Obviously, one also needs to take into account the functioning of credit markets. In the presence of a rental market for agricultural machinery, however, it is not obvious that the conclusions advanced here would be necessarily changed.

30. In fact, much of the growth economics literature focussed exclusively on the industrial sector, implicitly ignoring the possibility of investing in the agricultural sector. [Among the exceptions are: Dixit (1969), Newbery (1972) and Stern (1972)]. The prevalent notion in these approaches was that the potential for investment in agriculture is small, if not negligible, compared to that in industry. Such a view is

apparently not supported by the historical experience. Kuznets (1961), among others, shows that the investment in agriculture was in fact larger than that in industry in certain phases of the development of the present-day industrial economies.

31. Some other consequences of pricing are also worth noting. For example, if some of the investment goods in the agricultural sector are non-traded goods produced within the agricultural sector (such as labor intensive road construction), then the government would have to take into account the effect of its pricing of agricultural inputs and outputs on the costs of such investment goods. Similarly, if some of the investment decisions are made by peasants, and if the government's evaluation of the benefits from these decisions differs from that of the peasants, then the government would have to take into account the impact of its pricing policies on these private investment decisions.

32. The importance of quality differences, though obvious to those who buy and sell goods, has not received sufficient attention from economists, particularly in the context of policy making. In the extreme case, there are countries (like Nepal and Bangladesh) in which most of the potentially tradeable consumer goods are of sufficiently low quality that there is virtually no external trade in them. If, in addition, it happens that these countries face foreign sales constraints in other tradeable goods (like primary agricultural commodities), then the actual traded quantities would be nearly insensitive (at the margin) to pricing policies. In determining optimal prices, therefore, such countries must necessarily be treated almost like closed economies.

33. Specifically, those elements of the vector P which correspond to non-traded goods, will be replaced by the vector η/δ, where elements of the vector η are the Lagrange multipliers to the market clearing conditions of different non-traded goods.

34. Further, those non-traded goods which are not taxed are treated in the same manner as agricultural labor which, of course, is a non-traded, non-taxed commodity.

35. In Sah and Stiglitz (1983a, 1983b), we develop not only a general model of migration but also a general model of industrial wage determination. These models can be specialized to various hypotheses concerning migration (such as no migration, free migration with no unemployment, and the Harris-Todaro migration hypothesis in which the expected utility of the marginal migrant is equal in the two sectors), and to alternative hypotheses concerning industrial wage determination (such as the conventional hypothesis of marginal productivity, and those hypotheses which entail wage effects on labor productivity, labor quality and labor turnover).

36. In (19), the industrial wage is fixed in terms of industrial goods. Also, the level of industrial employment is fixed, since it is derived from an equalization of the wage and the marginal product of labor. These assumptions are being made here solely for brevity, as should be obvious from the previous footnote. Further, for simplicity, we have ignored the consumption of unemployed workers.

37. $\phi = [W(V^1) - W(V^u) - \beta^1 p X_a a] m_p / \delta Q \hat{\varepsilon}_{Qp}$,

where V^u is the utility of an unemployed worker, a is the agricultural land per peasant, $X_a = \frac{\partial X}{\partial a}$ is the marginal output (per peasant) with respect to a, and $m_p = \frac{\partial \ell n N^1}{\partial \ell n p}$ is the elasticity of rural population with respect to the rural price. We assume $V^2 > V^1 > V^u$, i.e., industrial workers are better off than peasants, who in turn are better off than those who are unemployed. We also assume agricultural land is not too congested. Specifically, the last assumption means that aX_a is small, and that $\varepsilon_{Qa} = \frac{\partial \ell n Q}{\partial \ell n a}$ (which is the elasticity of agricultural surplus per peasant with respect to the land per peasant) is smaller than one. Now, note in the expression for ϕ that the square bracket represents the net welfare gain if one unemployed worker migrates to the agricultural sector. This net gain is positive due to the above assumptions.

38. This follows from the previous footnote, and from

$$\hat{\varepsilon}_{Qp} = \varepsilon_{Qp} + (1 - \varepsilon_{Qa}) m_p$$

in which it is assumed that the agricultural population increases if the price of agricultural surplus is higher, i.e., $m_p > 0$. This assumption is automatically satisfied under the Harris-Todaro migration hypothesis which we discuss in a moment.

39. This is the well known Harris-Todaro migration hypothesis. For

simplicity, we assume here that the social welfare function is utilitarian, i.e., $\beta^1 = \lambda^1$. The main implication of the Harris-Todaro hypothesis then is that: $H = NV^1 + \delta I$, instead of (7). The corresponding result holds, therefore, in all those circumstances in which the government is concerned with the rural welfare alone.

40. Pricing in the industrial sector in the presence of endogenous migration can be analyzed in the same manner as above. Also, it is worthwhile noting here that the rules of price reform derived earlier in the paper hold with some modifications in the present case as well. For example, the rule for reform in rural price, (4), holds in the present case if ε_{Qp} is replaced by $\hat{\varepsilon}_{Qp}$.

41. See Stiglitz (1976, 1982a).

42. See footnote 35.

43. This representation is consistent with a hypothesis that the productivity depends on the level of worker's utility. It is also consistent with a hypothesis that the productivity may be more closely related to food consumption than to the consumption of other goods.

44. Expression (24) points out that the urban food price should not be increased beyond a point (even if the government does not care about the welfare of industrial workers), since the resulting decline in workers' productivity will make it unattractive to do so. Also, the possibility of a corner solution (in which the optimum urban food price is

excessively high) is remote when effects such as that of consumption on productivity are taken into account (in contrast to the basic model in which these effects were ignored; see footnote 14).

45. See footnote 35 on the extensions in the modelling of the industrial sector and the migration mechanism. Further, in Sah and Stiglitz (1983b), we analyze pricing under a more general international trade environment than the one in this paper.

46. See Sah (1983b) for a methodology for analyzing intra-household allocations.

47. This point has been missed in some of the earlier literature which has concluded that there always exist government policies which would result in an elimination of unemployment. This conclusion, in turn, has sometimes led to a belief that since the government can eliminate unemployment, it would do so. Consequently, unemployment must necessarily be a short run phenomenon which can be ignored in a long run policy analysis. These views are clearly misleading if the endogeneity of wages is taken into account.

48. See Solow and Stiglitz (1968) and Benassy (1975), for example.

49. For example, suppose that the employment in the present period can be substantially reduced through tax instruments but this leads, in the future periods, to a significant difference between the market wage and that wage which would have cleared the market. Leaving the present

unemployment unaltered, on the other hand, leads to market wage clearing the market in the future periods. Then there is a trade-off between the social costs of present high unemployment versus that of distortions in the future periods.

50. Atkinson and Stiglitz (1980) and Stiglitz (forthcoming).

51. This is the problem of price scissors. In this case, there is only one relative price (of agricultural and industrial goods) in the economy. For an analysis of price scissors in a closed economy, see Sah and Stiglitz (1984). Its extension to an open economy is straightforward, as can be seen in Sah and Stiglitz (1983a).

52. In any event, the nature of tax problem remains essentially unchanged even in a hypothetical situation in which land rents could be entirely taxed away. For comments on this issue, see Sah and Stiglitz (1983b).

53. For a modern analysis of some of the classical views on the land tax, see Feldstein (1977).

54. See Sah (1982a).

55. In Figure 1, this would be the case if the economy is already on the utility possibilities frontier, and if the projection of the frontier on the (V^1, V^2) plane is 'small'. Further, the conclusions drawn in the paper would also hold if a significant redistribution requires such taxation (nearly infinite tax rate on luxuries, for example) that the government would not adopt it.

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