Domestic Distortions, Tariffs, and the Theory of Optimum Subsidy: Some Further Results

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Bhagwati and Ramaswami (1963) showed that if there is a distortion, the Paretian first-best policy is to intervene with a tax (subsidy) at the point at which the distortion occurs. Hence a domestic tax-cum-subsidy with respect to production would be first-best optimal when there was a *domestic* distortion (defined as the divergence between domestic prices and the marginal rate of transformation in domestic production) just as a tariff policy would be first-best optimal under monopoly power in trade (which involves a *foreign* distortion). An important corollary, for the case of a distortionary wage differential, is that while a tax-cum-subsidy policy with respect to factor use would be first-best optimal, the second-best optimal policy would be a *domestic* production tax-cum-subsidy rather than a tariff policy.

While these central results are valid, Kemp and Negishi (1969) have correctly argued that two subsidiary propositions of Bhagwati and Ramaswami (1963) are false. These are (1) that no tariff (export subsidy) may exist which is superior to free trade in the presence of a domestic distortion, and (2) that no production tax-cum-subsidy may yield greater welfare than nonintervention when the nation has monopoly power.

We can demonstrate, however, that the Kemp-Negishi results are, in fact, special cases of the first of the following two theorems in the theory of second-best, which we shall prove:

Theorem 1.—If under laissez faire two of the variables *DRS*, *DRT*, and *FRT* are equal while the third has a different value, and the policy measure that will secure equal values of the three variables cannot be applied, some

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policy measure exists that will raise welfare above the laissez faire level, though it will destroy the equality of the first two variables.[1]

Theorem 2.—If under laissez faire all three variables *DRS*, *DRT*, and *FRT* have different values, and both of the policy measures that will secure equal values of the three variables cannot be applied, no feasible form of intervention may exist that will raise welfare.

We use the following notation:

- C_i, X_i denote the consumption and domestic output, respectively of commodity i, $i = 1, 2$.
- p_c denotes the ratio of the price of the first to that of the second commodity confronting consumers (*DRS*).
- p_t denotes $DRT = -dX_2/dX_1$.
- p_f denotes the ratio of the world price of the first commodity to that of the second commodity, that is, the *average* terms of trade. The marginal terms of trade $FRT = p_f$ only in the special case in which national monopoly power does not exist.

The welfare function $U(C_1, C_2)$ and the production functions are assumed to be differentiable as required. The U_i denotes the marginal utility of commodity i ($i = 1, 2$). It is assumed throughout the analysis that under laissez faire there is nonspecialization in consumption and production, and that some trade takes place.

Our procedure is as follows. We derive the expression for the change in welfare when there is a slight movement away from an initial equilibrium in which there is no intervention. If the levy of some tax (subsidy) at a *small* rate will secure a positive value for this expression, we can conclude that welfare can be raised above the laissez faire level by applying this tax (subsidy). Note that in such a case some *finite* (and not merely infinitesimal) tax (subsidy) rate will exist which yields greater welfare than laissez faire. If the derivative of welfare with respect to the rate of some tax (subsidy) is nonzero at the laissez faire point, then by continuity it is nonzero for some finite interval of values of the tax (subsidy) rate around the laissez faire point. If, on the other hand, the levy of some tax (subsidy) at a small rate does not change welfare, then there may not exist any rate of this tax (subsidy) which secures more welfare than under nonintervention.[2]

[1] *DRS*, *DRT*, and *FRT* denote, respectively, the marginal domestic rate of substitution in consumption, the marginal domestic rate of transformation in production, and the marginal rate of transformation through trade.

[2] If the function relating the level of welfare and the rate of a specified tax (subsidy) is concave and has a local maximum at the laissez faire point, then this local maximum is a global maximum, and a finite tax (subsidy) *must* reduce welfare below the laissez faire level. If this function is not concave, however, the local maximum need not be a global maximum and therefore some finite tax (subsidy) *may* exist which raises welfare above the laissez faire level.

The change in welfare due to a small deviation from an initial laissez faire equilibrium is

$$dU = U_1 dC_1 + U_2 dC_2 = U_2\left(\frac{U_1}{U_2} dC_1 + dC_2\right).$$

The marginal condition for utility maximization is that $U_1/U_2 = p_c$. So,

$$\begin{aligned} dU &= U_2(p_c dC_1 + dC_2) = U_2[p_f dC_1 + dC_2 + (p_c - p_f)dC_1] \\ &= U_2[d(p_f C_1 + C_2) - C_1 dp_f + (p_c - p_f)dC_1]. \end{aligned}$$

Assuming balanced trade, $p_f C_1 + C_2 = p_f X_1 + X_2$. So,

$$\begin{aligned} dU &= U_2[d(p_f X_1 + X_2) - C_1 dp_f + (p_c - p_f)dC_1] \\ &= U_2[p_f dX_1 + dX_2 + (X_1 - C_1)dp_f + (p_c - p_f)dC_1] \\ &= U_2\left[dX_1\left(p_f + \frac{dX_2}{dX_1}\right) + (X_1 - C_1)dp_f + (p_c - p_f)dC_1\right] \\ &= U_2[dX_1(p_f - p_t) + (X_1 - C_1)dp_f + (p_c - p_f)dC_1]. \end{aligned} \quad (1)$$

Theorem 1

There are three ways in which, under laissez faire, two of the variables *DRS*, *DRT*, and *FRT* have equal values, while the third has a different value: $DRS = FRT \neq DRT$, $DRS = DRT \neq FRT$, and $DRS \neq DRT = FRT$. We consider these three cases in turn.

Case 1

Assume that national monopoly power does not exist. We then discuss two alternative cases in turn: (1) production externality,[3] and (2) wage differential in one activity.[4] In either case, $DRS = FRT \neq DRT$, and we have $p_c = p_f$, $dp_f = 0$ and $p_f \neq p_t$. so equation (1) reduces to:

$$dU = U_2[dX_1(p_f - p_t)]. \quad (2)$$

It is clear that any policy measure that slightly increases (reduces) the output of the first commodity will raise welfare, if p_f is greater (less) than p_t.

So if, in the externality case, it is not feasible to secure first-best through the levy of a production tax-cum-subsidy, greater welfare than under

[3] A production externality that would produce a domestic distortion, in the sense of a divergence between the domestic prices and *DRT*, is where the production functions are the following: $X = X(Lx, Kx)$; $Y = Y(Ly, Ky, X)$, where the output of commodity y is a function of not merely the inputs of labor (Ly) and capital (Ky) but also the output level of commodity x, but the market does not remunerate the x-producers for this productivity.

[4] We will be assuming that the wage differential is distortionary, as in Bhagwati and Ramaswami (1963).

laissez faire can be obtained if (1) a tariff (trade subsidy) or (2) a factor tax-cum-subsidy is imposed. Note further than a tariff is *not* necessarily superior to a factor tax-cum-subsidy policy. Which of these measures is preferable in a given situation will depend on the form of the welfare and production functions. Thus, in any specific situation, a factor tax-cum-subsidy policy may be the second-best optimal policy, and the tariff (trade subsidy) the *third-best* optimal policy.[5]

In the case of a distortionary wage differential, the first-best policy is a factor tax-cum-subsidy, the second-best policy is a production tax-cum-subsidy, and the third-best policy is the tariff.[6]

Case 2

Now assume that there is no domestic distortion but national monopoly power exists, so that $DRS = DRT \neq FRT$ under laissez faire. Then $p_c = p_t = p_f$ and $dp_f \neq 0$; so equation (1) reduces to

$$dU = U_2(X_1 - C_1)dp_f. \tag{3}$$

Thus production, consumption, and factor-use tax-cum-subsidies will exist that will raise welfare above the laissez faire level by changing the marginal rate of transformation through trade. It would appear, however, that we cannot determine a priori what the second-best, optimal policy will be; and the ranking of the three policies—production, consumption, and factor-use tax-cum-subsidies—which are available when the first-best tariff policy is ruled out, will depend on the specific situation being considered.

Case 3

Suppose now that there is no national monopoly power, or distortion, or externality in production but that the sellers of one commodity charge consumers a uniform premium over the cost of both domestic and imported supplies. Then, under laissez faire, $DRS \neq DRT = FRT$. We have $dp_f = 0$, $p_f = p_t$, $p_c \neq p_f$; so equation (1) reduces to

$$dU = U_2[(p_c - p_f)dC_1]. \tag{4}$$

Thus, clearly the levy of a consumption tax-cum-subsidy will secure Paretian first-best. Furthermore, levy of tariff is necessarily superior to laissez faire. Moreover, the imposition of production or factor-use taxes

[5] Thus Kemp and Negishi (1969), who do not consider the entire range of policies that may be available when the first-best policy is ruled out, imply incorrectly that the "second-best, optimal" policy in a situation with domestic distortions will be a tariff (trade subsidy) policy.

[6] Note that a finite consumption tax-cum-subsidy policy can only hurt the economy by adding a consumption loss to the loss already being suffered by the economy, thanks to the distortion.

(subsidies) *may* also be superior to laissez faire (unless inferior goods in social consumption were ruled out).[7]

This completes our proof and discussion of theorem 1. An intuitive explanation is perhaps in order. A *small* deviation as the result of the levy of a tax (subsidy) from an initial situation of *equality* of the values of two of the variables *DRS*, *DRT*, and *FRT* does not entail welfare loss. So if the tax (subsidy) brings the value of the third variable closer to those of the two variables which were initially equal, the welfare gain on this account will constitute a net improvement in welfare. More than one form of tax (subsidy) may secure this result; and the levy of any one of these will be superior to laissez faire.

But it should be noted that when only the policy that secures first-best can make *DRS*, *DRT*, and *FRT* equal and adoption of this policy is ruled out, as when national monopoly power exists but a tariff cannot be levied, alternative policies cannot be ranked except with reference to the facts of a given situation. The corollary of this proposition is that when a second-best policy alone can secure equality of *DRS*, *DRT*, and *FRT*, as when a distortionary wage differential cannot be directly attacked, the third-best policy cannot be determined a priori.

Theorem 2

Assume now that national monopoly power exists, and that there is a production externality or that factor taxes (subsidies) cannot be used to eliminate a distortionary wage differential. Then $DRT \neq DRS \neq FRT$. We rule out the case in which, by chance, $DRT = FRT$. So $p_f \neq p_t$, $dp_f \neq 0$ and $p_c = p_f$; and equation (1) reduces to

$$dU = U_2[dX_1(p_f - p_t) + (X_1 - C_1)dp_f]. \tag{5}$$

The simultaneous levy of both a tariff and a production tax (subsidy) would secure first-best in the case of a production externality and second-best in the case of a distortionary wage differential. But if only a tariff or a production tax (subsidy) is applied, there may be exactly offsetting changes in $dX_1(p_f - p_t)$ and $(X_1 - C_1)dp_f$, and welfare may not increase. So if both

[7] Note that in the present case, dealing with a domestic consumption distortion, a production or factor-use tax-cum-subsidy policy may improve welfare, whereas case 1, dealing with a domestic production, did not admit to a consumption tax-cum-subsidy raising welfare above the laissez faire level. The reason for this asymmetry is as follows. In the latter case, a consumption tax-cum-subsidy, whether small or large, cannot shift production and hence cannot improve welfare. In the former case, however, a production or factor-use tax-cum-subsidy can affect consumption through its income effect. The level of such a tax-cum-subsidy at an infinitesimal rate cannot, of course, change welfare because the income effect is zero to a first order of approximation; but when the rate is large, welfare may improve if the function relating welfare and the rate of tax (subsidy) is not concave (a possibility introduced by the presence of goods inferior in social consumption).

the policy measures needed to secure equality of *DRS*, *DRT*, and *FRT* cannot be applied, no feasible intervention may exist that will raise welfare above the laissez faire level.

References

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