The Economics of Price Scissors

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An important policy issue facing many developing countries is that of the appropriate terms of trade between the industrial and agricultural sectors. Traditionally, this problem has been known as the "scissors problem," and it has been typically discussed in the context of a socialist society striving for capital accumulation in the early phase of economic development.[1] Changing the terms of trade has distributional consequences as well. We examine here both the accumulation and the distribution aspects simultaneously.

Our analysis is based upon a simple general equilibrium model of a dual economy, in which the role of incentives in the rural sector is emphasized. Using this model, we describe the effects of altering the terms of trade on the members of the rural and urban sectors, and on the state's surplus. We then extend our analysis to obtain normative results, such as: under what conditions will a change in the terms of trade unequivocally benefit a society; and what is the nature of the optimal terms of trade?

The issues being examined in the present paper are of considerable historical as well as contemporary significance. One of the central concerns of the classical economists was the relative roles of the town and the country in the early phases of economic growth. Probably the best known landmark of this interest was the lively controversy between Thomas Malthus and David Ricardo on the corn laws. These concerns were also recognized, but side-stepped, by Karl Marx.[2]

The town vs. country questions emerged as pivotal, however, on the eve of the October Revolution; so much so that every important Soviet leader had to grapple with it.[3] Furthermore, the economic events of the early 1920's were so severe (see Maurice Dobb, ch. 7) that the state's policy on the terms of trade became a raging controversy in the ensuing debate on Soviet industrialization. A seminal participant in this debate was Evgeny Preobrazhensky, who proposed that the state can, and should, increase its surplus by turning the terms of trade against peasants.[4] This policy of "primitive accumulation" was challenged on a number of different grounds by many members of the Soviet leadership (see Alexander Erlich, 1960). What interests us here about the Soviet debate is that some of our results clarify and correct certain crucial elements of this debate.

Even though the discussions within the USSR itself had subsided with the institution of Joseph Stalin's collectivization policy, the town vs. country problems have remained important in recent decades in many socialist countries, for example, in Eastern Europe

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[1]The term price scissors was used extensively in the Soviet industrialization debate. It denotes the relative price of the industrial (urban) good in terms of the agricultural (rural) good. It is interesting to note that the diagram of the relative movements of the retail prices of agricultural and industrial goods in the USSR, between April 1922 and March 1924, indeed resembles a pair of scissors (Maurice Dobb, 1966, p. 164).

[2]"The Foundation of every division of labour... is the separation of town from country. One might well say that the whole economic history of society is summed up in the movement of this antithesis. However, for the moment we shall not go into this" (1967, p. 472). Marx does not elaborate on this issue in his later writing either.

[3]For example, Nikolai Bukharin (1971), Vladimir Lenin (1975a, b), Evgeny Preobrazhensky (1965), Joseph Stalin (1954), and Leon Trotsky (1971).

[4]Preobrazhensky's verbal model consisted of a peasant sector existing side by side with a state controlled industrial sector. This model, as Avinash Dixit correctly points out (1973, p. 325), can be considered a precursor of the modern models of dual developing economies.

and in the People's Republic of China. Specifically, the past attempts of several socialist economies to achieve direct control of the agricultural sector have not been particularly successful, and these experiences in turn have added greater relevance to the examination of indirect control mechanisms, as, for example, through price incentives.

Similar considerations are relevant in developing economies. In fact, in a typical developing economy, not only does the government have fewer instruments of control, but also the agricultural sector plays a more important role in determining national output and employment. It is not surprising, therefore, that the issue of intersectoral pricing is a central aspect of policymaking in many developing economies.[5] The research on these issues, however, has been surprisingly inadequate.[6] In particular, an analytical examination of the scissors problem has been hitherto lacking, and the present paper is intended to fill this lacuna.

The plan of the paper is as follows. The basic model of the economy is presented in Section I. Descriptive analysis is conducted in Sections II and III. The analysis of normative questions is then taken up. Results on the desirable reforms in the terms of trade are presented in Section IV, and the optimal tax and the optimal terms of trade are discussed in Section V. The model is then expanded in Section VI to incorporate labor mobility and unemployment. Section VII contains some comments on the Soviet industrialization debate. Certain extensions of the present analysis are discussed in Section VIII.

[5]This may also explain why there has been an increasing sense of dissatisfaction with the quantity-based approach of the traditional theories of economic planning. These approaches, originating in the model of G. A. Fel'dman (see Nicholas Spulber, 1964), typically ignore the rural sector entirely, which implicitly means that the government can force the rural sector to deliver the desired amount of food needed for the urban workers, *regardless* of the amount of urban goods the rural sector receives in return.

[6]A significant recent work in this area is by Michael Lipton (1977), in which a history of the town vs. country ideologies is traced. Also, see Dixit (1969), and J. M. Hornby (1968).

I. The Model

The rural sector's population is N^1, and A is the total agricultural land area which is owned within the rural sector. Intrasectoral distribution is ignored, and $a = A/N^1$ is the land area per worker. The term L^1 denotes the hours worked by each worker. The production technology exhibits constant returns to scale, and $X \equiv X(A/N^1, L^1) \equiv X(a, L^1)$ is the output per worker. A rural worker's consumption of the rural and the urban good is denoted by (x^1, y^1). The surplus of the rural good per worker, Q, is given by

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

The relative price of the rural good in terms of the urban good is denoted by p. A rural worker's budget constraint becomes

$$(2) \qquad pQ = y^1.$$

A rural worker's utility is represented by $U^1 = U(x^1, y^1, L^1)$. The indirect utility is obtained from

$$(3) \quad V^1(p, N^1) = \max_{x^1, y^1, L^1} U(x^1, y^1, L^1) + \lambda^1[pX(A/N^1, L^1) - px^1 - y^1].$$

From the envelope theorem

$$(4) \qquad \partial V^1/\partial p = \lambda^1 Q > 0,$$

$$\text{and} \qquad \partial V^1/\partial N^1 = -\lambda^1 p X_a a/N^1 < 0,$$

where $X_a = \partial X/\partial a$, and λ^i is the (positive) marginal utility of income in sector i. It is evident that the rural surplus is a function of the relative price and the rural population, that is, $Q \equiv Q(p, N^1)$. It is also worth keeping in mind that, in our notation, an increase in the size of price scissors, that is, an increase in the relative price of the urban good, corresponds to a decrease in p.

The urban population is N^2, and an urban worker supplies L^2 hours of work which are fixed by the government, based on technological considerations. The urban worker's consumption of the rural and the urban good is denoted by (x^2, y^2), and w is the wage per hour, in terms of the industrial good. The budget constraint of an urban worker is given by

$$(5) \qquad px^2 + y^2 = wL^2.$$

Denoting the urban individual's utility function by $U^2 = U(x^2, y^2, L^2)$, the indirect utility is obtained from[7]

$$(6) \quad V^2(p,w) = \max_{x^2,y^2} U(x^2, y^2, L^2) + \lambda^2[wL^2 - px^2 - y^2].$$

The envelope theorem yields

$$(7) \qquad \partial V^2/\partial w = \lambda^2 L^2 > 0,$$

and $$\partial V^2/\partial p = -\lambda^2 x^2 < 0.$$

Naturally, the urban consumption is a function of the relative price and the urban wage, that is, $x^2 \equiv x^2(p,w)$. The consumption goods are assumed to be normal. The output of an urban worker is denoted by $Y \equiv Y(k, L^2)$, where $k = K/N^2$ is capital stock per urban worker, and K is the total urban capital stock.

The economy under consideration is a closed economy.[8] The sectoral populations are fixed. The total population is N, and

$$(8) \qquad N = N^1 + N^2.$$

The rural quantities cannot be controlled directly, but they can be influenced indirectly through the terms of trade, p. The urban sector is somewhat more controllable, in that the urban wage can be changed by the government.[9]

[7] Individuals' preferences are assumed identical in the two sectors, but the more general case can be easily worked out.

[8] As we discuss later, this is the correct assumption to make for examining the scissors problem. For an analysis of pricing in an open economy, see our 1983b paper.

[9] We discuss other possible instruments of policy, as well as other structures of the economy, in Section VIII.

The two basic constraints in the economy are the quantity balances of the urban and rural goods, respectively. Defining I as the state's surplus of the urban good, we have

$$(9) \quad I = N^2Y - N^2y^2 - N^1y^1; \; I = \dot{K}.$$

That is, the urban output is used either for consumption or for investment. Similarly, the balance between the supply and demand of the rural good requires

$$(10) \quad N^1Q(p, N^1) = N^2x^2(p,w).$$

Finally, note that the above model can be easily expanded to include the possibility of investing the urban capital good in the rural sector. We ignore this aspect because the focus of the present paper is on the analysis of the terms of trade. This analysis in any case remains essentially unchanged, as we will see later, if the investment allocation decision is incorporated.

With the features of the economy described above, we can now begin the analysis of the terms of trade. The next two sections trace the impact of altering the terms of trade on the basic economic variables. Interestingly enough, six decades ago, Preobrazhensky had presented certain important propositions on these matters. Our descriptive analysis ascertains the conditions under which Preobrazhensky's propositions are valid.

II. Preobrazhensky's First Proposition

Preobrazhensky's most important claim was that *the state can increase accumulation by moving the terms of trade against peasants, that is, by increasing the size of scissors*. For ease of reference, we call this Preobrazhensky's first proposition. Naturally, this proposition is quite basic, because it asserts the feasibility of using the terms of trade as an instrument for society's accumulation.

Recall that moving the terms of trade against peasants means a decrease in p. The above proposition thus says: $dI/dp < 0$. To examine the conditions under which this proposition holds, we obtain an alternative expression for the state's surplus. Substitution of (2), (5), and (10) in (9) yields

$$I = N^2(Y - wL^2). \tag{11}$$

The state's surplus is therefore the difference between the urban output and the wage payment to the urban workers, and the surplus does not directly depend on the terms of trade, p.

A change in p, however, requires a change in the urban wage w if the demand and supply balance of the rural good, (10), is to be preserved. To obtain the relation between p and w, we first define some notation. Let $m = wL^2$ be the income of an urban worker,

$$\varepsilon^1_{Qp} = \partial \ln Q / \partial \ln p, \tag{12}$$

$$\varepsilon^2_{xp} = -\partial \ln x^2 / \partial \ln p,$$

and $$\varepsilon^2_{xm} = \partial \ln x^2 / \partial \ln m$$

be, respectively, the price elasticity of the rural surplus, the price elasticity of the urban consumption of the rural good, and the income elasticity of the urban consumption of the rural good. Also, define ε_{wp} as the percent change in the urban wage which must accompany a percent increase in p. That is,

$$\varepsilon_{wp} = \partial \ln w / \partial \ln p. \tag{13}$$

Next, differentiation of (10), and the use of the above definitions yields

$$\varepsilon_{wp} = \left(\varepsilon^1_{Qp} + \varepsilon^2_{xp}\right)/\varepsilon^2_{xm}. \tag{14}$$

The change in the state's surplus due to a change in the terms of trade is then obtained from (11) and (14) as

$$dI/dp = -N^2 wL^2\left(\varepsilon^1_{Qp} + \varepsilon^2_{xp}\right)/p\varepsilon^2_{xm}. \tag{15}$$

In the above expression, the sign of the rural surplus response, ε^1_{Qp}, is not predictable theoretically because this response is a composite of the production response, the consumption response, and the labor supply response. Fortunately, however, several sources of empirical evidence already exist on this subject. Among them are (i) analysis of rural surplus in the Soviet Union during the 1920's (Dobb, ch. 7), (ii) econometric studies of economywide supply response of different crops in many countries, following an early work by Jere Behrman (1968), and (iii) microeconometric studies of farm-household behavior (Lawrence Lau, Wuu-Long Lin, and Pan Yotopoulos, 1978, and Howard Barnum and Lyn Squire, 1979). All of these studies indicate a positive surplus response to price. Based on this evidence, we maintain throughout the paper that

$$\varepsilon^1_{Qp} > 0. \tag{16}$$

Now, looking at the right side of (15), ε^2_{xp} and ε^2_{xm} are positive because consumption goods are normal. Using (16), therefore, $dI/dp < 0$. (In fact, the same result will hold even if ε^1_{Qp} is negative within some range.) Further, note from (15) that a higher ε^1_{Qp} corresponds to a higher magnitude of dI/dp.

We therefore conclude that *Preobrazhensky's first proposition is valid, that is, turning the terms of trade against peasants leads to an increased accumulation.* Also that *turning the terms of trade against peasants leads to a larger increase in accumulation if the price response of the rural surplus is larger.*

The above results need to be contrasted with the assertion made by several authors that increasing the squeeze on farmers through the price scissors may not lead to accumulation if the rural surplus is highly price responsive (for example, Michael Lipton, pp. 129–30, and Ashok Mitra, 1977, p. 54). As shown above, not only is this not correct, but quite the opposite is true!

The main point missed by earlier researchers is the distinction between the rural surplus and the state's surplus, and the distinction between the state's surplus and the consumption of industrial workers. Surely, a decrease in the relative price of the rural good will lead to a lower rural surplus, if the price response of the rural surplus is higher. This in turn will require a higher decrease in the urban demand of the rural good, and the only way in which it can be accomplished is if a higher decrease in the urban real wage is enforced by the government. This higher decrease in the urban wage will then naturally lead to a higher state's surplus.

III. Preobrazhensky's Second Proposition

The economic content of another important claim of Preobrazhensky can be expressed as follows: *by turning the terms of trade against peasants, it is possible to accumulate in a manner that the economic position of industrial workers will not deteriorate.*[10]

This proposition can be expressed in our notation as: $dV^2/dp \leq 0$. From the earlier analysis, it is clear that there are two effects of changing the terms of trade on an urban worker: a direct price effect, and an indirect effect due to the induced change in the urban wage. The total effect is expressed as

$$(17) \qquad \frac{dV^2}{dp} = \frac{\partial V^2}{\partial p} + \frac{\partial V^2}{\partial w}\frac{dw}{dp}.$$

Substitution of (7) in the above yields

$$(18) \qquad \frac{dV^2}{dp} = \lambda^2\left[-x^2 + \frac{wL^2}{p}\varepsilon_{wp}\right].$$

We define $\alpha_x^2 = px^2/wL^2$ as the urban budget share of the rural good, and $\varepsilon_{xp}^{2u} = -(p/x^2)(\partial x^2/\partial p)_{\bar{V}^2}$ as the price elasticity of the compensated demand for the rural good in the urban sector. Using these definitions, the Slutsky expression can be written as

$$(19) \qquad \varepsilon_{xp}^2 = \varepsilon_{xp}^{2u} + \alpha_x^2\varepsilon_{xm}^2.$$

Substitution of (14), and (19), in (18) gives

$$(20) \qquad \frac{dV^2}{dp} = \frac{\lambda^2 x^2}{\alpha_x^2}\frac{\left(\varepsilon_{Qp}^1 + \varepsilon_{xp}^{2u}\right)}{\varepsilon_{xm}^2}.$$

In the above expression, $\varepsilon_{xp}^{2u} \geq 0$ from the standard Slutsky property of compensated demand. It follows from (16) and (20) that $dV^2/dp > 0$. Also note that a higher ε_{Qp}^1 corresponds to a higer dV^2/dp.

Therefore: *the welfare of industrial workers must decline if the state accumulates by turning the terms of trade against peasants. Preobrazhensky's second proposition is therefore invalid.* Also: *turning the terms of trade against peasants leads to a larger decline in the welfare of industrial workers if the price response of the rural surplus is larger.*

The crucial point missed by Preobrazhensky and subsequent researchers is the constraint generated by the demand and supply balance of the rural good.[11] This constraint, (10), dictates the feasible combinations of the terms of trade and the urban wage and, hence, it determines the feasible (as well as the necessary) change in the urban wage corresponding to any change in the terms of trade.[12] This in turn determines the effect of a change in the terms of trade on the state's surplus as well as on the welfare of urban workers.

To recapitulate, we have shown that turning the terms of trade against the rural sector leads to an increase in the state's surplus according to (15), and that it leads to a decrease in the welfare of urban workers according to (20). Finally, the effect of the terms of trade on the rural sector's welfare is given directly by (4). As one would expect, the peasants experience a decrease in welfare if the price ratio is turned against them.

[10] "The objection that taxation on the basis of a definite price policy will affect the wages of workers... is completely futile.... Here is a numerical example: if as a result of an appropriate price policy the working class along with the rest of the population pays to the state industry say 50 million, the state can easily return this sum to the workers by an increase in wages,..." (Preobrazhensky, p. 112).

[11] It is in fact possible that some governments are also ignorant of such a constraint. If this is the case, then a government may decide to lower the relative price of food *without* changing the urban wage. A natural response to the resulting shortage of food in cities would be to introduce an urban rationing system. In turn, then, one could argue that the recurring occurrences of rationing in many economies is consistent with the kind of ignorance suggested above. In any event, a rationing system, whether it is introduced by design or because the government is unaware of the constraints in the economy, entails a different set of instruments than the one on which we focus in this paper. See our 1983b paper for further analysis.

[12] Contrast this to fn. 10, which appears to suggest that the urban wage can be arbitrarily changed along with any given change in the terms of trade.

These three effects are now put together for normative analysis, which is conducted in the next two sections.

IV. Reform in the Terms of Trade

The aim of a policy reform analysis is to identify rules for an improvement in society's overall welfare. Naturally any such rule is more useful if less information is required to apply it. The results in this section are particularly significant from this point of view because, as we shall see, their application requires quite minimal information.

The first step in the analysis of reform is to define the aggregate social welfare. For this, we use an additive Bergson-Samuelson social welfare function, ψ, to aggregate over individual utilities.

$$(21)\qquad \psi = N^1W(V^1)+N^2W(V^2),$$

where W is concave and increasing in V. If δ is the social value of the marginal investment, then the current value of the aggregate social welfare, H, is given by

$$(22)\qquad H=\psi+\delta I.$$

Substituting (11) in (22)

$$(23)\qquad H = N^1W(V^1(p,N^1)) + N^2W(V^2(p,w))+\delta N^2[Y-wL^2].$$

The above expression is now perturbed with respect to p, while ensuring a corresponding perturbation in the urban wage to preserve the identity (10). Using (4) and (7), we obtain

$$(24)\qquad \frac{dH}{dp}=\frac{\partial H}{\partial p}+\frac{\partial H}{\partial w}\frac{dw}{dp} = N^1\beta^1Q+N^2\beta^2\left[-x^2+\frac{wL^2}{p}\varepsilon_{wp}\right] - \delta N^2wL^2\varepsilon_{wp}/p,$$

where $\beta^i=\lambda^i\partial W/\partial V^i$ is the social value of a marginal increase in the income of a worker in sector i. The three terms on the right-hand side of (24) represent, respectively, the welfare gain to the rural sector, the welfare gain to the urban sector, and the loss of investment due to an increase in the relative price of the rural good. Naturally, these gains and losses are weighed by their respective social weights.

Using (10), and the definition of the budget share, α_x^2, (24) can be expressed as

$$(25)\qquad dH/dp = N^2x^2(\beta^1-\beta^2) + N^2x^2(\beta^2-\delta)\varepsilon_{wp}/\alpha_x^2.$$

Note that the above expression clearly separates the two distinct effects of a change in the relative price. The first term is the direct effect of an increase in the relative price of the rural good, which benefits the peasants but hurts the urban workers. The second term is the net effect of the induced increase in the urban wage, which benefits the urban workers but reduces the investment fund.

The expression (25) can now be used to obtain the rules for reform in the terms of trade, that is, the sufficient conditions which will guarantee that a specific change in the relative price will increase the social welfare. Rewriting (25), we obtain

$$(26)\qquad dH/dp = N^2x^2\left[(\beta^1-\delta) + (\beta^2-\delta)(\varepsilon_{wp}/\alpha_x^2-1)\right].$$

Next note from (19) that $\varepsilon_{xp}^2/\alpha_x^2\varepsilon_{xm}^2\geq 1$, because $\varepsilon_{xp}^{2u}\geq 0$. Further, as $\varepsilon_{Qp}^1>0$, it follows from (14) that

$$(27)\qquad \varepsilon_{wp}/\alpha_x^2>1.$$

Substitution of the above in (26) yields the following two rules for reforms:

$$(28)\qquad dH/dp<0,\ \text{if } \beta^1\leq\delta \text{ and } \beta^2\leq\delta$$

(with at least one strict inequality);

$$(29)\qquad dH/dp>0,\ \text{if } \beta^2\geq\delta \text{ and } \beta^2\geq\delta$$

(with at least one strict inequality).

From (28) and (29), we find that: *moving the terms of trade against (in favor of) peasants is desirable if the social weight on investment is greater (smaller) than the social weights on rural and urban income*. Note that this rule holds no matter which one of the two social weights on income is larger. The reason for this is quite simple. If the social valuation of a dollar of investment exceeds the social valuation of a dollar of consumption (in both sectors), then the gains from moving the prices against peasants exceed the losses due to decreased consumption, regardless of which one of the two sets of workers is worse off.

What is important about these rules is that their use does not require the knowledge of the behavioral parameters (such as the rural surplus response, and the urban consumption response). Our rules can be used solely on the basis of the social weights in the existing regime, that is, the social weights associated with a dollar of rural and urban income versus a dollar of investment. The simplicity of these rules is quite unlike the results which one typically finds in the public finance literature (see Anthony Atkinson and Stiglitz, 1980, pp. 382–86, for a recent review of this material).

The procedure for moving the terms of trade in the desirable direction can now be examined. Suppose we are in an initial regime in which the social weight on investment exceeds the two social weights on income. Then, from (28) the relative price of the rural good, p, should be decreased. A decrease in p, from (4) and (20), will decrease the individual utilities, V^1 and V^2, but, on the other hand, it will increase the investment I, due to (15). The social weights on income, β^1 and β^2, will in turn increase since individuals now have lower levels of utility.[13] In contrast, it is natural to expect that the decrease in p will lead to a decrease in the social weight on investment, δ, because the investment has become larger.

Thus, after every small decrease in the relative price, we need to compare β^1, β^2, and δ. The price decrease should be continued until that point when the larger of the two social weights on incomes becomes equal to the social weight on investment. Once this equality arises, any finite decrease in p will violate (28). Thus, we can no longer use the rules of reform, and additional information is needed to facilitate further policymaking. Essentially the same line of reasoning applies for an increase in the relative price if we are in an initial regime in which the social weight on investment is smaller than both of the social weights on income, that is, when (29) holds.

A final point needs to be emphasized here. The above analysis clearly shows that, over a range of social weights, the decision to widen or to narrow the price scissors is independent of the comparison between rural and urban welfare. Instead, this decision depends on the intertemporal comparison between consumption and investment.

V. Optimal Terms of Trade

We are already in a position to recognize some features of the optimal price structure. Assuming that a unique interior maximum exists for our maximization problem, we should have $dH/dp = 0$ at the optimum. The necessary conditions for this characteristic of the optimum can be extracted from (28) and (29). We find that the optimal price structure must satisfy[14]

$$(30) \qquad \beta^1 > \delta > \beta^2, \text{ or } \beta^2 > \delta > \beta^1.$$

In other words, if the social weight on investment does not lie between the social weights on the rural and the urban income, then the regime is not optimal, and it can be improved through price policy. This result needs to be contrasted with a view often held in the literature on project evaluation that

[13] This is because $\partial\beta/\partial V < 0$. To ensure this, we are assuming that either (i) the social welfare function is strictly concave and the marginal utility of income is nonincreasing in income, or (ii) the social welfare function is concave and the marginal utility of income is decreasing in income.

[14] To keep our exposition uncluttered, we are ruling out a rather rare regime in which $\beta^1 = \beta^2 = \delta$.

the social weight on investment should be higher than the (undifferentiated) social weight on consumption (Yotopoulos and Jeffrey Nugent, 1976, p. 385, for example). The view is incorrect if the terms of trade can be used as an instrument of policy.

Before analyzing the optimal term of trade, we take up the question of taxation in the present policy problem. The recent literature on optimal tax theory suggests that more insights can often be obtained by comparing market prices with shadow prices, rather than by comparing producer and consumer prices (Stiglitz and Partha Dasgupta, 1971). This is especially relevant here since producer and consumer prices are identical. In fact, a rural worker is simultaneously a producer and a consumer.

We therefore define "tax" ("subsidy") as the difference between the consumer (producer) price and the social opportunity cost of producing the same good. If η is the shadow price of the rural good, then the shadow price of the rural good in terms of the urban good is η/δ. The subsidy rate therefore is defined as $s=(p-\eta/\delta)/p$. An interesting feature of the present problem is that the same price regime will mean a subsidy to one sector and a tax on another sector. For example, if $s>0$, then the urban sector is paying a tax while the rural sector is receiving a subsidy.

To obtain the optimal tax formula, the following Lagrangian is defined by explicitly incorporating the rural good constraint, (10), into the maximand

$$(31)\quad Z=\psi+\delta\left[N^2Y-N^2y^2-N^1y^1\right]+\eta\left[N^1Q-N^2x^2\right],$$

where ψ is given by (21), and p and w are the control variables.[15] The first-order conditions with respect to p and w, after some manipulation,[16] can be written as

$$(32)\quad s=(\beta^1-\beta^2)/\delta\left(\varepsilon^1_{Qp}+\varepsilon^2_{xp}\right),$$

$$(33)\quad s=(\delta-\beta^2)/\delta\alpha^2_x\varepsilon^2_{xm}.$$

Equations (32) and (33) are alternative expressions for the optimal subsidy rate, and these can be easily interpreted. Note from (32) that s is positive or negative depending on whether β^1 is greater than or smaller than β^2. A higher β, on the other hand, corresponds to a lower level of utility (see fn. 13). The expression (32), therefore, clearly demarcates the location of the optimal tax (or subsidy) between the two sectors: *the workers who are better off should be taxed, while the workers who are worse off should be subsidized. This result is independent of the behavioral responses in the economy, of the social valuation of investment, and of whether the peasants or the industrial workers are better off*. Note, however, that the *magnitude* of subsidy does depend on the social weight on investment.

The influence of the rural surplus response on the subsidy can be partly understood in the following manner. For the moment, assume that the social weights are constants. Then, a higher ε^1_{Qp} means that an increase in the price p leads to a higher loss (gain) to the government if p exceeds (is less than) η/δ. The government, therefore, would want to keep a lower absolute value of the rate of subsidy, as (32) indicates. This explanation, however, is only partial because our formulae for an optimum do not provide a closed-form solution for the rate of subsidy.

The formula for the optimal price is easily obtained by equating the right-hand sides of (32) and (33), and using (14):

$$(34)\quad px^2(\beta^1-\beta^2)=wL^2(\delta-\beta^2)\varepsilon_{wp}.$$

The above expression equates the net social gain from a price increase to the net social loss due to the price-induced wage increase. Rearranging the terms in (34), we obtain a

[15] Note that the focus in this paper is on determining the properties of the optimal regime at any given point in time. An instructive and useful extension will be to find out how the optimum policy variables as well as the resulting welfare levels of individuals change over time. Such an analysis of the optimal time path is beyond the scope of the present paper.

[16] We use (4) and (7), and also the expressions for $\partial y^1/\partial p$, $\partial y^2/\partial p$, and $\partial y^2/\partial w$ from (2) and (5).

remarkably simple rule to characterize the optimum.

$$(35) \qquad \frac{(\delta-\beta^2)\varepsilon_{wp}}{(\beta^1-\beta^2)} = \alpha_x^2 \equiv \text{budget share.}$$

Alternative Characterizations: In the above analysis we have employed the terms of trade as the instrument of control. This we have done to keep the analysis within the context of the scissors problem. There are several alternative ways, however, in which the present problem can be characterized.

First, consider the control of the nominal price of the urban good or the nominal urban wage, because it is through these variables that a terms-of-trade policy can actually be implemented. It can be verified that an increase in the nominal price of the urban good corresponds to a movement in the terms of trade against the rural sector, and that an increase in the nominal urban wage corresponds to a movement in the terms of trade in favor of the rural sector. Either one of these two nominal variables can therefore be used as the instrument of control, without affecting the results.

Second, the economic content of the analysis remains unchanged if either the level of investment, I, or the rural surplus, Q, is used as the independent policy instrument. In these cases the analysis will correspond to what is sometimes called the "investment problem," and the "marketed surplus" problem.

Third, our conclusions regarding the terms of trade remain essentially unaltered if the "modern" capital good produced in the urban sector can be productively employed in the rural sector, and if the government exercises the choice over the intersectoral allocation of investment. As a simple example, consider the case in which there is positive investment in both sectors and the rent on the rural capital accrues to the rural sector. Then it can be verified that pricing rules (32)–(35) continue to characterize the optimum. Similarly, our qualitative results on the terms of trade will not change if a time-dependent process of technical progress in production is incorporated in the model.

Finally, we can reinterpret our analysis in a decentralized economic setting. To see this, first imagine that the government instructs its public sector managers to maximize profits based on the nominal prices they face, but introduces either a commodity tax on the urban good or a wage tax. Naturally, then, the government can control the terms of trade at any level that it desires. In particular, the optimum which we analyzed earlier is implementable in this manner. Next, assume that the industrial production is privately owned, but that the government imposes a 100 percent profit tax, and that it also imposes one of the two taxes mentioned above. It follows that the desired public policy can be implemented through a private market equilibrium.[17]

VI. Unemployment and Labor Mobility in Developing Economies

Many developing economies are characterized by significant unemployment as well as by endogenous mobility of labor between rural and urban sectors. It is then necessary that the design of pricing policy in such economies should take into account its influence on labor mobility and unemployment.[18] In this section, therefore, we extend our basic model to include these additional aspects.

The population is now divided into three groups consisting of employed rural workers, employed urban workers, and unemployed workers. Their utilities are represented by $V^1(p,N^1)$, $V^2(p,w)$, and V^u, and their populations are denoted by N^1, N^2, and N^u, respectively. For simplicity, the present analysis abstracts from transfer arrangements from the employed to the unemployed work-

[17] The relationship between the optimal production and pricing in public enterprises and optimal taxation of private enterprises has been discussed in the standard tax literature. See, for instance, Stiglitz and Dasgupta.

[18] By the same token, the valuation of labor, i.e., the shadow wage of labor, will be influenced not only by the dependence of the two sectors through trade and resource transfers, but also by the pricing policies of the government. The existing literature on the shadow wage has not paid sufficient attention to these relationships. See our 1983a paper for a more complete analysis.

ers, and assumes that the unemployed workers have zero income.

We posit that the mobility of labor across different groups of workers can be described through a reduced-form equation

$$N^1 = N^1(p, w, N^2), \tag{36}$$

which gives the rural population as a function of the relative price, the urban wage, and urban employment. It follows then that the level of unemployment can be obtained as a function of the same variables, since

$$N = N^1 + N^2 + N^u. \tag{37}$$

Note that our representation of labor mobility is quite general. Specific hypotheses concerning migration which have been proposed in the literature, for example, the Harris-Todaro hypothesis (John Harris and Michael Todaro, 1970), can be treated as special cases of the above.

Next, one needs to specify the determination of the urban wage. A number of alternative theories have been proposed in the literature (see Stiglitz, 1982a, b), and it is possible to examine the correct pricing policy for each of these theories of urban wage determination (see our 1983a paper for such an approach). For brevity, however, we follow here a simple hypothesis, according to which the urban wage is fixed, and the urban employment is controlled by the government. This representation of what the government can control in a developing economy conforms to the view that the urban wage is institutionally determined and also that much of the urban employment is in the public sector, over which the government exercises some control.

Note, however, that the two policy variables, p and N^2, cannot be controlled independently in the present problem. This is because a given combination of (p, N^2) determines a level of N^1 through (36), and the resulting set of variables cannot in general be expected to satisfy the quantity balance of the rural good, (10).

For later use, we define the following elasticities. Based on (36),

$$M_p = \frac{\partial \ln N^1}{\partial \ln p} \quad \text{and} \quad M_e = \frac{\partial \ln N^1}{\partial \ln N^2} \tag{38}$$

are the elasticities of the rural population with respect to the relative price and urban employment, respectively, and $\varepsilon^1_{Qa} = \partial \ln Q / \partial \ln a$ is the elasticity of rural surplus per rural worker with respect to land per rural worker. Further, $\hat{\varepsilon}^1_{Qp} = \partial \ln(N^1 Q)/\partial \ln p$ is elasticity of total rural surplus with respect to its price. It is simple to verify that

$$\hat{\varepsilon}^1_{Qp} = \varepsilon^1_{Qp} + \left(1 - \varepsilon^1_{Qa}\right) M_p. \tag{39}$$

The relevant Lagrangian is defined by (31) in which

$$\begin{aligned} \psi = {} & N^1 W(V^1) + N^2 W(V^2) \\ & + (N - N^1 - N^2) W(V^u). \end{aligned} \tag{40}$$

The first-order conditions with respect to p and N^2 can be obtained easily. For brevity, we present and interpret only the first-order condition with respect to p, which after making substitutions which are similar to those encountered earlier, can be written as

$$s = \frac{(\beta^1 - \beta^2) + \phi M_p / pQ}{\delta\left[\varepsilon^1_{Qp} + \left(1 - \varepsilon^2_{Qa}\right) M_p + \varepsilon^2_{xp}\right]}, \tag{41}$$

where

$$\phi = W(V^1) - W(V^u) - \beta^1 p X_a a. \tag{42}$$

Note immediately that (41) reduces to (32) if $M_p = 0$. This is precisely what we would expect. If the marginal migration is zero, then the rule for optimal pricing with endogenous migration is the same as the one in which populations are fixed.

The additional effects introduced by labor mobility can be understood intuitively by comparing (41) with (32). First note that the rural surplus response in the denominator of (41) is now redefined, according to (39), to include the effect of price on the size of rural population. Second, from (42), ϕ is the gain in the social welfare if one unemployed worker becomes employed in the rural sector. This includes the direct gain, $W(V^1) - W(V^u)$, and the indirect loss, $\beta^1 p X_a a$, due to the increased congestion on the rural land. The term containing ϕ in (41), therefore, represents the welfare gain from the price-induced labor mobility.

In the rest of this section, we provide a specific illustration of the above approach in which the migration is described by the Harris-Todaro hypothesis. According to this hypothesis, the unemployed workers are in the urban sector, and the probability that a migrant worker from the rural sector finds employment in the urban sector is $N^2/(N-N^1)$. The sectoral populations are determined by the equalization of the rural utility with the expected urban utility. That is, the expression (36) is specialized to

$$(43) \quad (N-N^1)V^1 = N^2V^2 + (N-N^1-N^2)V^u.$$

To ensure that N^u remains positive, it is explicitly assumed that $V^2 > V^1 > V^u$. This naturally restricts the range of prices within which the above hypothesis is meaningful. In addition, we make the following simplifying assumptions: (i) the rural land is not too scarce, that is, X_a and ε^1_{Qa} are negligible in magnitude, and (ii) the social welfare function is utilitarian, that is, $W(V)=V$, and $\beta^i = \lambda^i$. Because of the second assumption, our results do not depend on whether the social welfare function is defined over the *ex ante* or the *ex post* utilities of workers.

By perturbing (43) with respect to p and N^2, we find that

$$(44) \quad M_p > 0 \quad \text{and} \quad M_e < 0.$$

A result follows immediately. *An increase (decrease) in the price of agricultural output will be accompanied by an increase (decrease) in industrial employment.* This can be seen as follows. An increase in p increases the total rural surplus because $\hat{\varepsilon}^1_{Qp} > 0$, from (39) and (44). Also, an increase in p decreases the urban demand for the rural good. As a result, there will be an oversupply of the rural good. An increase in the urban employment will therefore be necessary to achieve a balance between the demand and supply of the rural good.

From the first-order conditions of optimality with respect to p and N^2, we obtain

$$(45) \quad s = \lambda^1 N/\delta N^1\left(\hat{\varepsilon}^1_{Qp} + \varepsilon^2_{xp}\right),$$

$$(46) \quad s = N^2L^2(w - Y_L)/N^1pQ(1-M_e),$$

where $Y_L = \partial Y/\partial L^2$.

There are two results to be noted. First, $s > 0$ from (45). Therefore, *the optimal terms of trade will entail a subsidy to peasants and a tax on industrial workers.*

Second, *the optimal terms of trade will entail a level of industrial employment such that the industrial wage will exceed the marginal product of an industrial worker.* This follows from (44), (46), and $s > 0$. The idea behind this result is quite intuitive. The society in the present case is concerned only with the rural utility because this utility is the same as the expected utility of other workers. An increase in the rural price therefore raises the social welfare associated with consumption. From an earlier result, on the other hand, a higher rural price will be accompanied by an increase in the urban employment. The contribution of an additional urban worker to investment is $(Y_L - w)L^2$, which declines as urban employment increases because of the declining marginal product. The optimal terms of trade will thus involve a tradeoff between a gain in consumption and a loss in investment. The latter obviously implies that $Y_L < w$.

VII. Comments on the Soviet Debate

A significant shortcoming of the Soviet debate was the lack of attention given to the behavioral responses of peasants. This is especially surprising since the economic events faced by the early Soviet state (Dobb, ch. 7), as well as Vladimir Lenin's warnings,[19] had already pointed out the importance of incentives. Be that as it may, we have clearly demonstrated that the behavioral responses of peasants are central to any analysis of the scissors problem.

On the specific effects of turning the prices against peasants, we find that the government *can indeed* increase the rate of accumulation by imposing a price squeeze on peasants. This effect was originally claimed by Preobrazhensky, and his claim is valid, despite the doubts raised by subsequent researchers. But, the other important proposition made by Preobrazhensky, that the price

[19] "...it is impossible to increase the production and collection of grain...except by improving the condition of the peasantry..." (1975b, p. 536).

squeeze can be operated without hurting the industrial proletariat, is invalid. A price squeeze on peasants will hurt the industrial proletariat, just as it will hurt the peasants.

It is of some interest to note here that much of the criticism faced by Preobrazhensky in the Soviet debate was that he was anti-peasant. "They accused him of favoring the 'exploitation' of the peasants, of advocating a kind of internal colonialism" (Alec Nove, 1965, p. *xi*). In fact, Preobrazhensky himself devoted much of his energies to trying to prove that he was not as anti-peasant as his book might have suggested at first (see his reply to Nikolai Bukharin and other opponents in the Appendix in his book). Some of this criticism might have been avoided, we suspect, had he not claimed (incorrectly, as demonstrated by our analysis) that the industrial proletariat would not have to pay any price for the state's accumulation.

Our analysis has also shown that the determination of the correct "tax" level or the correct size of the scissors depends on the social valuation of the welfare of the peasants and the industrial proletariat, as compared to the social valuation of investment (see equations (32)–(35)). On this score, it has often been believed that the peasants' welfare was irrelevant to the early Soviet state. Probably a better interpretation of the precollectivization debates might be that Preobrazhensky represented the lower end of the concern for the peasants, in contrast to Lenin who represented the middle position,[20] and to Bukharin who represented the higher end of the concern for the peasants.[21] On the other hand, it appears that the early Soviet leadership was fairly unanimous in placing a higher social weight on investment as compared to consumption, and in placing a higher social weight on the consumption of the industrial proletariat as compared to the consumption of the peasants.[22]

For this interpretation of the initial Soviet situation, our analysis shows that a movement in the terms of trade against peasants emerges as desirable, at least to that point where investment and the consumption of industrial protetariat have the same social weight (see equation (28)). The *direction* of change in the terms of trade, therefore, remains the same even though the relative concern for peasants might differ! The level of tax to be imposed on peasants, on the other hand, will differ according to the social concern for them: a higher concern will correspond to a lower tax (see equation (32)).

VIII. Extensions

There are two important aspects of a model of policy analysis such as the present one: the structure of the economy under consideration, and the instruments of policy which the government can (or cannot) employ. We have worked with a simple dual economy model, while ensuring an adequate representation of individuals' incentives. The terms of trade is the instrument of control on which we have focussed, although we have discussed a number of alternative ways in which the same control problem can be characterized. It is always possible to include *additional* instruments in an analysis, but one needs to exercise some care in doing so.

Take the example of the policy debates in the Soviet Union in the 1920's. A number of instruments of policy, other than the terms of trade, were brought up in these debates; among them were quantity controls, credit policy, foreign trade and borrowing, railway tariff, and printing money. It was widely acknowledged, however, that the opportunities provided by these additional instruments were at best quite limited, given the institutional limitations of the economy at that time. Further, it was also acknowledged that the inadequacies of the bureaucracy and the possibility of an underground economy were quite serious, and that these features should be considered in using any instrument which required a direct control of quantities.[23]

[20] See Lenin (1975a).

[21] Bukharin, in fact, exhorted the peasants to *enrich* themselves.

[22] Stated differently, it appears that there was unanimity on $\delta > \beta^2 > \beta^1$. But there were differences on the relative size of β^1 compared to β^2. It is obvious that, in the present context, the welfare evaluations are not based on an anonymous social welfare function.

[23] "Exchange is freedom to trade; it is capitalism. It is useful to us in as much as it will help us overcome the

The institutional constraints faced by many developing countries today are no less restrictive, probably much more so, than those faced by the early Soviet state. For such countries, therefore, it is desirable to focus on instruments like the terms of trade, which are less difficult to implement.

In developing economies with relatively greater institutional capabilities, however, many instruments of policy have been used which are relevant to the town vs. country considerations. Among the instruments which need to be examined are agricultural marketing boards and internal tax borders which exercise some regional control over prices and can tax the marketed surplus, and nonprice methods for the distribution of food in urban areas.[24,25]

IX. Conclusion

The problem of price scissors has remained a controversial issue ever since the Soviet leadership debated it in the 1920's. Also, it is a topic of substantial importance in much of today's developing world. Our analysis of the problem shows that some of the received wisdom on this issue is correct, while some of it is not correct. We conclude that the rate of accumulation in a socialist economy can indeed be increased by imposing a price squeeze on the rural sector. But, a price squeeze on the peasants leads to a decrease in the welfare of industrial workers, just as it leads to a decrease in the welfare of the peasants. We have also identified the critical parameters which influence the impact of the terms of trade on the state's surplus, and on the welfare of industrial workers. These parameters are the price response of the rural surplus, and the price and the income response of the urban consumption of the rural good.

Our analysis of desirable reforms in the terms of trade yields rules that are particularly simple to use, requiring only the knowledge of the social weights on the incomes of workers in the two sectors and of the social weight on investment. In many cases, the desirability of a shift in the terms of trade can be assessed simply by looking at the intertemporal tradeoffs (rather than by looking at the rural-urban tradeoffs). Finally, we have analyzed the optimal terms of trade. This analysis leads to a remarkably simple rule to determine which of the two sectors should be taxed and which should be subsidized.

We have then extended our analysis to incorporate unemployment and labor mobility, which are critical features of many of today's developing economies. Using a simple model with rigid industrial wage, we show that the optimal terms of trade will entail a subsidy to the rural sector and a tax on the urban sector. Further, the corresponding level of urban employment will be such that the urban wage will exceed the marginal product of an urban worker.

We also discuss a number of other ways in which the present approach can be expanded to suit the varying economic structures and institutional capabilities of different economies. These extensions will naturally modify the precise form of the results obtained here. We believe, however, that the central economic effects which we have brought out in our analysis, focussing on the consequences of pricing policy (terms of trade) on incentives in the rural and the urban sectors, and the general equilibrium effects of a price change on the welfare of individuals and on accumulation, will remain valid.

dispersal of the small producer, and to a certain degree combat the evils of bureaucracy" (Lenin, 1975b, p. 555).

[24]Another issue which arises repeatedly in policy discussions is the role and the nature of correct pricing and taxation policies in those open developing economies which not only have the special features associated with dualism, but which in addition face restrictions on the external trade of some of the goods they produce, as well as on the external borrowing which is available to them. For an analysis of many of these issues, see our 1983b paper.

[25]See Sah (1982) for a comparison of the performance of several different nonprice instruments to allocate a good within a single sector with many consumers.

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