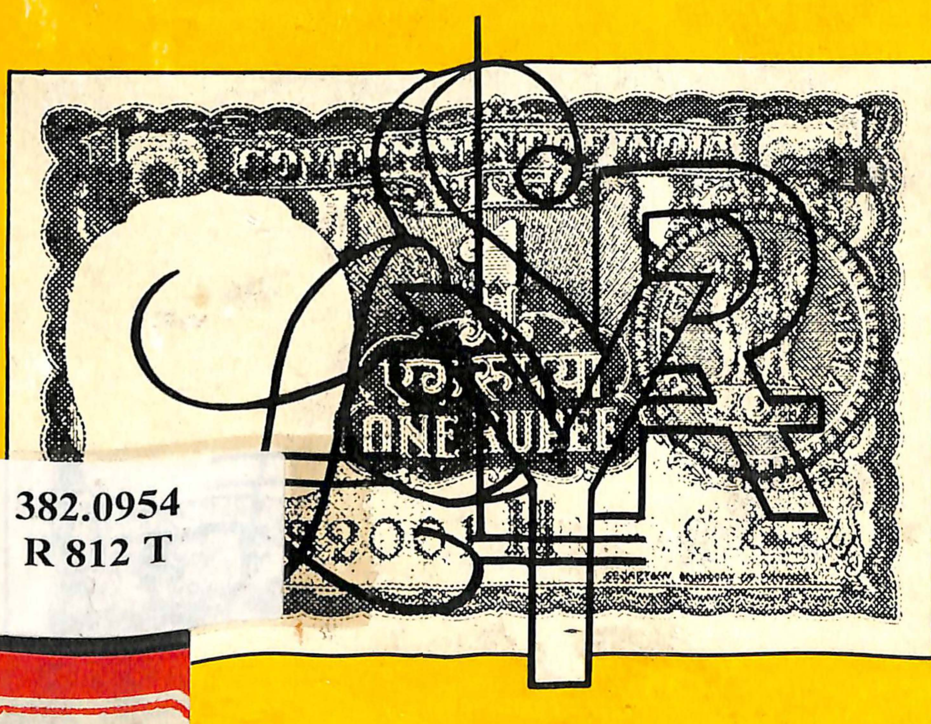
TRADE, PROTECTION AND ECONOMIC POLICY

Alok Ray



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Essays in International Economics

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Preface

The essays collected in this volume were written over the years 1971-1975 while I was a graduate student at the University of Rochester and subsequently teaching at Cornell University, Delhi School of Economics and the Indian Institute of Management, Calcutta. They cover a fairly wide range of issues in International Economics, e g., the implications of intermediate inputs, non-traded goods, domestic distortions, non-economic objectives, smuggling, government budget constraint, wealth effect, issues which have attracted considerable attention among professional economists in recent years. Two of the essays (Chapters 1 and 2) are primarily concerned with the positive aspects of the pure theory of trade, four essays (Chapters 3, 4, 5, 6) with the theory of trade and welfare, and one (Chapter 7) with the balance of payments theory.

The first three essays deal with the implications of a nontradables sector producing intermediate as well as final goods. The first essay (Chapter 1) shows how some of the standard theorems in trade theory, e.g., the Heckschar-Ohlin, Stolper-Samuelson, Factor Price Equalisation and Rybczynski theorems can be generalised to a two-factor-three-commodity framework where the third commodity is a nontradable and all commodities can be used as intermediate inputs and final products simply by considering factor intensity rankings in terms of *total* coefficients.

In the presence of nontraded intermediates (but not otherwise) the factor intensity rankings in terms of direct coefficients need not correspond to that in terms of *total* coefficients and hence the above theorems will not be valid, in general, if factor intensity rankings are considered in terms of *direct* coefficients. The second essay (Chapter 2) brings out the resource allocation significance of three alternative measures of effective protection to cope with nontraded inputs in terms of a general equilibrium framework. In the third essay (Chapter 3) we show that one of the standard results of domestic distortions and optimal economic policy, namely, the existence of a *positive* import duty (export subsidy) superior to free trade when domestic distortion causes under-production of the import (export) commodity, may not necessarily hold in the presence of a nontraded sector. This is so even when the output space is two-dimensional and the gross substitutability restriction is imposed on the demand side.

We prove a theorem on optimum tax structures to achieve various non-economic objectives in Chapter 4. The theorem says that if a small country with no domestic distortions wants to achieve a specified maximum or minimum value of import, export, production or consumption of a class of commodities by a system of first best taxes, the optimal tax structure will involve uniform tax rate for that class of commodities and zero taxes on the rest. With second best taxes, on the other hand, the optimal tax structure will, in general, involve taxes at different rates of commodities both within and outside the class. In Chapter 5 we show that the above theorem on uniform tax structure no longer holds good in the presence of smuggling. Not only that, smuggling may render invalid the traditional superiority of import duties over production subsidies as alternative means to cut down import below the free trade level. Chapter 6 is concerned with the relationship between the optimum tariff and the maximum revenue tariff in the presence or smuggling.

In Chapter 7 we derive the one-period multipliers corresponding to various alternative macro-economic policies in an open economy model, taking explicitly into account the wealth effect arising out of the government budget deficit and the balance of payments surplus. Some unorthodox possibilities come up, e.g., that with a high degree of international capital mobility government expenditure financed by bond issues is likely to be *less* expansionary than tax-financed government expenditure under a flexible exchange rate system but that the opposite is true under fixed exchange rates.

Contents

CHAPTER ONE

Non-Traded Intermediate Inputs and Some Aspects of the Pure Theory of International Trade

Since Bhagwati (1964) pointed to the exclusion of intermediate goods as the major limitation of conventional trade theory, a large body of literature has developed to trace the implications of introducing intermediate goods. However, by looking into the existing literature, one will find that intermediate inputs have always been introduced in either of two ways, both of which preserve the essential feature of a two-commodity production model. Some [e.g., Jones (1971)] have just added a domestically non-produced imported input to the usual two-(tradeable)-product-two-factor model whereas others [e.g., Kemp (1969, Chapter 7), Vanek (1963)] have introduced intermediate inputs by permitting inter-industry flows between the two traded-good industries. But no writer seems to have studied so far the implications of the existence of non-traded intermediate goods for even such basic building blocks of conventional trade theory as the Stolper-Samuelson theorem and the Rybczynski theorem. Though, in recent years, the validity (and necessary modifications) of these theorems in the presence of a non-traded sector has been investigated by some writers [e.g., Komiya 1967), Kemp (1969, Chapter 6)] they have always assumed the (non-tradeable to be a 'pure' final commodity.

The major purpose of the present paper is to investigate the implications of introducing non-traded intermediate inputs in the standard Swedish-Samuelson framework. To be more specific, we shall study the modifications, if any, that will be necessary for the Stolper-Samuelson theorem, the factor price equalisation theorem, the Heckscher-Ohlin theorem and the Rybczynski theorem in a two-factor-three-commodity (one of the commodities being non-traded) production model where all commodities can be used as intermediate input and final product. Furthermore, it does not seem to have been properly realised in the literature that it makes an essential difference to the results whether the traded intermediate commodity is assumed to be domestically produced or solely imported from abroad. We shall also make clear the nature of this difference.

I

We assume three commodities 1, 2 and N being produced locally in industries 1, 2 and N respectively. Commodities 1 and 2 are internationally traded and commodity N is a non-traded commodity. There are two primary factors, labor and capital (in amounts L and K respectively), that are used in the production of all three commodities. We further assume (unless otherwise noted) that the only inter-industry flows in the system are that both commodities 2 and N are used as intermediate inputs in the production of commodity 1. We could have assumed a more complicated input-output structure but that would merely complicate the analysis without affecting any of the basic results of this paper. Production functions are linear homogeneous in labor, capital and intermediate inputs (where any) for all three industries. We have full employment of both primary factors and perfect competition in all product and factor markets.

Our basic model consists of five equations, viz., three competitive profit conditions and two full employment conditions. We use P_i for the price of commodity i, w for the wage of labour, r for the rental of capital, x_j for the gross output of commodity j, y_j for the net output of commodity j, x_{ij} for the amount of commodity i used *directly* as input by the j^{th} industry and a_{ij} for the amount of input i used *directly* per unit of commodity j. Thus we have

(1) $$a_{L1}w + a_{K1}r + a_{21}P_2 + a_{N1}P_N = P_1$$

(2) $$a_{L2}w + a_{K2}r = P_2$$

(3) $$a_{LN}w + a_{KN}r = P_N$$

(4) $$a_{L1}x_1 + a_{L2}x_2 + a_{LN}x_N = L$$

(5) $$a_{K1}x_1 + a_{K2}x_2 + a_{KN}x_N = K$$

Equations (1), (2) and (3) give the price-equals-average-cost condition in all three industries which must be satisfied under competitive equilibrium if all commodities are to be produced. We are assuming that given some P_1 and P_2 (determined by world demand and supply conditions) for the tradeables, P_N adjusts in such a way that all three industries find it profitable to produce non-zero outputs. Note that if all three commodities were traded and their prices were set arbitrarily, we would have three independent equations to determine w and r, and inconsistency could arise. Something has to give and one way out would be that one of the industries would cease to produce, dropping with it the corresponding equation out of the system. This problem does not arise when one of the commodities, say, commodity N is non-traded. Then we get three equations to determine three variables w, r and P_N, given P_1 and P_2. Thus, apart from defining commodity N to be non-traded, the above considerations provide a justification for so labelling commodity N.[1] Equations (4) and (5) give the full employment conditions for labor and capital.

The full employment conditions could, however, be expressed in terms of net, rather than gross, outputs. Since $x_1 = y_1$, $x_2 = y_2 + a_{21}x_1$ and $x_N = y_N + a_{N1}x_1$ in the present model, (4) and (5) can alternatively be expressed as

(4′) $$A_{L1}y_1 + A_{L2}y_2 + A_{LN}y_N = L$$

(5′) $$A_{K1}y_1 + A_{K2}y_2 + A_{KN}y_N = K$$

where $A_{i1} = a_{i1} + a_{i2}a_{21} + a_{iN}a_{N1}, A_{i2} = a_{i2}$ and $A_{iN} = a_{iN}, i = L,K$. Note that A_{ij}'s are the *total* requirements of primary factors per unit of output. $A_{L1} = a_{L1} + a_{L2}a_{21} + a_{LN}a_{N1}$, for example, is nothing but the amount of labor used directly plus the amount of labor embodied in the quantities of commodities 2 and N that go into the production of one unit of commodity 1.

Finally, we assume that input coefficients in an industry depend on the prices of all inputs used in that industry so that

(6) $$a_{i1} = c_{i1}\ (w, r, P_2, P_N) \qquad i = L, K, 2, N$$

(7) $$a_{i2} = a_{i2}\ (w, r) \qquad i = L, K$$

(8) $$a_{iN} = a_{iN}\ (w, r) \qquad i = L, K.$$

Under constant returns to scale each a_{ij} is homogeneous of degree zero in all its arguments.

Let A, A' and A'' be the matrices formed by the *direct*, *direct-plus-indirect* and *total* primary factor coefficients in industries 1 and 2 so that

$$A = \begin{bmatrix} a_{L1} & a_{L2} \\ a_{K1} & a_{K2} \end{bmatrix}$$

$$A' = \begin{bmatrix} a_{L1} + a_{LN}a_{N1} & a_{L2} \\ a_{K1} + a_{KN}a_{N1} & a_{K2} \end{bmatrix}$$

$$A'' = \begin{bmatrix} A_{L1} & A_{L2} \\ A_{K1} & K_{K2} \end{bmatrix}$$

By *direct-plus-indirect* labor (capital) coefficient in industry j we mean the amount of labor (capital) used directly plus the amount of labor (capital) used indirectly through the use of commodity N but *not* through the use of any tradeable inputs in the production of one unit of commodity j.

Now, define θ_{ij} as the *direct* distributive share of input i in industry j, λ_{ij} as the proportion of input i used *directly* in x_j and β_{ij} as the proportion of input i used in y_j. Thus, for

example, $\theta_{L1} \equiv a_{L1}w/P_1, \theta_{21} \equiv a_{21}P_2/P_1, \lambda_{L1} \equiv a_{L1}x_1/L,$
$\lambda_{21} \equiv a_{21}x_1/x_2 \;\; \beta_{L1} \equiv A_{L1}Y_1/L.$
We can then define six more matrices—λ, λ', β, θ, θ' and θ''—as follows

$$\lambda = \begin{bmatrix} \lambda_{L1} & \lambda_{L2} \\ \lambda_{K1} & \lambda_{K2} \end{bmatrix}$$

$$\lambda' = \begin{bmatrix} \lambda_{L1} + \lambda_{LN}\lambda_{N1} & \lambda_{L2} \\ \lambda_{K1} + \lambda_{KN}\lambda_{N1} & \lambda_{K2} \end{bmatrix}$$

$$\beta = \begin{bmatrix} \beta_{L1} & \beta_{L2} \\ \beta_{K1} & \beta_{K2} \end{bmatrix}$$

$$\theta = \begin{bmatrix} \theta_{L1} & \theta_{K1} \\ \theta_{L2} & \theta_{K2} \end{bmatrix}$$

$$\theta' = \begin{bmatrix} \theta_{L1} + \theta_{LN}\theta_{N1} & \theta_{K1} + \theta_{KN}\theta_{N1} \\ \theta_{L2} & \theta_{K2} \end{bmatrix}$$

$$\theta'' = \begin{bmatrix} \theta_{L1} + \theta_{LN}\theta_{N1} + \theta_{L2}\theta_{21} & \theta_{K1} + \theta_{KN}\theta_{N1} + \theta_{K2}\theta_{21} \\ \theta_{L2} & \theta_{K2} \end{bmatrix}$$

It can be easily verified that

(i) $|A'| = |A''|$ and $|\theta'| = |\theta''|$
(ii) sign $|A| =$ sign $|\lambda| =$ sign $|\theta|$
(iii) sign $|A'| =$ sign $|\lambda'| =$ sign $|\theta'| =$ sign $|\beta|$.

Note, further, that $|A| > 0$ if and only if commodity 1 is labor-intensive relative to commodity 2 in terms of *direct* coefficients and $|A''|$ $(= |A'|) > 0$ if and only if commodity 1 is labor-intensive in terms of *total* (or, *direct-plus-indirect*) coefficients.

The point to be emphasised here is that in the presence of non-traded inputs, the factor intensity rankings of commodities 1 and 2 in terms of *direct* coefficients may well be different from that in terms of *total* coefficients since the signs of $|\lambda|$ and $|\lambda'|$ need not necessarily be the same.[2] However, the factor intensity rankings in the above two senses cannot be different, even in the presence of inter-industry flows between industries

1 and 2, so long as the non-traded commodity is not used as input into industries 1 and/or 2. This can be readily checked by assuming $\lambda_{N1} = 0$ in the present model.[3] Note, finally that, since $|A'| = |A''|$, the factor intensity rankings in terms of *direct-plus-indirect* coefficients must always be the same as those in terms of *total* coefficients.

Using ^ ('hat') to denote proportionate change in a variable or parameter (so that $\hat{P}_1 \equiv dP_1/P_1$, etc.), it is possible to derive the following five equations from our basic set of five equations (1) through (5):

(1.1) $$\theta_{L1}\hat{w} + \theta_{K1}\hat{r} + \theta_{21}\hat{P}_2 + \theta_{N1}\hat{P}_N = \hat{P}_1$$

(2.1) $$\theta_{L2}\hat{w} + \theta_{K2}\hat{r} = \hat{P}_2$$

(3.1) $$\theta_{LN}\hat{w} + \theta_{KN}\hat{r} = \hat{P}_N$$

(4.1) $$\lambda_{L1}\hat{x}_1 + \lambda_{L2}\hat{x}_2 + \lambda_{LN}\hat{x}_N = \hat{L} - [\lambda_{L1}\hat{a}_{L1} + \lambda_{L2}\hat{a}_{L2} + \lambda_{LN}\hat{a}_{LN}]$$

(5.1) $$\lambda_{K1}\hat{x}_1 + \lambda_{K2}\hat{x}_2 + \lambda_{KN}\hat{x}_N = \hat{K} - [\lambda_{K1}\hat{a}_{K1} + \lambda_{K2}\hat{a}_{K2} + \lambda_{KN}\hat{a}_{KN}].$$

Equations (4′) and (5′) can similarly be expressed, in terms of rates of change, as

(4.1′) $$\beta_{L1}\hat{y}_1 + \beta_{L2}\hat{y}_2 + \beta_{LN}\hat{y}_N = \hat{L} - [\beta_{L1}\hat{A}_{L1} + \beta_{L2}\hat{A}_{L2} + \beta_{LN}\hat{A}_{LN}]$$

(5.1′) $$\beta_{K1}\hat{y}_1 + \beta_{K2}\hat{y}_2 + \beta_{KN}\hat{y}_N = \hat{K} - [\beta_{K1}\hat{A}_{K1} + \beta_{K2}\hat{A}_{K2} + \beta_{KN}\hat{A}_{KN}].$$

In deriving (1.1), (2.1) and (3.1) we have simply made use of the first-order cost minimisation conditions[4]

$$\theta_{L1}\hat{a}_{L1} + \theta_{K1}\hat{a}_{K1} + \theta_{21}\hat{a}_{21} + \theta_{N1}\hat{a}_{N1} = 0$$

$$\theta_{L2}\hat{a}_{L2} + \theta_{K2}\hat{a}_{K2} = 0$$

$$\theta_{LN}\hat{a}_{LN} + \theta_{KN}\hat{a}_{KN} = 0.$$

II

We shall now examine to what extent some of the standard theorems in the pure theory of international trade carry through in our model. In the present section we shall deal with the factor price equalisation theorem, the Heckscher-Ohlin theorem and the Stolper-Samuelson theorem, leaving the Rybczynski theorem for the next section.

It is clear from (1), (2) and (3) that factor prices (w, r) and the price of the non-traded commodity P_N depend *only* upon the prices of the traded commodities (P_1, P_2), since c_{ij}'s depend *only* upon (w, r, P_1, P_2, P_N). Given (P_1, P_2), w, r and P_N will be completely determined from those three equations assuming the existence of positive outputs in all three industries. Now, if we assume that the solution is unique, w, r and P_N must be equalised whenever P_1 and P_2 are equalised as between the trading partners provided that they have the same technology. Since a_{ij}'s depend, in general, on (w, r, P_1, P_2, P_N) marginal productivities of factors (which depend *only* upon a_{ij}'s under constant returns to scale) must also be equalised whenever P_1 and P_2 are equalisation through free trade. The factor price equalisation theorem clearly holds in our model. Note, however, that the absence of factor intensity reversal in terms of *direct* coefficients for the tradeable industries 1 and 2 is neither necessary nor sufficient to guarantee one-to-one correspondence between w/r and P_1/P_2. To see that, substitute the values $\hat{P}_2$ and $\hat{P}_N$ from (2.1) and (3.1) respectively into (1.1). This gives

$$(1.2) \qquad \hat{w}(\theta_{L1} + \theta_{LN}\theta_{N1} + \theta_{L2}\theta_{21}) + \hat{r}(\theta_{K1} + \theta_{KN}\theta_{N1} + \theta_{K2}\theta_{21}) = \hat{P}_1.$$

Solving (1.2) and (2.1) together, we get[5]

$$(9) \qquad |\theta''|(\hat{w} - \hat{r}) = (\hat{P}_1 - \hat{P}_2).$$

Thus w/r will be monotonically related to P_1/P_2 if and only if $|\theta''|$ has the same sign throughout. Since $|\theta''|$ may be zero even without $|\theta|$ being zero and vice versa the reversal of factor intensities in terms of *direct* coefficients is neither necessary nor sufficient for such a reversal in terms of *total* coefficients. Thus, we have derived the following result:

Proposition 1. If all three commodities are produced and there is no reversal of factor intensities in terms of *total* coefficients factor prices must be fully equalised as between the trading partners under identical technology and other usual assumptions.

The Heckscher-Ohlin theorem about trade patterns also follows immediately from (9) if factor abundance is defined in terms of pre-trade relative factor prices in the two countries. We get

Proposition 2. If the technology matrix is the same for both trading partners and there occurs no reversal of factor intensities in terms of *total* coefficients, the labor-abundant (in the sense of having a lower pre-trade wage-rental ratio as compared to the other country) country's exports will be labor-intensive in terms of *total* coefficients and vice versa.

It should be stressed that the above result does not shed any new light on resolving the so-called Leontief paradox. Leontief clearly had the sense of working with *total* coefficients to test the Heckscher-Ohlin theorem. All that the above proposition suggests is that he could not possibly simplify his task by concentrating on *direct* coefficients only since there exists a large non-traded sector in the American economy (as in all other economies) which also supplies inputs to the traded-good industries and there is no *a priori* basis for knowing that its role as a supplier of inputs is '*equally*' important for both the exportable and the importable sectors of the economy.

Before turning to the Stolper-Samuelson theorem it should be noted here that two alternative measures of effective protective rate (defined as proportionate change in value added) have been suggested in the literature to cope with non-traded inputs—one including the value of non-traded inputs (henceforth called the *Corden measure*)[6] and the other excluding the value of non-traded inputs (henceforth called the *modified Balassa measure*)[7] in value added.

We shall now prove the following two propositions 3*a* and 3*b* as alternative versions of a 'generalised' Stolper-Samuelson theorem. It should be emphasised that these propositions will hold under the assumption:

(*A*.1) There does not exist any domestically non-produced imported input.

Later, we shall relax this assumption and show that these propositions must then be replaced by a set of weaker propositions 4*a* and 4*b*.

Proposition 3a. Under Assumption (*A*.1), if the price of commodity 1 rises relative to the price of commodity 2, or if industry 1 is protected relative to industry 2 in the Corden sense, the real reward (in terms of any of the domestically produced commodities) of the factor used intensively, in terms of *total* coefficients, in industry 1 must go up and that of the other factor must go down.

Proposition 3b. Under Assumption (*A*.1), if industry 1 is protected relative to industry 2 in modified Balassa sense, the real reward (in terms of any of the domestically produced commodities) of the factor used intensively, in terms of *direct* coefficients, in industry 1 must go up and that of the other factor must go down.

Let us now prove the above results. Equation (9) shows that given $\hat{P}_1 > \hat{P}_2$, $\hat{w} > \hat{r}$ if and only if $|\theta''| > 0$. It is also possible to express (1.1) [by substituting for $\hat{P}_N$ from (3.1) into (1.1) and then dividing through by $1 - \theta_{21}$] as

$$(1.3) \quad \frac{\theta_{L1} + \theta_{N1}\theta_{LN}}{1 - \theta_{21}}\,\hat{w} + \frac{\theta_{K1} + \theta_{N1}\theta_{KN}}{1 - \theta_{21}}\,\hat{r} = \frac{\hat{P}_1 - \theta_{21}\hat{P}_2}{1 - \theta_{21}}$$

which, combined with (2.1), yields

$$(10) \qquad \frac{(\hat{w}-\hat{r})|\theta'|}{1-\theta_{21}} = \left[\frac{\hat{P}_1-\theta_{21}\hat{P}_2}{1-\theta_{21}} - \hat{P}_2\right].$$

Since $1-\theta_{21}>0$, it is clear that, given $(\hat{P}_1-\theta_{21}\hat{P}_2)/(1-\theta_{21}) > \hat{P}_2$, $\hat{w}>\hat{r}$ if and only if $|\theta'|>0$. The R.H.S. of (10) is nothing but the difference between the effective protective rates for industries 1 and 2 according to the Corden measure.[8] We know that $|\theta''|(=|\theta'|)>0$ if and only if $|A''|(=|A'|)>0$. Moreover, it follows from (1.2), (2.1) and (3.1) that each of $\hat{P}_1$, $\hat{P}_2$ and $\hat{P}_N$ will be bounded by $\hat{w}$ and $\hat{r}$ since each is a positive-weighted average of $\hat{w}$ and $\hat{r}$. Thus, given

$$\hat{P}_1>\hat{P}_2 \text{ or } (\hat{P}_1-\theta_{21}\hat{P}_2)/(1-\theta_{21})>\hat{P}_2,$$

(i) $\hat{w}>\hat{P}_1>\hat{P}_2>\hat{r}$ if and only if $|A''|(=|A'|)>0$

and (ii) $\hat{r}>\hat{P}_1>\hat{P}_2>\hat{w}$ if and only if $|A''|(=|A'|)<0$

with $\hat{P}_N$ also falling in the range bounded by $\hat{w}$ and $\hat{r}$, though its exact location relative to $\hat{P}_1$ and $\hat{P}_2$ cannot be predicted *a priori*.

The proof of Proposition 3*b* follows similar lines. Note that (1.1) can also be expressed, by dividing through by $1-\theta_{N1}-\theta_{21}$, as

$$(1.4) \qquad \frac{\theta_{L1}}{1-\theta_{N1}-\theta_{21}}\hat{w} + \frac{\theta_{K1}}{1-\theta_{N1}-\theta_{21}}\hat{r} = \frac{\hat{P}_1-\theta_{N1}\hat{P}_N-\theta_{21}\hat{P}_2}{1-\theta_{N1}-\theta_{21}}.$$

Solving (1.4) and (1.2) together

$$(11) \qquad (\hat{w}-\hat{r})\frac{|\theta|}{1-\theta_{N1}-\theta_{21}} = \left[\frac{\hat{P}_1-\theta_{N1}\hat{P}\ -\theta_{21}\hat{P}_2}{1-\theta_{N1}-\theta_{21}} - \hat{P}_2\right].$$

It is clear from above that given

$$(\hat{P}_1 - \theta_{N1}\hat{P}_N - \theta_{21}\hat{P}_N)/(1 - \theta_{N1} - \theta_{21}) > \hat{P}_2, \hat{w} > \hat{r} \text{ if}$$

and only if $|\theta| > 0$. The R.H.S. expression in (11) is the difference between the effective protective rates for industries 1 and 2 according to the modified Balassa measure. Moreover, we know that $|\theta| > 0$ if and only if $|A| > 0$ and that $\hat{P}_1$, $\hat{P}_2$ and $\hat{P}_N$ must all be bounded by $\hat{w}$ and $\hat{r}$. Thus, given that industry 1 is protected relative to industry 2 in Balassa sense

(i) $\hat{w} >$ each of $\hat{P}_1$, $\hat{P}_2$, $\hat{P}_N$ and $\hat{r} <$ each of $\hat{P}_1$, $\hat{P}_2$, $\hat{P}_N$ if and only if $|A| > 0$ and

(ii) $\hat{w} <$ each of $\hat{P}_1$, $\hat{P}_2$, $\hat{P}_N$ and $\hat{r} >$ each of $\hat{P}_1$, $\hat{P}_2$, $\hat{P}_N$ if and only if $|A| < 0$

from which Proposition 3*b* follows immediately.

Kemp (1969, Chapter 7) could get his result that the knowledge of $(\hat{P}_1 - \hat{P}_2)$ and *direct* factor intensities of industries 1 and 2 was enough to determine unambiguously the movements of real rewards of factors, even with inter-industry flows between industries 1 and 2, because he had no other domestically produced commodity in his model. As already explained, the moment a third domestically produced commodity which can be used as input into industries 1 and/or 2 is introduced, nothing short of *total* coefficients will be needed, in general, to predict the sign (not to speak of the extent) of $(\hat{w} - \hat{r})$ following a particular combination of $(\hat{P}_1 - \hat{P}_2)$.

That our Propositions 3*a* and 3*b* will not hold if we introduce a domestically non-produced imported input is easy to see. Let us introduce another commodity S that is being *solely* imported from abroad to be used in the production of commodity 1 as input. The rest of the model remains the same as before. The competitive profit condition for industry 1, in terms of rates of change, will now be [after substituting for $\hat{P}_N$ from (3.1)]

$$(\theta_{L1} + \theta_{N1}\theta_{LN})\hat{w} + (\theta_{K1} + \theta_{N1}\theta_{KN})\hat{r}$$
$$= \hat{P}_1 - \theta_{21}\hat{P}_2 - \theta_{S1}\hat{P}_S$$

or, dividing through by $(1 - \theta_{21} - \theta_{S1})$,

$$(1.5)\quad \frac{\theta_{L1}+\theta_{N1}\theta_{LN}}{1-\theta_{21}-\theta_{S1}}\hat{w}+\frac{\theta_{K1}+\theta_{N1}\theta_{KN}}{1-\theta_{21}-\theta_{S1}}\hat{r}=\frac{\hat{P}_1-\theta_{21}\hat{P}_2-\theta_{S1}\hat{P}_S}{1-\theta_{21}-\theta_{S1}}.$$

Solving (1.5) and (2.1) simultaneously

$$(12)\quad \frac{(\hat{w}-\hat{r})|\theta'|}{1-\theta_{21}-\theta_{S1}}=\frac{\hat{P}_1-\theta_{21}\hat{P}_2-\theta_{S1}\hat{P}_S}{1-\theta_{21}-\theta_{S1}}-\hat{P}_2.$$

Thus, it is still true that when industry 1 is relatively protected in the Corden sense, wage-rental ratio will rise if and only if commodity 1 is labor-intensive, in terms of *total* coefficients, relative to commodity 2. But it cannot be established that $\hat{w}>\hat{p}_1$ and $\hat{r}<\hat{p}_1$ whenever the wage-rental ratio rises as it is no longer possible to express $\hat{P}_1$ as a weighted average of $\hat{w}$ and $\hat{r}$.[9] Proposition 3*a* must then be replaced by the following weaker Proposition 4*a*. For the same reason, Proposition 3*b* must also be replaced by Proposition 4*b* in the presence of *solely* imported inputs.

Proposition 4*a*. When industry 1 is protected relative to industry 2 in the Corden sense, the wage-rental ratio will rise (fall) if and only if commodity 1 is labor-intensive (capital-intensive), in terms of *total* coefficients, relative to commodity 2.

Proposition 4*b*. When industry 1 is protected relative to industry 2 in the modified Balassa sense, the wage-rental ratio will rise (fall) if and only if commodity 1 is labor-intensive (capital-intensive), in terms of *direct* coefficients, relative to commodity 2.

Note that none of the propositions 3*a* and 3*b* will be affected insofar as the movements of real rewards in terms of any of the *domestically produced* commodities are concerned if the solely imported commodity is used *only* for final consumption. An unambiguous increase (decrease) in real reward must mean, however, an increase (decrease) in factor reward in terms of *all* final commodities, domestically produced or solely imported. That the movements of real factor rewards cannot be predicted unambiguously in the presence of solely imported final commodity is nothing surprising or new since even in the standard two-commodity-two-factor model (with no inter-industry flows), the Stolper-Samuelson correspondence between the movement in commodity price ratio and the movement in *real* factor rewards, as it is well known, might be destroyed by complete specialisation. What is more striking and less obvious is the result that it is generally impossible to predict, from relative factor intensities (in whatever sense) and movements in the prices (or, values added, in whatever sense) of domestically produced tradeables, whether the real reward of a factor will go up (or down) unambiguously if we introduce a *solely* imported '*pure*' intermediate commodity that does not enter the consumption basket of people (and hence real reward in terms of that commodity itself is of no concern to the consumers).[10]

III

Finally, we turn to the Rybczynski theorem and its generalisation by Jones (1965). Jones proved that if, say, L increases relative to K in the usual two-commodity-two-factor model with no inter-industry flows and full employment of both factors is to be maintained at constant commodity price ratio, then

(i) $\hat{x}_1 > \hat{L} > \hat{K} > \hat{x}_2$ if and only if commodity 1 is relatively labor-intensive, and

(ii) $\hat{x}_2 > \hat{L} > \hat{K} > \hat{x}_1$ if and only if commodity 2 is relatively labor-intensive.

The Rybczynski theorem follows as a special case where $\hat{L} > 0$ and $\hat{K} = 0$ and the output of the capital-intensive commodity must then go down absolutely.

We shall investigate how far such results carry through in our present model. Since we have two full employment conditions to determine three variables x_1, x_2 and x_N (or y_1, y_2 and y_N), it is obvious that we must impose some additional restrictions on the variables to get determinate results following a change in factor endowments. In fact, we shall prove two theorems closely akin to the Rybczynski result [or its generalised version by Jones (1965)] with the help of the two alternative assumptions listed overleaf:

$(A.2)$ commodity N is a 'pure' intermediate commodity, i.e., with zero final demand.

$(A.3)$ α_N, the marginal propensity to consume commodity N, lies between zero and one (i.e., $0 \leqq \alpha_N \leqq 1$).

Moreover, as it is customary in the literature, we shall assume the non-traded market to adjust first so that domestic demand is equal to domestic supply for commodity N even at constant prices after factor growth.

Proposition 5. Suppose L expands at a greater rate than K. Under assumption $(A.2)$ the gross as well as the net output of the labor-intensive, in terms of *total* coefficients, tradeable must increase at a greater rate and that of the other tradeable at a smaller rate than both L and K if the prices of all tradeables move at the same rate.

When $\hat{P}_1 = \hat{P}_2 = \hat{P}_S$, it is clear from (9) that $\hat{w} = \hat{r}$. Moreover, $\hat{w} = \hat{r}$ must imply (since each of $(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1 - \theta_{S1})$, $\hat{P}_2$ and $\hat{P}_N$ can be expressed as a weighted average of $\hat{w}$ and $\hat{r}$ and $\hat{P}_1 = \hat{P}_2 = \hat{P}_S$) $\hat{w} = \hat{r} = \hat{P}_1 = \hat{P}_2 = \hat{P}_S = \hat{P}_N$. Thus, all input prices change at the same rate and hence all $\hat{a}_{ij} = 0$. With no final demand for commodity N (so that $x_N = x_{N1} = a_{N1}x_1$) and all $\hat{c}_{ij} = 0$ (4.1) and (5.1) reduce to

$$\hat{x}_1 (\lambda_{L1} + \lambda_{LN}\lambda_{N1}) + \hat{x}_2\lambda_{L2} = \hat{L}$$

$$\hat{x}_1 (\lambda_{K1} + \lambda_{KN}\lambda_{N1}) + \hat{x}_2\lambda_{K2} = \hat{K}.$$

Since $\lambda_{N1} = 1$, we get, through simultaneous solution,

$$|\lambda'| (\hat{x}_1 - \hat{x}_2) = (\hat{L} - \hat{K}).$$

Moreover, with $\lambda_{N1} = 1$, each of $\hat{L}$ and $\hat{K}$ is a positive-weighted average of $\hat{x}_1$ and $\hat{x}_2$. Hence

$$\hat{x}_1 > \hat{L} > \hat{K} > \hat{x}_2 \text{ if and only if } |\lambda'| > 0$$

and $$\hat{x}_2 > \hat{L} > \hat{K} > \hat{x}_1 \text{ if and only if } |\lambda'| < 0.$$

Proposition 5 follows immediately for gross output movements of tradeables.

Note, moreover, that assumption $(A.2)$ implies $\hat{y}_N = 0$. (4.1′) and (5.1′) then reduce to

$$\hat{y}_1\beta_{L1} + \hat{y}_2\beta_{L2} = \hat{L}$$

$$\hat{y}_1\beta_{K1} + \hat{y}_2\beta_{K2} = \hat{K}$$

when all $\hat{a}_{ij} = 0$. $\beta_{L1} + \beta_{L2} = \beta_{K1} + \beta_{K2} = 1$ when $\lambda_{N1} = 1$. Hence

$$|\beta|(\hat{y}_1 - \hat{y}_2) = (\hat{L} - \hat{K}).$$

Since $|\beta| > 0$ if and only if $|A''| > 0$, Proposition 5 holds for net output movements as well.

An intuitive explanation of Proposition 5 may be as follows. With unchanged a_{N1} and no final demand for commodity N, one unit of commodity 1 and a_{N1} units of commodity N can be considered as constituting one unit of a 'composite' commodity. We are essentially back to the usual two commodity model, the two commodities being the composite commodity and commodity 2. The Rybczynski theorem and its generalised version by Jones (1965) will then readily apply for these two commodities. The relevant factor intensity rankings should clearly be in terms of *direct-plus-indirect* or *total* coefficients since one unit of the composite commodity uses labor and capital in the ratio $(a_{L1} + a_{LN}a_{N1})/(a_{K1} + a_{KN}a_{N1})$.

It may be mentioned that Proposition 5 will also be valid for a two-factor-two-commodity production model with inter-industry flows such as in Kemp (1969, Chapter 7) for such a model is, in effect, a special case of our more general model where $x_N = a_{N1} = 0$.[11] However, as we have already noted, the factor intensity ranking in terms of *total* coefficients and that in terms of *direct* coefficients cannot be different in the absence of non-traded inputs. Thus, '*total* coefficients' could be replaced by '*direct* coefficients' in the phrasing of Proposition 5 in a two-factor-two-commodity model with inter-industry flows. Assumption $(A.2)$ will obviously be irrelevant in such a model.[12]

The next result that we shall prove is:

Propositon 6. Suppose L expands with K remaining constant. Under assumption (A.3) the gross as well as the net output of the labor-intensive, in terms of *total* coefficients, tradeable must expand and that of the other tradeable must go down if the prices of all tradeables change at the same rate.

Suppose L expands by ΔL with no growth in capital stock. As already explained, $\hat{P}_1 = \hat{P}_2 = \hat{P}_S$ implies all $\hat{a}_{ij} = 0$. Now, with unchanged labor and capital coefficients, output-labor ratio in industry N, or, what is the same thing, the average product of labor in industry $N(APL_N)$ remains unchanged. The increase in x_N that will just absorb the increase in L is $APL_N.\Delta L$. At constant relative prices, the increase in income in terms of commodity N due to the factor growth is $MPL_N \cdot \Delta L$ (where MPL_N denotes the marginal product of labor in industry N), since wage must be equal to the value of the marginal product under perfect competition. The increase in final demand for commodity N will be $\alpha_N \cdot MPL_N \cdot \Delta L$ which must be equal to Δy_N. Under constant returns to scale, $MPL_N \leqq APL_N$.[13] Since by assumption (A.3) $0 \leqq \alpha_N \leqq 1$, $0 \leqq \alpha_N \cdot MPL_N \cdot \Delta L \leqq APL_N \cdot \Delta L$. y_N will clearly increase but not by so much as to absorb the whole of ΔL. The increase in y_N must also absorb a part of the unchanged capital stock.[14] Thus x_1, x_2 and x_{N1} must absorb a larger amount of labour and a smaller amount of capital than they did before the factor growth. After this point, the proof is the same as that of Proposition 5.

Komiya (1967) has shown, in terms of a two-factor-three-commodity production model where the third commodity is a non-tradeable and all three commodities are 'pure' final commodities, that the Rybczynski theorem holds for the output movements of tradeables if inferiority in consumption is ruled out. We have shown above that the Komiya result is valid for both gross and net output movements of tradeables even when there exist inter-industry flows in the system provided that factor intensities are considered in terms of *total* coefficients.

Note, however, that if $\hat{L} > \hat{K} > 0$ we cannot say [even under assumption (A.3)] whether the output of the labor-intensive tradeable will increase or not relative to that of the capital-intensive tradeable. The reason is that if commodity N is 'highly' labor-intensive, y_N may absorb so much of L and so little of K that the ratio of L to K that x_1, x_2 and x_{N1} must absorb may be *lower* than before, even when the absolute amounts of labor and capital to be absorbed by x_1, x_2 and x_{N1} may both be greater than before. If, however, we assume homothetic social indifference surfaces the output of the labor-intensive tradeable must increase relative to that of the other tradeable whenever $\hat{L} > \hat{K}$. The logic is simple to understand. Suppose $\hat{L} > \hat{K}$. This can be considered as an equal rate of growth of L and K combined with an increase in L with K remaining constant. When $\hat{L}=\hat{K}$ income of the community and hence the final demand for commodity N (which must be equal to y_N) must also grow at the same rate at constant relative prices. Thus the ratio of labor to capital that x_1, x_2 and x_{N1} must absorb will remain the same and x_1, x_2 and (x_{N1}) must grow at the same rate to maintain full employment. Combining this result with Proposition 6 (which holds when $\hat{L} > 0$ and $\hat{K}=0$)[15] we can say that with homothetic taste pattern the output of the labor-intensive (in terms of *total* coefficients) tradeable must expand relative to that of the other tradeable when L grows at a higher rate than K.

IV

Though highly aggregated, our model in this paper can be considered to be a fairly general one in the sense that it includes all the essential features of the production side of an open economy—an exportables sector, a domestically-produced-importables sector, a non-tradeables sector and a sector comprising domestically non-produced imported commodities and all sorts of input-output connections among those different sectors. We have shown how some of the standard theorems in trade theory derived in the context of the usual two-factor-two-commodity model can be generalised to such a framework simply by considering relative factor intensities in terms of *total* coefficients. However, in the presence of non-traded intermediate inputs (but not otherwise) the ranking of tradeable industries in terms of *direct* coefficients need not correspond to that in terms of *total* coefficients and hence the traditional trade theory results will not be valid, in general, if the factor intensity rankings are interpreted in terms of *direct* coefficients.

NOTES

1. In section III we shall also use the conventional zero-excess-demand characteristic of the non-traded commodity.
2. One can think of special cases where the factor intensity rankings in the above two senses must be the same even in the presence of non-traded inputs. Two such special cases are: (a) the *direct* labor-capital ratio in industry N lies in between those of industries 1 and 2; and (b) the tradeable industry having the higher *direct* labor-capital (capital-labor) ratio uses commodity N relatively intensively (in the sense of a larger distributive share of commodity N in this tradeable than in the other), when commodity N has the highest *direct* labor-capital (capital-labor) ratio among the three industries. In case (a) the difference in *total* factor intensities of commodities 1 and 2 will be less than that in *direct* factor intensities but will still be in the same direction. In case (b) the difference in *total* factor intensities will be even greater (in the same direction) than that in *direct* factor intensities.
3. Kemp (1969, Chapter 7) gives a neat economic explanation why the *direct* and *total* factor intensity rankings of industries 1 and 2 cannot be different in the face of inter-industry flows between the two industries.
4. See, for example, Kemp (1969) and Jones (1966, 1971) for applications of the same technique.
5. The following type of solution will always appear when each row sum of the coefficients matrix is unity.
6. Since Corden is the foremost and best-known advocate of this measure. See Corden (1966, pp. 226-8).
7. Since Balassa (1965) had worked with a partial equilibrium version of this measure. We call this measure 'modified' since we shall take into account the change in the price of the non-tradeable resulting from changes in the prices of tradeables while computing value added. Balassa (1965) treated non-tradeables like tradeables with unchanged prices for the purpose of computing the effective protective rates.
8. To avoid any misunderstanding let it be noted that the formulae for the effective protective rates as used in this paper are not necessarily

restricted to the case of fixed coefficients only. For 'small' changes it does not matter whether the pre-change or the post-change θ_{ij} is used as the base. Jones (1971), for example, has applied the same method while explicity considering the variable coefficients case.

9. Since $\hat{P}_S$, unlike $\hat{P}_2$ and $\hat{P}_N$, cannot be expressed as some kind of a θ-weighted average of $\hat{w}$ and $\hat{r}$. All that we can express as a weighted average of $\hat{w}$ and $\hat{r}$ is

$$(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1-\theta_{S1}).$$

10. Note that this result is valid for both two-factor-two-commodity and two-factor-three-commodity production models.
11. Kemp (1969, Chapter 7) also had $a_{12}>0$. However, it can be checked that the basic nature of the problem is the same whether there is one-way or two-way inter-industry flows.
12. Though Kemp (1969, Chapter 7) claimed to have proved this result in his model he was involved in an error in his proof by writing the full employment equations as

$$a_{L1}X_1 + a_{L2}X_2 = L$$

$$a_{K1}X_1 + a_{K2}X_2 = K$$

where a_{ij} was defined as the amount of input i used directly per unit of commodity j and X_j was defined as the net output of commodity j. But, for the above equations to be valid, one must either define a_{ij} as the total requirement of input i per unit of net output of commodity j or define X_j as the gross output of commodity j. This has been abundantly made clear in the course of our analysis [look at Eqs. (4), (5), (4′) and (5′)].
13. This follows from the Euler's equation

$$MPL_N.L_N + MPK_N.K_N = x_N$$

where L_N and K_N are the amounts of labor and capital employed in industry N. Dividing through by L_N, we get

$$MPL_N = APL_N - MPK_N.\frac{K_N}{L_N}.$$

Since,

$$MPK_N.\frac{K_N}{L_N} \geqq 0,\ MPL_N \leqq APL_N.$$

14. I owe to a large extent the idea of this proof to Arup Mallik.

15. Assumption $(A.3)$ is necessarily satisfied when indifference surfaces are homothetic.

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CHAPTER TWO

Non-Traded Inputs and Effective Protection: A General Equilibrium Analysis

The theory of effective protection was originally developed under the simplifying assumptions of a small country, fixed intermediate input coefficients and the absence of non-traded intermediate inputs. The general equilibrium implications of relaxing the fixed coefficients assumption have been studied in a large number of recent papers.[1] In contrast, no rigorous general equilibrium analysis of the question of non-traded inputs in connection with the theory of effective protection has appeared so far except, perhaps, for the paper by Ethier (1971).[2] Ethier's treatment runs in terms of a most 'general' (in the sense of having any number of goods and primary factors) general equilibrium model and hence his results are quite general. However, the nature of some of the special economic issues involved in the problem was not made very clear by him, maybe partly due to his search for full generality.

In this paper, we shall investigate, in terms of a simple general equilibrium model, the resource allocation implications of a number of alternative measures of effective protection that have been (or could have been) suggested in the literature to cope with non-traded inputs. We shall adhere to the assumptions of fixed intermediate input coefficients (though primary factor coefficients will be variable), two domestically-produced tradeables[3] and a small country to keep our basic issue of non-traded inputs in sharp focus.

Throughout the paper, the effective protective rate for an industry $j(EPR_j)$ will be defined as the proportionate change in value added per unit output of industry j. Thus the issue is: which measure of value added and hence of *EPR* has the best predictive power regarding the output movements of tradeables and (indirectly) of non-tradeables in the presence of non-traded inputs.

Corden (1966) treated non-traded inputs like primary factors and argued for the inclusion of the value of non-traded inputs in value added. On the other hand, Balassa (1965) treated non-traded inputs just like ordinary traded inputs with zero tariffs (and hence unchanged prices for a small country) for computing the change in value added. However, the prices of non-traded commodities change, in general, when tariffs are imposed on traded commodities in a general equilibrium framework. Therefore, if one likes to treat non-traded inputs in exactly the same way as traded inputs he should ideally take into account the changes in the prices of non-traded inputs (since that is what he does for traded inputs) resulting from the setting up of a particular protective structure in computing *EPR*'s. Thus, we get at least three alternative measures of effective protections in the face of non-traded inputs. The measure which treats non-traded inputs just like primary factors will be called the *Corden measure*. The *Balassa measure* will be the one which treats non-traded inputs like traded inputs with unchanged prices. The third measure will be called the *modified Balassa measure*. It is different from the Balassa measure in that the changes in the prices of non-traded commodities as a result of changes in the prices of traded commodities will be taken into account.

It will be shown that the Balassa measure does not carry any resource allocation significance. The Corden measure correctly predicts the output movements of tradeables as well as the direct-plus-indirect primary factor movements and value added shifts as between the two traded-good activities so long as the non-traded commodities (whatever be their number) are 'pure' intermediate commodities. With two non-tradeables solely used as inputs, the Corden measure of (relative) protection to the traded-good industries also provides a correct indicator of the degree of (relative) indirect protection to the non-tradeable industries. The modified Balassa measure, on the other hand, assumes the same significance as the Corden measure if and only if the ranking of the traded-good industries in terms of direct primary factor coefficients is the same as that in terms of direct-plus-indirect coefficients.

I

Let us consider an economy where four commodities 1, 2, N and M are being produced locally in four industries 1, 2, N and M respectively. Of these, commodities 1 and 2 are internationally traded and commodities N and M are non-tradeables or home-goods[4]. There are two primary factors, labor and capital—being fully employed and in fixed supply (L, K). Both primary factors are used in the production of all four commodities. In addition, industry 1 uses commodities N, M and S (which are being entirely imported from abroad with no domestic production thereof) and industry 2 uses commodities N and M as intermediate inputs. Production functions in all industries are linear homogeneous in labor, capital and intermediate inputs, where any. Primary factor coefficients per unit of output are variable, in general, but intermediate input coefficients per unit of output are assumed fixed. The country is a small country and there is perfect competition in all markets.

Let us use P_j for the domestic price of commodity j, w for the wage of labor, r for the rental of capital, x_j for the gross output of commodity j and a_{ij} for the amount of input i used directly per unit of commodity j. Our model then consists of six basic equations, viz., four zero-profit conditions for the four industries and two full employment conditions for the two primary factors. Thus we have

$$(1) \qquad a_{L1}w + a_{K1}r + a_{N1}P_N + a_{M1}P_M + a_{S1}P_S = P_1$$

$$(2) \qquad a_{L2}w + a_{K2}r + a_{N2}P_N + a_{M2}P_M = P_2$$

$$(3) \qquad a_{LN}w + a_{KN}r = P_N$$

(4) $$a_{LM}w + a_{KM}r = P_M$$

(5) $$a_{L1}x_1 + a_{L2}x_2 + a_{LN}x_N + a_{LM}x_M = L$$

(6) $$a_{K1}x_1 + a_{K2}x_2 + a_{KN}x_N + a_{KM}x_M = K.$$

By writing the competitive profit equations (1) through (4) in strict equality form, we are implying that given some set of prices P_1, P_2 and P_S for the tradeables (determined by world demand and supply conditions), w, r, P_N and P_M adjust in such a way that *all* four industries produce non-zero outputs. This may not be possible, in general, unless commodities N and M are non-tradeables, whose prices, unlike P_1, P_2 and P_S, are not set arbitrarily from outside the system. This consideration provides a justification for labelling commodities N and M as non-tradeables in our model. Equations (5) and (6) provide the full employment conditions for the two primary factors, labor and capital.

Let A and A' represent the matrices formed by the *direct* and *direct-plus-indirect* primary factor coefficients in industries 1 and 2, so that

$$A = \begin{bmatrix} a_{L1} & a_{L2} \\ a_{K1} & a_{K2} \end{bmatrix}$$

$$A' = \begin{bmatrix} A_{L1} & A_{L2} \\ A_{K1} & A_{K2} \end{bmatrix}$$

where $A_{Lj} = a_{Lj} + a_{LN}a_{Nj} + a_{LM}a_{Mj}$ and

$$A_{Kj} = a_{Kj} + a_{KN}a_{Kj} + a_{KM}a_{Mj};\ j = 1, 2.$$

By direct-plus-indirect labor (capital) coefficient in industry j we mean the amount of labor (capital) used directly plus the amount of labor (capital) used indirectly through the use of non-traded inputs in industry j.

Under our assumptions of constant returns to scale and fixed intermediate input coefficients, the prices of intermediate inputs should not affect the cost-minimising values of a_{Lj} and a_{Kj} and hence of A_{Lj} and A_{Kj} which will depend only upon w/r. Thus

(7) $$A_{Lj} = a_{Lj}(w/r)$$

(8) $$A_{Kj} = a_{Kj}(w/r).$$

Let us now define θ_{ij} as the direct distributive share of input i in industry j and λ_{ij} as the proportion of input i used directly in industry j. Thus, for example, $\theta_{L1} \equiv a_{L1}w/P_1$, $\theta_{N1} \equiv a_{N1}P_N/P_1$, $\lambda_{L1} \equiv a_{L1}x_1/L$ and $\lambda_{N1} \equiv a_{N1}x_1/x_N$. It is now possible to define four other matrices as follows:

$$\lambda = \begin{bmatrix} \lambda_{L1} & \lambda_{L2} \\ \lambda_{K1} & \lambda_{K2} \end{bmatrix}$$

$$\lambda' = \begin{bmatrix} \lambda'_{L1} & \lambda'_{L2} \\ \lambda'_{K1} & \lambda'_{K2} \end{bmatrix}$$

$$\theta = \begin{bmatrix} \theta_{L1} & \theta_{K1} \\ \theta_{L2} & \theta_{K2} \end{bmatrix}$$

$$\theta' = \begin{bmatrix} \theta'_{L1} & \theta'_{K1} \\ \theta'_{L2} & \theta'_{K2} \end{bmatrix}$$

where $\lambda'_{ij} = \lambda_{ij} + \lambda_{iN} + \lambda_{iM}\lambda_{Mj}$ and

$$\theta'_{ij} = \theta_{ij} + \theta_{iN}\theta_{Nj} + \theta_{iM}\theta_{Mj}\ ;\ i = L, K\ ;\ j = 1, 2.$$

Denoting the determinants of the above matrices as $|A|$, $|\lambda|$, $|\theta|$ etc., it can be verified that the following relationships hold:

$$\text{sign}\ |A| = \text{sign}\ |\lambda| = \text{sign}\ |\theta|$$

(9) $$\text{sign}\ |A'| = \text{sign}\ |\lambda'| = \text{sign}\ |\theta'|.$$

Note, further, that $|A| > 0$ if and only if commodity 1 is labor-intensive in terms of direct coefficients and that $|A'| > 0$ if, and only if commodity 1 is labor-intensive in terms of direct-plus-indirect coefficients. Since $|\theta|$ and $|\theta'|$ may well differ in sign, commodity 1 may be labor-intensive in terms of direct coefficients but capital-intensive in terms of direct-plus-indirect coefficients.

Now, let ^ ('hat') over a variable represent the proportionate change in that variable so that $\hat{P}_1 \equiv dP_1/P_1$, etc. The competitive profit equations (1) through (4) can be written, in terms of rates of change, as

$$\theta_{L1}\hat{w} + \theta_{K1}\hat{r} + \theta_{N1}\hat{P}_N + \theta_{M1}\hat{P}_M + \theta_{S1}\hat{P}_S = \hat{P}_1 \tag{1.1}$$

$$\theta_{L2}\hat{w} + \theta_{K2}\hat{r} + \theta_{N2}\hat{P}_N + \theta_{M2}\hat{P}_M = \hat{P}_2 \tag{2.1}$$

$$\theta_{LN}\hat{w} + \theta_{KN}\hat{r} = \hat{P}_N \tag{3.1}$$

$$\theta_{LM}\hat{w} + \theta_{KM}\hat{r} = \hat{P}_M \tag{4.1}$$

In deriving (1.1) through (4.1) we have simply made use of the first order cost-minimisation conditions[5] (since $da_{N1} = da_{M1} = da_{N2} = da_{M2} = 0$ by assumption)

$$\theta_{Lj}\hat{a}_{Lj} + \theta_{Kj}\hat{a}_{Kj} = 0 \qquad j = 1, 2, N, M.$$

In our present model EPR for industry 1 is $(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1-\theta_{S1})$ by the Corden measure $(\hat{P}_1-\theta_{S1}\hat{P}_S)/(1-\theta_{S1}-\theta_{N1}-\theta_{M1})$ by the Balassa measure and $(\hat{P}_1 - \theta_{S1}\hat{P}_S - \theta_{N1}\hat{P}_N - \theta_{M1}\hat{P}_M)/(1 - \theta_{S1} - \theta_{N1} - \theta_{M1})$ by the modified Balassa measure. For industry 2, EPR is $\hat{P}_2$ by the Corden measure, $\hat{P}_2/(1-\theta_{N2}-\theta_{M2})$ by the Balassa measure and $(\hat{P}_2-\theta_{N2}\hat{P}_N-\theta_{M2}\hat{P}_M)/(1-\theta_{N2}-\theta_{M2})$ by the modified Balassa measure.

By substituting for $\hat{P}_N$ from (3.1) and $\hat{P}_M$ from (4.1) into (1.1) and then dividing through by $1 - \theta_{S1}$ one gets

$$\frac{\theta'_{L1}}{1-\theta_{S1}}\hat{w} + \frac{\theta_{K1}}{1-\theta_{S1}}\hat{r} = \frac{\hat{P}_1 - \theta_{S1}\hat{P}_S}{1-\theta_{S1}} \tag{1.2}$$

Similarly, substituting for $\hat{P}_N$ from (3.1) and $\hat{P}_M$ from (4.1) into (2.1)

$$\theta'_{L2}\hat{w} + \theta'_{K2}\hat{r} = \hat{P}_2. \tag{2.2}$$

Solving (1.2) and (2.2) together[6]

$$(10)\qquad (\hat{w}-\hat{r})=\frac{1-\theta_{S1}}{|\theta'|}\left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S}{1-\theta_{S1}}-\hat{P}_2\right].$$

On the other hand, dividing through (1.1) by $(1-\theta_{S1}-\theta_{N1}-\theta_{M1})$ and (2.1) by $1-\theta_{N2}-\theta_{M2}$ and then solving them simultaneously

$$(11)\qquad (\hat{w}-\hat{r})=\frac{(1-\theta_{S1}-\theta_{N1}-\theta_{M1})(1-\theta_{N2}-\theta_{M2})}{|\theta|}$$

$$\times\left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S-\theta_{N1}\hat{P}_N-\theta_{M1}\hat{P}_M}{1-\theta_{S1}-\theta_{N1}-\theta_{M1}}-\frac{\hat{P}_2-\theta_{N2}\hat{P}_N-\theta_{M2}\hat{P}_M}{1-\theta_{N2}-\theta_{M2}}\right].$$

(10) and (11) in turn imply

$$(12)\qquad \left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S}{1-\theta_{S1}}-\hat{P}_2\right]\Bigg/\left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S-\theta_{N1}\hat{P}_N-\theta_{M1}\hat{P}_M}{1-\theta_{S1}-\theta_{N1}-\theta_{M1}}-\frac{\hat{P}_2-\theta_{N2}\hat{P}_N-\theta_{M2}\hat{P}_M}{1-\theta_{N2}-\theta_{M2}}\right]$$

$$=\frac{|\theta'|(1-\theta_{S1}-\theta_{N1}-\theta_{M1})(1-\theta_{N2}-\theta_{M2})}{|\theta|(1-\theta_{S1})}.$$

Since $(1-\theta_{S1}-\theta_{N1}-\theta_{M1})/(1-\theta_{S1})>0$, the Corden measure and the modified Balassa measure yield two different ranking of industries 1 and 2 in terms of *EPR*'s, if and only if $|\theta|$ and $|\theta'|$ differ in sign. In other words, it is possible for industry 1 to be protected relative to industry 2 in Corden sense and at the same time industry 2 to be protected relative to industry 1 in modified Balassa sense, if and only if the *direct* factor intensity rankings of the two industries are different from *direct-plus-indirect* factor intensity rankings.

II

Since we have two full employment equations to determine four output levels x_1, x_2, x_N and x_M, it is obvious that we need some additional restrictions to get determinate results. The problem can be reduced to a two-variable one if commodities N and M are assumed to be 'pure' intermediate commodities (i.e., with zero final demand). We shall explore the resource allocation implications of our three alternative measures of *EPR* by employing this restriction throughout.

From (7) and (8)

$$\hat{A}_{Lj} = -\sigma_{Lj}(\hat{w} - \hat{r}) \qquad j = 1, 2 \tag{7.1}$$

$$\hat{A}_{Kj} = \sigma_{Kj}(\hat{w} - \hat{r}) \qquad j = 1, 2 \tag{7.2}$$

where σ_{Lj} and σ_{Kj} are defined as $-\hat{A}_{Lj}/(\hat{w} - \hat{r})$ and $\hat{A}_{Kj}/(\hat{w} - \hat{r})$ respectively. Clearly

$$\sigma_{Lj} > 0, \ \sigma_{Kj} > 0. \tag{13}$$

Now, assuming commodities N and M to be used *only* as intermediate inputs in the production of commodities 1 and 2 so that $x_N = a_{N1}x_1 + a_{N2}x_2$ and $x_M = a_{M1}x_1 + a_{M2}x_2$ the full employment equations, in terms of rates of change, reduce to

$$\lambda'_{L1}\hat{x}_1 + \lambda'_{L2}\hat{x}_2 = -(\lambda'_{L1}\hat{A}_{L1} + \lambda'_{L2}\hat{A}_{L2}) \tag{5.1}$$

$$\lambda'_{K1}\hat{x}_1 + \lambda'_{K2}\hat{x}_2 = -(\lambda'_{K1}\hat{A}_{K1} + \lambda'_{K2}\hat{A}_{K2}) \tag{6.1}$$

Since $\lambda_{N1} + \lambda_{N2} = \lambda_{M1} + \lambda_{M2} = 1$, each row sum of the coefficients matrix of the above two equations is unity. Hence their simultaneous solution, after using (7.1) and (7.2), gives

$$|\lambda'|(\hat{x}_1 - \hat{x}_2) = \alpha(\hat{w} - \hat{r}) \tag{14}$$

where $\alpha = \sum_j \lambda_{Lj}\sigma_{Lj} + \sum_j \lambda_{Kj}\sigma_{Kj} > 0 \qquad j = 1, 2.$

Now, by substituting for $(\hat{w}-\hat{r})$ from (10) and (11) respectively, (14) can be expressed in two alternative forms:

$$(14.1) \qquad (\hat{x}_1-\hat{x}_2)=\frac{\alpha(1-\theta_{S1})}{|\lambda'||\theta'|}\left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S}{1-\theta_{S1}}-\hat{P}_2\right]$$

$$(14.2) \qquad (\hat{x}_1-\hat{x}_2)=\frac{\alpha(1-\theta_{S1}-\theta_{N1}-\theta_{M1})(1-\theta_{N2}-\theta_{M2})}{|\lambda'||\theta|} \times\left[\frac{\hat{P}_1-\theta_{S1}\hat{P}_S-\theta_{N1}\hat{P}_N-\theta_{M1}\hat{P}_M}{1-\theta_{S1}-\theta_{N1}-\theta_{M1}}-\frac{\hat{P}_2-\theta_{N2}\hat{P}_N-\theta_{M2}\hat{P}_M}{1-\theta_{N2}-\theta_{M2}}\right].$$

Since $|\lambda'|$ and $|\theta'|$ must have the same sign but $|\lambda'|$ and $|\theta|$ need not have, it follows from (14.1) and (14.2) that the Corden measure correctly predicts the output movements of tradeables, but the modified Balassa measure may not in the present case. Insofar as $[(\hat{P}_1-\theta_{S1}\hat{P}_S)/(1-\theta_{S1}-\theta_{N1}-\theta_{M1})-\hat{P}_2/(1-\theta_{N2}-\theta_{M2})]$ may differ in sign from $[(\hat{P}_1-\theta_{S1}\hat{P}_S)/(1-\theta_{S1})-\hat{P}_2]$, the Balassa measure may also be misleading. It is obvious that these results will be valid whatever be the number of non-traded goods so long as they are 'pure' intermediate commodities.

An intuitive explanation of the above results may be as follows. In the present case where commodities N and M are pure intermediate commodities, the entire output space is reduced essentially to two dimensions involving two composite commodities. For instance, one unit of x_1, a_{N1} units of x_N and a_{M1} units of x_M constitute one unit of the first composite commodity. Clearly one unit of the composite commodity uses labor and capital given by our direct-plus-indirect coefficients. The Corden measure measures the protection accorded to the direct-plus-indirect (rather than direct) value added, and thus correctly predicts the output movements of the composite commodities. Since x_1 and x_2 must be proportional to the output levels of the composite commodities (under fixed intermediate input coefficients assumption), the Corden measure is a correct indicator of the output movements of the traded-good industries. The modified Balassa measure, by measuring protection accorded to direct value added, will fail to yield a correct prediction about the output movements of the composite commodities and hence of the traded-good industries if the direct coefficients ranking of the traded-good industries is different from direct-plus-indirect coefficients ranking. The Balassa measure does not measure correctly the protection given to direct-plus-indirect value added (nor to direct value added either) and hence may be misleading also.

Humphrey (1969a, 1969b) suggests that if somehow the changes in the prices of non-tradeables (in other words, the tariff-equivalents for non-tradeables), resulting from a particular protective structure for tradeables could be known, the *EPR*'s computed on the basis of the nominal tariff rates and the tariff-equivalents will be the appropriate ones to use. But these *EPR*'s are really nothing but what we have called *EPR*'s in terms of the modified Balassa measure. However, we have already shown above that this measure may not correctly predict the output movements of tradeables in a general equilibrium framework in situations where the Corden measure is the correct indicator of resource movements. Corden (1971, pp. 162–3) on the other hand, conjectures that the modified Balassa measure (which he prefers to call the *Scott method*) is the appropriate one if there is only one non-traded commodity, or if the price-relationships among non-tradeables remain unchanged. But it can be checked very easily that our result that the Corden measure is the appropriate one and the modified Balassa measure may not be so long as the non-tradeables are 'pure' intermediate commodities will hold even when there is only one non-tradeable in the model. Thus, Corden's conjecture is not valid in general.

The next interesting point to be noted in connection with the present case where non-tradeables are 'pure' intermediate commodities is that whenever industry 1 is protected relative to industry 2 in the Corden sense, the output of the non-tradeable used intensively in industry 1 must increase relative to that of the other non-traded commodity. In other words, the Corden measure correctly measures the degree of indirect (relative) protection accorded to the non-traded industries supplying inputs to the traded-good industries.

The proof is simple. Define two more matrices such that

$$\bar{A}=\begin{bmatrix} a_{N1} & a_{N2} \\ a_{M1} & a_{M2} \end{bmatrix}$$

$$\bar{\lambda}=\begin{bmatrix} \lambda_{N1} & \lambda_{N2} \\ \lambda_{M1} & \lambda_{M2} \end{bmatrix}$$

and note that

$$\text{sign } |\bar{A}| = \text{sign } |\bar{\lambda}|.$$

Clearly $|\bar{A}| > 0$ if and only if industry 1 is N-intensive (rather than M-intensive).

Now, $\hat{x}_N = \lambda_{N1}\hat{x}_1 + \lambda_{N2}\hat{x}_2$ and $\hat{x}_M = \lambda_{M1}\hat{x}_1 + \lambda_{M2}\hat{x}_2$. Therefore,

(15) $$(\hat{x}_N - \hat{x}_M) = (\lambda_{N1} - \lambda_{M1})\hat{x}_1 - (\lambda_{M2} - \lambda_{N2})\hat{x}_2.$$

Since each row sum of $|\bar{\lambda}|$ is unity

(16) $$|\bar{\lambda}| = \lambda_{N1} - \lambda_{M1} = \lambda_{M2} - \lambda_{N2}$$

and hence (15) can be written as

(17) $$(\hat{x}_N - \hat{x}_M) = |\bar{\lambda}| (\hat{x}_1 - \hat{x}_2).$$

Substituting for $(\hat{x}_1 - \hat{x}_2)$ from (14.1) into (17)

(18) $$(\hat{x}_N - \hat{x}_M) = \frac{\alpha(1-\theta_{S1})|\bar{\lambda}|}{|\lambda'|\,|\theta'|}\left[\frac{\hat{P}_1 - \theta_{S1}\hat{P}_S}{1-\theta_{S1}} - \hat{P}_2\right].$$

Since $\alpha(1-\theta_{S1})/(|\lambda'|\,|\theta'|) > 0$, $(\hat{x}_N - \hat{x}_M) > 0$ if and only if $|\bar{\lambda}| > 0$ whenever $[(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1-\theta_{S1}) - \hat{P}_2] > 0$. It readily follows that if industry 1 is protected relative to industry 2 in the Corden sense, the output of the non-traded commodity used intensively in industry 1 will expand relative to that of the other non-traded commodity. Since the Balassa measure and the modified Balassa measure may still yield rankings of industries 1 and 2 that are different from that in terms of the Corden measure, none of these two measures will possess that significance.

So far we have confined ourselves to output movements only. Let us now indicate, rather briefly the implications of the alternative *EPR* measures with regard to domestic resource movements and value added shifts as between the two traded good industries in our model. It can be proved that if $EPR_1 > EPR_2$ in the Corden sense the amounts of direct-plus-indirect labor and capital used in industry 1 will go up and those in industry 2 will go down. To save space we merely give here the expression in for the proportionate change in direct-plus-indirect labor used in industry 1:

$$(19) \qquad (A_{L1} \cdot x_1) = \hat{A}_{L1} + \hat{x}_1 = \frac{(1 - \theta_{S1})}{|\theta'|} \times \left[\frac{\hat{P}_1 - \theta_{S1}\hat{P}_S}{1 - \theta_{S1}} - \hat{P}_2\right]\left\{-\sigma_{L1} + \frac{\beta}{|\lambda'|}\right\}$$

where $\beta = \lambda'_{K2}(\sigma_{L1}\lambda'_{L1} + \sigma_{L2}\lambda'_{L2}) + \lambda'_{L2}(\sigma_{K1}\lambda'_{K1} + \sigma_{K2}\lambda'_{K2}) > 0$ with $(P_1 - \theta_{S1}P_S)/(1 - \theta_{S1}) > P_2$, the expression is clearly positive if $|\theta'|$ and $|\lambda'|$ are both negative.[7] It can also be checked that $\beta > \sigma_{L1}|\lambda'|$ so that $\{\sigma_{L1} + \beta/|\lambda'|\}$ is positive whenever $|\lambda'|$ is positive. Thus the expression in (19) must be positive if and only if $EPR_1 > EPR_2$ in Corden sense. Needless to say, neither the Balassa nor the modified Balassa measure will necessarily have this property.

It cannot be proved (without imposing additional restrictions), however, that direct labor and capital will go up in indusry 1 and go down in industry 2 if $EPR_1 > EPR_2$ in terms of any of the three measures.

Turning now to shifts in values added one can prove that the direct-plus-indirect value added in industry 1 will go up and that in industry 2 will go down if $EPR_1 > EPR_2$ in the Corden sense and, in addition, $EPR_1 > 0$ and $EPR_2 < 0$. Again, we give here only the expression for the proportionate change in the direct-plus-indirect value added in industry 1:

$$(20) \qquad \widehat{(v_1 x_1)} = \hat{v}_1 + \hat{x}_1 = \frac{\hat{P}_1 - \theta_{S1}\hat{P}_S}{1 - \theta_{S1}} + \frac{\beta(1-\theta_{S1})}{|\theta'||\lambda'|} \times \left[\frac{\hat{P}_1 - \theta_{S1}\hat{P}_S}{1-\theta_{S1}} - \hat{P}_2\right]$$

where $v_1 = P_1 - a_{S1}P_S$ is the direct value added per unit output in industry 1. The expression in (20) is clearly positive if $(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1-\theta_{S1}) > \hat{P}_2$ and $(\hat{P}_1 - \theta_{S1}\hat{P}_S)/(1-\theta_{S1}) > 0$. Thus an output tariff for industry 1 (i.e., $\hat{P}_1 > 0, \hat{P}_2 = \hat{P}_S = 0$) or an input subsidy for industry 1 (i.e., $\hat{P}_S < 0, \hat{P}_1 = \hat{P}_2 = 0$) will definitely increase the amount of direct-plus-indirect value added in industry 1.[8]

It is also true that direct value added will go up in industry 1 and go down in industry 2 if $EPR_1 > EPR_2$ in Corden sense and, in addition, direct value added per unit output in industry 1 goes up and that in industry 2 goes down. However, *a priori* there are no simple tariff combinations which will definitely bring this about. For example, an output tariff for industry 1 with no other tariffs in the system (i.e., $\hat{P}_1 > 0, \hat{P}_2 = \hat{P}_S = 0$) certainly makes $EPR_1 > EPR_2$ in Corden sense but does not guarantee that the direct value added per unit output in industry 1 goes up in as much as the prices of non-tradeables might change in such a way as to reduce the direct value added per unit output in industry 1.

It is obvious that if we allow commodities N and M to be used also for final consumption no EPR measure can predict correctly the output, resource of value added movements as between the two traded-good industries in our model.

Note, finally, that the modified Balassa measure cannot be applied even for a small country without first solving the whole system. In contrast, both the Corden measure and the Balassa measure are applicable without there being any need to solve the system if the country is a small country. Since, as we have already noted, the Balassa measure does not carry any resource allocation significance, this leaves the Corden measure as the only measure which is operational and at the same time has some (limited) resource allocation significance.

NOTES

1. See, for example, Jones (1971), Ethier (1970, 1971), Bhagwati and Srinivasan (1971), Ruffin (1969).
2. Of the partial equilibrium or at-best quasi-general equilibrium studies, mention may be made of the papers by Leith (1968) and Humphrey (1969a, 1969b). Corden's analysis (1966, 1971) of the problem, though it runs along general equilibrium lines, is far from rigorous.
3. It has been demonstrated in the literature that with variable intermediate input coefficients no usual value added concept of effective protection is appropriate for predicting output movements even in a simple two-commodity-two-factor model with no non-traded inputs [see, for example, Jones (1971)]. Moreover, in a multi-dimensional output space the output movements cannot be predicted simply by looking at the structure of effective protective rates, even with fixed intermediate input coefficients and the absence of non-traded inputs [see, Ethier (1971)].
4. The necessity of having two non-traded commodities will be apparent in the later part of the paper when we consider indirect protection to the non-tradeable industries.
5. See Jones (1965, 1971) and Kemp (1969) for applications of the same technique.
6. The following type of solution will appear whenever each row sum of the coefficients matrix formed by the simultaneous equations is unity.
7. Recall $|\lambda^1|$ and $|\theta^1|$ must have the same sign.
8. If direct-plus-indirect values added are measured at (fixed) world prices instead of domestic prices (as done above) direct-plus-indirect value added in industry 1 must go up and that in industry 2 must go down if and only if $EPR_1 > EPR_2$ in Corden sense. This is because the direct-plus-indirect values added at world prices per unit output in industries 1 and 2 are constants by the small country and fixed intermediate input coefficients assumptions. Thus whenever $\hat{x}_1 > 0$ and $\hat{x}_2 <$ (which happens if and only if $EPR_1 > EPR_2$ in Corden sense) the direct-plus-indirect value added world prices must increase in industry 1 and decrease in industry 2.

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CHAPTER THREE

Domestic Distortion, Non-Traded Sector And Optimal Economic Policy

It has recently been demonstrated in the literature[1] that if, in a two-commodity small country model, there occurs an under-production of, say, the import (export) commodity due to domestic distortion, there always exists some *positive* level of import tariff (export subsidy) which will be superior to free trade provided that output responses are 'normal'.[2] The explanation is as follows. Suppose, there is suboptimal production of the import commodity under free trade. If, starting from initial free trade, a small positive import tax is levied, the consumption loss will be insignificant because of the initial equality between the price ratio and the marginal rate of substitution in consumption. There will, however, be a production gain as the relative price of the importable rises and, assuming 'normal' production response, the output of the import commodity increases. This production gain will not be insignificant since in the initial free trade situation the price ratio was *not* equal to the marginal rate of transformation in production. However, this result is not necessarily valid if we allow a third, non-traded commodity in the model.[3]

To save space, we shall use X_i for the output of commodity i, D_i for the demand for commodity i, P_i^c and P_i^p for the price to the consumers and the price to the producers, respectively, of commodity i and the subscripts x, m and n for the exportable, the importable and the non-traded commodity, respectively. Suppose, now, that there is underproduction of the import commodity under free trade due to domestic distortion and that the country is a small country. As a small import tariff is imposed, starting from initial free trade, the price of the import commodity will definitely rise relative to that of the export commodity. But it is quite possible that the price of non-tradeable may rise relative to the price of the import commodity. For example, Komiya (1967) has demonstrated the existence of this possibility in terms of a two-factor-three-commodity production model where it crucially depends on the factor intensity rankings of the three industries. Thus, it is not impossible for the output of the import commodity to fall, thus resulting in a production loss. In that case no positive level of import tariff will yield a better solution than free trade.

One should not think that this result is merely due to the indeterminacies of a multi-dimensional output space rather than to the existence of the non-traded sector. For, suppose that the small country produces *only* the export commodity and the non-traded commodity so that the output space is two-dimensional. Suppose, further, that there is underproduction of the export commodity under free trade. With a small positive export subsidy, the price of the non-traded commodity may still rise relative to that of the export commodity. In fact, such a possibility remains even if all commodities are assumed to be gross substitutes in consumption. To see that, start with the hypothesis that due to some small positive export subsidy $P_x^p (= P_x^c)$ and $P_n^p (= P_n^c)$ have gone up proportionately. So the production point remains unchanged. $P_m^c (= P_m^p)$ is constant by small country assumption. Now, writing the demand function for the non-traded commodity as

$$(1) \qquad D_N = D_N (P_x^c, P_m^c, P_n^c, X_x, X_n)$$

and setting $P_x^c = P_N^c$ initially by a suitable choice of units, the expression for dD_n reduces to

(2) $$dD_n = \left(\frac{\partial D_n}{\partial P_x^c} + \frac{\partial D_n}{\partial P_n^c}\right) \cdot dP_x^c$$

in the present case where, by hypothesis, $dX_x = dX_n = dP_m^c = 0$ and $dP_x^c = dP_n^c > 0$ as a result of the positive export subsidy. Gross substitutability implies $\frac{\partial D_n}{\partial P_x^c} > 0$ whereas gross substitutability together with zero-degree homogeneity of D_N in absolute prices implies $\frac{\partial D_n}{\partial P_n^c} < 0$. So the sign of dD_n is indeterminate even with the gross substitutability restriction. Thus with $P_n^P\,(= P_n^c)$ and $P_x^P\,(= P_x^c)$ moving up proportionately as a result of the positive export subsidy there might be an excess demand for the non-traded commodity driving up P_n^P relative to P_x^P. This, in turn, would imply, with 'normal' output responses, a fall in X_x resulting in a production loss. No positive level of export subsidy would then be better than free trade. Note that for the above possibility one of the commodities must be non-traded; otherwise as an export subsidy is imposed, the price of the other commodity cannot change under the small country assumption. With 'normal' output responses, the output of the export commodity (whose production was suboptimal) must then expand.

An important contrast is to be noted here. It will still be true that if the small country is suffering from an underproduction of the export commodity and there is no domestic production of importables (so that the output space is two-dimensional) there will exist some *positive* level of *production subsidy* (a better means of attacking a production distortion than trade intervention)[4] on exportables which will yield a better solution than free trade. Again, start with the hypothesis that due to some small positive production subsidy on exportables P_x^P and $P_n^P\,(= P_n^c)$ have gone up proportionately. The production point remains unchanged—hence no change in real income (or welfare) as there is no production gain (or loss) or consumption distortion. Since P_x^c and P_m^c have remained constant while P_n^c has gone up there will be a substitution effect against D_n. With fixed X_n and no income effect this substitution effect causes on excess supply of the non-traded commodity, pushing down its price. Therefore, $P_n^P\,(= P_n^c)$ must fall relative to P_x^P when a positive production subsidy is imposed on exportables. Production of the (under-produced) exportable will rise leading to a production gain with no corresponding consumption loss, implying a definite improvement in welfare. With a three dimensional output space, however, the optimum production subsidy on exportables need no longer be positive simply because of the indeterminancies of a multidimensional output space.

NOTES

1. See Kemp and Negishi (1969), Bhagwati, Ramaswamy and Srinivasan (1969).
2. By 'normal' output responses we mean that if the (producers') price of commodity 1 rises relative to that of commodity 2, the output of commodity 1 goes up and that of commodity 2 goes down. This condition need not necessarily be met if there is distortion. See Jones (1971) on this point.
3. Two recent papers, viz., Arndt (1971) and Batra (1973) have considered some of the implications of introducing domestic distortion in a model with non-traded goods. However, the implications considered in those papers are different from the ones considered in the present note.
4. In case suboptimal production is due to distortion originating in the factor market, a still better policy, as is well known, is a tax-cum-subsidy on factor use rather than production subsidies.

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CHAPTER FOUR

On Uniform Versus Differentiated Tax-Subsidy Structure: A General Theorem

H.G. Johnson (1964) advanced two interesting propositions in connection with a 'second-best optimum tariff structure'. Formally, these can be written as

Proposition 1. For a 'small country' with no domestic distortions in the economy, the optimal tariff structure will, in general, be differentiated for a group of commodities when the country wants to increase the value of output of that group above the free trade level.

Proposition 2. For a 'small country' with no domestic distortions the optimal tariff structure will, in general, be uniform when the country wants to reduce the value of imports below the free trade level.

Though Johnson did not prove the above-mentioned Proposition 2, he provided a proof of Proposition 1. The purpose of this paper is to show that those results constitute special cases of a more general result:

If a 'small country' with no domestic distortions wants to attain a specified minimum or maximum value (at world prices) of import, export, production or consumption of a class of commodities by a system of first-best taxes (subsidies),[1] the optimal tax (subsidy) structure will involve a uniform tax (subsidy) rate for that class of commodities and zero taxes (subsidies) on all commodities outside the class. If, on the other hand, the government has to attain any of those objectives by a system of second-best taxes (subsidies),[2] the optimal tax (subsidy) structure will, in general, involve taxes (subsidies) at different rates on different commodities both within and outside the class. Moreover, the above result will be seen to be valid even in the presence of intermediate goods in the model.

Assume a 'small country' with no domestic distortions in order to avoid getting mixed up with the standard optimum-tariff and various domestic-distortion-based arguments for government intervention. Let there be n commodities $1, \ldots, n$. We shall use the following notations throughout.

X_i = gross output of commodity i
M_i = import (algebraic + or −) of commodity i
X_{ij} = amount of commodity i used as input into the production of commodity j
Y_i = net output of commodity i, defined as

$$(X_i - \sum_{j=1}^{n} X_{ij})$$

D_i = final consumption of commodity i
P_i^* = the world price of commodity i
P_i = the price paid by the domestic consumers for commodity i
π_i = the price received by the domestic producers for commodity i.

Assume that the country's welfare is indicated by a social utility index U which depends upon the final consumption bundle of the community so that

$$U = U(D_1, \ldots, D_n). \tag{1}$$

We assume the social utility function to possess behavioral as well as welfare significance so that

$$\partial U/\partial D_i = \lambda P_i \tag{2}$$

where λ is the (positive) marginal utility of income. Market clearing conditions imply that

$$D_i = X_i + M_i - \sum_{j=1}^{n} X_{ij}. \tag{3}$$

Using (2) and (3), the change in social welfare, free of utility units, is

$$dU/\lambda = \sum_{i=1}^{n} P_i \, dD_i = \sum_{i=1}^{n} P_i \, d(Y_i + M_i). \tag{4}$$

Differentiation of the balance of trade constraint $\sum_{i=1}^{n} P_i^* M_i = 0$ gives[3]

$$\sum_{i=1}^{n} P_i^* \, dM_i = 0. \tag{5}$$

It is a well-known result that in the neighbourhood of the equilibrium production point, the price-weighted sum of changes in net outputs is of second-order small so that

$$\sum_{i=1}^{n} \pi_i \, dY_i = 0. \tag{6}$$

Subtracting (5) and (6) from (4), we obtain

$$dU/\lambda = \sum_{i=1}^{n} (P_i - \pi_i) \, dY_i + \sum_{i=1}^{n} (P_i - P_i^*) \, dM_i. \tag{7}$$

We shall now illustrate our General Theorem by taking two specific non-economic constraints by turn, viz., a value-of-output and a value-of-import constraint. The general method involved will become sufficiently clear so that the extension to all remaining cases will follow as a matter of course.

Suppose that we have an additional constraint in the form of a specified minimum value (at world prices) of net output of a group of commodities, say, $1, \ldots, k$, so that

(8) $$\sum_{i=1}^{k} P_i^* \, Y_i \geqq \bar{Y}$$

where $\bar{Y}$ is the specified minimum value of output of the class of commodities $1, \ldots, k$. Assuming the constraint to be binding, (8) has to be satisfied with strict equality at the optimum point. Thus, for an optimum in the present case, dU/λ must be zero for all differentials dY_i and dM_i satisfying $\sum_{i=1}^{k} P_i^* \, dY_i = 0$. Clearly, a set of sufficient conditions to guarantee that will be

(9) $$\begin{aligned} &P_i = P_i^* \text{ for } i = 1, \ldots, n \\ &\pi_i = P_i \text{ for } i = k+1, \ldots, n \\ &\pi_i \text{ proportional to } P_i^* \text{ for } i = 1, \ldots, k. \end{aligned}$$

In other words, uniform production subsidy for the class of commodities $1, \ldots, k$ with zero subsidy for all other commodities turns out to be the optimal policy in the present case and production subsidy is known to be the first-best means for achieving production goals. Uniform tariff (and tariff is the second-best means in the present case) on the class $1, \ldots, k$ imply

(10) $$\pi_i \text{ proportional to } P_i^* \text{ for } i = 1, \ldots, k.$$

(7) can be rewritten, by using (3), as

(7′) $$dU/\lambda = \sum_{i=1}^{n} (P_i^* - \pi_i)\, dY_i + \sum_{i=1}^{n} (P_i - P_i^*)\, dD_i.$$

It is clear from (7′) that (10) will necessarily make dU/λ zero for all values of dY_i and dM_i satisfying $\sum_{i=1}^{k} P_i^* \, dY_i = 0$, if $\sum_{i=k+1}^{n} (P_i^* - \pi_i)\, dY_i + \sum_{i=1}^{n} (P_i - P_i^*)\, dD_i = 0$. Setting zero tariffs on commodities $k+1, \ldots, n$ will make $\sum_{i=k+1}^{n} (P_i^* - \pi_i)\, dY_i$

$= \sum_{i=k+1}^{n} (P_i - P_i^*) dD_i = 0$ but the remaining terms $\sum_{i=1}^{k} (P_i - P_i^*) dD_i$ will not be zero in general. Thus, for optimality we might need non-uniform tariffs not only for the commodities belonging to the class $1, \ldots, k$ but also for other commodities.[4] In economic terms, the policy of uniform tariffs on the class $1, \ldots, k$ and zero tariffs on the rest of the commodities minimises the production cost but not necessarily the consumption cost (and hence total cost) of achieving the value-of-output objective. Some appropriate non-uniform tariff structure, by striking a better balance between the consumption cost and the production cost of tariffs, may be able to achieve the output objective at a lower total cost to the society.

By an analogous method, uniform tariff can be shown to be the optimal policy in the face of a value-of-import constraint and tariff is the well-known first best means for achieving import goals. It can also be shown that achieving the value-of-import goal by some second-best means like, say, consumption tax implies that some non-uniform consumption tax structure may be optimal. Suppose, the constraint is of the form $\sum_{i=1}^{k} P_i^* M_i \leqq \overline{M}$ where $\overline{M}$ is the maximum permissible value of import of the class of commodities $1, \ldots, k$. For an optimum dU/λ as given in (7) must be zero for all dY_i and dM_i satisfying $\sum_{i=1}^{k} P_i^* dM_i = 0$ (since the constraint is assumed to be binding). A set of sufficient conditions for that purpose is

$$
\begin{aligned}
&P_i = \pi_i \text{ for } i = 1, \ldots, n \\
(11) \qquad &P_i = P_i^* \text{ for } i = k+1, \ldots, n \\
&P_i \text{ proportional to } P_i^* \text{ for } i = 1, \ldots, k
\end{aligned}
$$

which will be satisfied if there are tariffs at an uniform rate on commodities $1, \ldots, k$ and zero tariffs on the rest. Note that this result is somewhat more general than that suggested by Johnson in Proposition 2. Johnson was concerned with the value of imports of *all* importables as a constraint but, as we have seen above, the group of commodities $1, \ldots, k$ need not necessarily include all importables. With an uniform consumption tax for commodities 1, ..., k and zero taxes for all other commodities, we get

$$\begin{aligned} &\pi_i = P_i^* \text{ for } i = 1, \ldots, n \\ (12) \qquad &P_i \text{ proportional to } \pi_i \text{ for } i = 1, \ldots, k \\ &P_i = \pi_i \text{ for } i = k+1, \ldots, n \end{aligned}$$

which obviously cannot make dU/λ zero for all dM_i and dY_i satisfying $\sum_{i=1}^{k} P_i^* \, dM_i = 0$. Depending upon the nature of cross demand and supply elasticities among different commodities, some kind of a non-uniform consumption tax structure will be optimal, in general.

The method of proof used for the above two cases can be extended in an obvious manner to all remaining cases covered by our general theorem.

NOTES

1. By first-best taxes (subsidies) we mean import taxes (subsidies) to attain import goals, export taxes (subsidies) for export goals, production taxes (subsidies) for production goals and consumption taxes (subsidies) in the case of a consumption constraint. See, for example, Bhagwati and Srinivasan (1969).
2. By second-best taxes (subsidies) we mean any taxes (subsidies) other than first-best taxes (subsidies). However, it readily follows from the well-known symmetry relationship between trade, production and consumption taxes that it is possible to duplicate the results of a first-best tax by some appropriate combination of second-best taxes. For example, a consumption tax plus a production subsidy is equivalent to an equal-rate import tariff on that commodity. Thus, even though the consumption tax or the production subsidy, by itself, is a second-best means for achieving import goals their appropriate combination is equivalent to the import tariff, the first-best means in the present case. Similarly, for achieving production objectives a combination of an import tariff (or an export subsidy if it is an export commodity) and a consumption subsidy will be a first-best means just as a production subsidy. For consumption goals a combination of an import tariff (or export subsidy if it is an export commodity)

and a production tax is a first-best means as it is equivalent to a consumption tax.

3. Note that Eq. (5) will remain intact even if the balance of trade constraint is written as

$$\sum_{i=1}^{n} P_i^* M_i = \text{constant rather than zero.}$$

Hence, what is required for our purposes is a constant but not necessarily zero balance of trade.

4. Depending upon the nature of cross effects the optimal policy structure might involve import subsidies (rather than tariffs) for some commodities. This has been noted by Johnson also.

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CHAPTER FIVE

Smuggling, Import Objective and Optimum Tax Structure

It is well known that the first best means of reducing import below the free trade level is a tax on import.[1] Moreover, if the objective is a specific value (at world prices) of a class of commodities, the optimal tax structure for a small country would involve uniform import tariffs for that class of commodities.[2] The present paper seeks to show that none of these results remains generally valid in the presence of smuggling.[3]

It is assumed that smuggling is an increasing cost activity carried on a competitive basis. Both smugglers and legal importers are buying the import commodity at the same price (fixed by small country assumption) in the world market and selling at the same tariff-inclusive price in the domestic market. For legal imports, the gap between the domestic price and the world price goes to the government in the form of tariff revenue and then is returned to the public through lump-sum transfers. The same gap is eaten up by higher costs (e.g., higher transport costs) of evading customs officials in the case of competitive smugglers.

We assume a small country with no domestic distortion in order to avoid the standard optimum tariff and the various domestic-distortion-based arguments for government intervention.

Let there be n commodities $1, \ldots, n$. We use X_i for the output, L_i (algebraic + or —) for the legal import, S_i for the smuggled import, M_i ($= L_i + S_i$) for the total import, D_i for the consumption, P_i^* for the world price and t_i for the rate of import tariff, for commodity i. Throughout the algebra in this paper we do not allow any taxes other than tariffs so that P_i represents the consumers price as well as the producers' price for commodity i.

The community's welfare is indicated by a social utility index U which depends on the consumption basket of the community so that

$$(1) \qquad U = U(D_1 \ldots, D_n).$$

We assume, further, that the social utility function possesses both behavioral and welfare significance[4] so that from first order optimum conditions

$$(2) \qquad \partial U / \partial D_i = \lambda P_i$$

where λ is the (positive) marginal utility of income.

The community budget constraint can be written as

$$(3) \qquad \sum_{i=1}^{n} P_i D_i = \sum_{i=1}^{n} P_i X_i + \sum_{i=1}^{n} P_i^* \, t_i \, L_i$$

which states that the value of consumption at domestic prices is equal to the value of production at domestic prices plus tariff revenues which are assumed to be returned to the public in the form of lump-sum transfers.[5]

Market clearing conditions imply

$$(4) \qquad D_i = X_i + M_i = X_i + L_i + S_i.$$

Smuggling is assumed to be an increasing function of the gap between the domestic (consumers') price and the world price of a commodity so that

$$(5) \qquad S_i = S_i(P_i - P_i^*) \text{ with } S_i' > 0.$$

Since no taxes other than tariffs are allowed in the algebra of the paper

(6) $$P_i = P_i^* \ (1 + t_i).$$

It follows from the production equilibrium condition that the price-weighted sum of changes in outputs at the equilibrium point is zero so that

(7) $$\sum_{i=1}^{n} P_i \, dX_i = 0.$$

Now, differentiating (3) and using (2), (4), (6) and (7), we finally get the expression for the change in social welfare, free of utility units,

(8) $$dU/\lambda = \sum_{i=1}^{n} P_i \, dD_i = \sum_{i=1}^{n} P_i^* \ t_i \, dM_i - \sum_{i=1}^{n}$$

or, alternatively

(9) $$dU/\lambda = \sum_{i=1}^{n} P_i \, dD_i = \sum_{i=1}^{n} P_i^* \ t_i \, dL_i - \sum_{i=1}^{n} P_i^* \ S_i \, dt_i.$$

Suppose, now, that the government wants a specific value of legal imports of a class of commodities, say $1, \ldots, k$ so that the additional constraint is $\sum_{i=1}^{k} P_i^* \ L_i = \text{constant}$. Hence, for an optimum solution in the present case the expression for dU/λ must be zero for all dL_i satisfying $\sum_{i=1}^{k} P_i^* \ dL_i = 0$. With uniform tariffs for the first k commodities and zero taxes elsewhere in the system so that $t_1 = \ldots = t_k = t$ and $t_{k+1} = \ldots = t_n = 0$, the expression for dU/λ in (9) reduces to

(10) $$dU/\lambda = t \sum_{i=1}^{k} P_i^* \ dL_i - \sum_{i=1}^{n} P_i^* \ S_i \, dt_i.$$

However, this is not necessarily zero when $\sum_{i=1}^{k} P_i^* \, dL_i = 0$ (i.e., when the constraint is satisfied) simply because of the additional term $\sum_{i=1}^{n} P_i^* \, S_i \, dt_i$ which is introduced by smuggling. In the absence of smuggling, i.e., when $S_i = 0$ for all i, the expression in (9) is clearly zero whenever an uniform tariff structure satisfies the constraint, i.e., whenever $t_1 = \ldots = t_k = t$ and $t_{k+1} = \ldots = t_n = 0$ and $\sum_{i=1}^{k} P_i^* \, dL_i = 0$. Thus an uniform tariff structure which is the optimal policy for attaining a value of import objective in the absence of smuggling is no longer optimal, in general, in the presence of smuggling. To understand the rationale of the result further, let us start from an uniform tariff structure which satisfies the value of import constraint. Then raise (by small amounts) t_i in cases where $P_i^* \, S_i$ is relatively low and reduce (by small amounts) t_i in cases where $P_i^* \, S_i$ is relatively high, still satisfying the constraint. This will make $\sum_{i=1}^{n} P_i^* \, S_i \, dt_i$ positive implying an improvement in welfare. Hence a non-uniform tariff structure may well yield a higher level of welfare than an uniform tariff structure in the presence of smuggling.

The result does not change if a specific value of *total*, instead of *legal*, import of the first k commodities is introduced as the additional constraint. The expression for dU/λ in (8) does not necessarily become equal to zero with $t_1 = \ldots = t_k = t$ and $t_{k+1} = \ldots = t_n = 0$ even when $\sum_{i=1}^{k} P_i^* \, dM_i = 0$. An intuitive economic explanation of the above results is as follows.

An uniform tariff structure (even in the presence of smuggling) minimises the sum of the production and the consumption costs of attaining an import objective by equating the marginal excess cost on the production side with the marginal excess cost on the consumption side (both are proportional to the tariff rate) for all commodities whose value of imports is the additional constraint of the system. However, the cost in the form of a loss of tariff revenue due to the diversion from legal to smuggled imports consequent on the imposition of tariffs[6] is not necessarily minimised by an uniform tariff structure. A non-uniform tariff structure, by striking a better balance between the revenue cost of smuggling on the one hand and the production and the consumption costs of tariffs on the other, may achieve the import objective at a lower total cost to the society. By the same token, it follows that in the presence of smuggling, tariff (however judiciously employed) may turn out to be worse than production subsidies to attain an import goal.[7] Production subsidies do not generate any smuggling and hence do not give rise to the cost in the form of a loss of revenue through smuggling. As is well known, production subsidies will entail a larger cost on the production side than the combined production and consumption cost of tariffs to attain a given level or value of imports. Still, production subsidies may be able to attain the import objective at a lower total cost, as compared to tariff, simply because production subsidies are free from the revenue loss cost of smuggling whereas tariffs are not.

An interesting asymmetry is to be noted in this connection. If the objective is a certain level of production of the import commodity, as Bhagwati and Hansen (1973) have noted, the superiority of production subsidy over tariff becomes even more pronounced in the presence of smuggling. However, as already explained, if the objective is a certain level of import, tariff which is otherwise a better means of attaining that objective than production subsidy is not necessarily so in the presence of smuggling. The asymmetry is due to the additional cost of smuggling set in motion by tariffs but not by production subsidies which tilts the balance in favour of production subsidy *vis-à-vis* tariff in both the cases.

NOTES

1. See, for example, Bhagwati and Srinivasan (1969).
2. See Johnson (1964).
3. Some other aspects of the welfare implications of smuggling have

been studied in two recent papers, viz., Bhagwati and Hansen (1973) and Bhagwati and Srinivasan (1972).

4. See Chipman (1965), pp. 690–8, for the alternative assumptions under which this would be true. In any case, this dual property of the social utility function is customarily assumed in the literature on trade and welfare.

5. Note that this implies by using (4) and (6), the balance of trade condition $\sum_{i=1}^{n} P_i^* L_i + \sum_{i=1}^{n} P_i S_i = 0$ instead of the usual balance of trade condition $\sum P_i^* M_i = \sum P_i^* L_i = 0$ in the absence of smuggling. In other words, smuggled imports involve a worsened terms of trade P which is higher than P^*, the terms of trade applying to legitimate trade.

6. Alternatively, the cost in the form of a worsened terms of trade through smuggling. See note 5 on this.

7. Production subsidies can be easily incorporated in the algebra of this paper. Its incorporation, however, would complicate the algebra without adding any new economic insight and are hence omitted here.

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CHAPTER SIX

Smuggling, Optimum Tariff and Maximum Revenue Tariff

In a recent paper Bhagwati and Hansen (1973) have made a beginning in the exploration of the economics of smuggling. Harry Johnson (1972) has further extended the analysis to the realm of international trade theory and has concluded that (a) the optimum tariff in the presence of smuggling must be lower than that in the absence of smuggling and (b) the revenue-maximising tariff rate in the presence of smuggling must be lower than that in the absence of smuggling (in the small country case). The purpose of the present paper is to show that none of the above propositions is generally valid. This paper will further show that, as in the traditional model without smuggling, the optimum tariff is less than the maximum revenue tariff in the presence of smuggling.

In contrast to Johnson's diagrammatic and heuristic arguments, our analysis is conducted in terms of algebra and straightforward economic logic.

I. The Model

Our model is the standard two-country-two-commodity model of international trade with the addition of smuggling. As in Johnson (1972), it is assumed that a greater quantity of smuggled imports would come in only at a higher average and marginal cost. There is perfect competition among smugglers so that smuggling continues upto the point where the average cost of smuggled goods is equated to the tariff-inclusive domestic price. So, smuggling is an increasing function of the domestic price of the import commodity.[1] Both legal importers and smugglers buy the import commodity at the same price in the world market and charge the same (tariff-inclusive) price in the domestic market. In the case of legal imports, the gap between the domestic price and the world price is taken away as tariff revenue (and then given back to the public). For competitive smugglers, the same gap is eaten up by higher transport costs and other costs of evading law-enforcement authorities.

We assume that the home country is importing commodity 2 and exporting commodity 1. For the home country, D_i stands for the demand for commodity i, X_i for the production of commodity i, M for total import (legal plus smuggled), X for export, S for smuggled import, L for legal import, P for the domestic price of commodity 2 in terms of commodity 1, t for the *ad valorem* rate of import duty and m for the marginal propensity to import. Let the same symbols with asterisk (*) refer to the rest of the world. For example, P^* is the price of commodity 2 in terms of commodity 1 in the rest of the world. The rest of the world is following a free trade policy. Throughout, production responses are assumed to be normal (i.e., an increase in the relative price of a commodity causes an increase in the production of that commodity) and inferiority in consumption is ruled out.

The home country's social utility function is

$$(1) \qquad U = U(D_1, D_2)$$

which has both behavioral and welfare significance. Taking differentials, then dividing through by $\partial U/\partial D_1$ and using the consumer's equilibrium relation $\frac{\partial U/\partial D_2}{\partial U/\partial D_1} = P$, we get dy, the standard expression for the change in welfare in terms of commodity 1,[2]

(2) $$dy \equiv \frac{dU}{\partial U/\partial D_1} = dD_1 + PdD_2.$$

The budget constraint for the commodity is

(3) $$D_1 + PD_2 = X_1 + PX_2 + tP^*L$$

which says that the value of consumption at domestic prices is equal to the value of production at domestic prices plus tariff revenues on legal imports.

Totally differentiating (3), then using (2) and the production equilibrium condition $dX_1 + PdX_2 = 0$, we get

(4) $$dy = -MdP + d(tP^*L)$$

where $M \equiv D_2 - X_2 = S + L$.

There are other alternative expressions for dy. To get them, insert $P = P^*(1 + t)$ in (3). This yields

(5) $$D_1 + P^*D_2 = X_1 + P^*X_2 - (P - P^*)S.$$

Taking differentials on both sides of (5), then adding and subtracting PdD_2 on the L.H.S. and PdX_2 on the R.H.S. of the expression and, finally, using (2) and the production equilibrium condition $dX_1 + PdX_2 = 0$, we get

(6) $$dy = -MdP^* + (P - P^*)dM - d[(P - P^*)S]$$

or, alternatively,

(6′) $$dy = -LdP^* + (P - P^*)(dM - dS) - SdP.$$

We shall make use of all these alternative expressions for dy in our subsequent analysis.

II. Optimum Tariff and Maximum Revenue Tariff

We shall first establish that e^*, the elasticity of supply of exports by the rest of the world, defined as $\frac{P^*}{X^*}\cdot\frac{dX^*}{dP^*}$, must be positive at the optimum tariff point.

First, note that $dP^*/dt < 0$. Since

$$M = D_2(P, y) - X_2(P) = M(P, y)$$

$$dM = \frac{\partial M}{\partial P}\, dP + \frac{\partial M}{\partial Y}\, dy. \tag{7}$$

Now, at constant P^*, $dy = (P - P^*)\, dM - d\,[(P - P^*)\, S]$. Substituting for dy in (7), we eventually get

$$\Delta \cdot dM = \frac{\partial M}{\partial P}\, dP - \frac{m}{p}\, d\,[(P - P^*)\, S] \tag{8}$$

where $\Delta = \left(1 - m + \frac{m}{1+t}\right) > 0$. As t increases, constant P^* implies a rise in P and hence in S. Thus $-\frac{m}{P}\, d[(P - P^*)\, S] < 0$ and $\frac{\partial M}{\partial P}\, dP < 0$ $\left(\text{since } \frac{\partial M}{\partial P} \text{ is the pure substitution term}\right)$, implying $dM < 0$. Constant P^*, on the other hand, implies unchanged X^*. So, at constant P^* there will be an excess supply in the world market for commodity 2 pushing P^* down.

Next, find out the signs of dP, dM and dS at the optimum tariff point. As t increases at the optimum tariff point, $dy = 0$. With $dy = 0$, there will be a world excess supply of commodity 2 at unchanged P if (and only if) $e^* < 0$. Unchanged P implies a fall in P^* as t increases. With $dy = 0$, $dM = 0$ at unchanged P. A fall in P^*, on the other hand, implies a *rise* in X^* if (and only if) $e^* < 0$. The resulting world excess supply of commodity 2 at unchanged P will cause a fall in P. Thus $dP < 0$ if and only if $e^* < 0$ at the optimum tariff point. With $dy = 0$, $dM \gtreqless 0$ according as $dP \lesseqgtr 0$. Since S is a rising function of P

it also follows that $dS \gtreqless 0$ according as $e^* \gtreqless 0$ at the optimum tariff point.

Thus, at the optimum tariff point ($dy = 0$) $dP^* < 0$, $dP \leqq 0$, $dM \geqq 0$ and $dS \leqq 0$ if $e^* \leqq 0$ which implies that the expression for dy in (6′) must be positive. Since this is a clear contradiction with $dy = 0$, $e^* \leqq 0$ is inconsistent with optimum tariff.

Therefore, $e^* > 0$ at the optimum tariff point. As already explained this will imply $dP^* < 0$, $dP > 0$[3] and $dS > 0$ so that $d[(P - P^*) S] > 0$. Then, it follows from (6) that at the optimum tariff point $[-MdP^* + (P - P^*) dM] > 0$. Moreover, $-MdP^* > 0$ and $(P - P^*) dM < 0$ implying $-MdP^* > -(P - P^*) dM$. Since $(P - P^*) = tP^*$ and $X^* = M$ in trade equilibrium this implies that at the optimum tariff point $t < \frac{1}{e^*}$ in the presence of smuggling. In the absence of smuggling, $t = \frac{1}{e^*}$ at the optimum tariff point. But, in general, the value of e^* varies along the offer curve. So, one cannot say from the above analysis that the optimum tariff with smuggling must be less than that without smuggling.[4] In the special case where e^* is a monotonically increasing function of t or is a constant over the relevant range, Johnson's conclusion is valid, however. For, suppose that the optimum tariff is *greater* with smuggling than without. If e^* increases with t, $\frac{1}{e^*}$ will be smaller with smuggling than without at the optimum tariff point. But, given that $t < \frac{1}{e^*}$ with smuggling but $t = \frac{1}{e^*}$ without, this implies that the optimum tariff rate is *smaller* with smuggling than without which contradicts our initial hypothesis. Hence the optimum tariff rate must be lower with smuggling than without if e^* increases with t. Obviously, the same conclusion holds if e^* is a constant.

That the optimum tariff must be less than the maximum revenue tariff even in the presence of smuggling can be easily shown. Look at the expression for dy in (4). We have already proved that at the optimum tariff point $dP > 0$ as t increases. Therefore $d(P^*tL) > 0$ when $dy = 0$. Tariff revenue is increasing as t increases at the optimum tariff point. Hence it reaches a maximum at a tariff rate higher than the optimum tariff rate.

As regards the comparison between the maximum revenue tariff in the presence and in the absence of smuggling, Johnson's result is, again, not generally valid even for the small country case. The revenue function in the presence of smuggling is

$$R = P^* t (D_2 - X_2 - S). \tag{9}$$

Setting $dR/dt = 0$, we get

$$tP^* \frac{dM}{dt}\left(1 + \frac{1}{e^*}\right) + P^* M - \frac{d(tP^* S)}{dt} = 0. \tag{10}$$

Since tariff is protective at the maximum revenue point[5] $-\frac{d(tP^*S)}{dt} = -\frac{d[(P - P^*)S]}{dt}$ must be negative. Hence, at the maximum revenue point

$$tP^* \frac{dM}{dt}\left(1 + \frac{1}{e^*}\right) + P^* M > 0 \tag{11}$$

or,

$$t < -\frac{M}{\frac{dM}{dt}\left(1 + \frac{1}{e^*}\right)} \tag{12}$$

since $\frac{dM}{dt} < 0$ at the maximum revenue point.[6] In the absence of smuggling ($S = 0$), t equals the R.H.S. expression in (12) at the maximum revenue point. But that does *not* necessarily imply that the maximum revenue tariff rate with smuggling is less than that without smuggling in as much as the values of e^*, M and $\frac{dM}{dt}$ depend upon the points at which they are evaluated. Evidently, the same conclusion holds for the small country case where $e^* = \infty$ since nothing can be specified *a priori* about whether the derivative $\frac{dM}{dt}$ increases or decreases as t goes up.

NOTES

1. It can be checked that the results of this paper will be unaffected if smuggling is assumed instead to be a rising function of the gap between the domestic price and the world price of the import commodity.
2. See, for example, Jones (1969) for more details on this and the following derivations.
3. In other words (as in the traditional model without smuggling), the so-called Metzler Paradox cannot hold at the optimum tariff point.
4. The error in Johnson's proof seems to lie in his statement: 'Given the less steep slope condition on $PO'F$ relative to OCP, the tangency position must lie to the right of $C'C$ on $PO'F$ and must involve a lower tariff rate than the former optimum tariff' (pp. 6–7). That the tangency must lie to the right of $C'C$ on $PO'F$ in terms of Johnson's Figure II does *not* necessarily imply a lower tariff rate than the tariff rate implied by the difference in slopes of OT' and of the tangent to the foreign offer curve at C (which is the optimum tariff rate without smuggling).
5. Proof : The maximum revenue tariff is greater than the optimum tariff. Hence $dy < 0$ at the maximum revenue point as t increases. Consider the expression for dy in (4). Since $d(tP^*L) = 0$ at the maximum revenue point, dP must be positive in order to produce $dy < 0$.
6. Proof :

$$\frac{dM}{dt} = \frac{\partial M}{\partial P} \cdot \frac{dP}{dt} + \frac{\partial M}{\partial y} \cdot \frac{dy}{dt}.$$

We have proved that

$$\frac{dy}{dt} < 0 \text{ and } \frac{dP}{dt} > 0$$

at the maximum revenue point (see note 5). With

$$\frac{\partial M}{\partial y} > 0 \text{ and } \frac{\partial M}{\partial P} < 0$$

(pure substitution effect), this implies $\frac{dM}{dt} < 0$ at the maximum revenue point.

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CHAPTER SEVEN

Impact of Alternative Government Policies in an Open Economy

I. Introduction

The primary objective of the present paper is to extend the analysis of the short-run impact of alternative government policies in an *open* economy model, taking explicitly into account the wealth effects that arise out of the government budget deficit and the current account trade surplus. Though the 'long-run' implications[1] of these two types of wealth effects in an open economy model have recently been investigated,[2] the 'short run' implications have remained unexplored so far.

In this paper we shall make a distinction between a number of alternative concepts of monetary and fiscal policies and shall derive the impact multipliers corresponding to these alternative policies in an open economy model. We shall show that with a 'high' degree of international capital mobility bond-financed government expenditure is likely to be less expansionary than tax-financed expenditure under a flexible exchange rate system but that the opposite is true under fixed exchanged rates. In our model the derivation of this unorthodox possibility depends crucially on either a positive wealth effect on the demand for money or the demand for money being (indirectly) a function of disposable income rather than total national income. Thus, our analysis will also highlight some interesting implications of the alternative specifications of the demand function for money. Finally, with perfect international capital mobility the distinction between 'inside' and 'outside' money creation will be found to be highly significant under fixed exchange rates but to be of little significance under a flexible exchange rate regime.

We assume the home country to be 'small' so that foreign repercussions can be neglected. The home country is open in that there is international trade in commodities as well as international capital movements. We postulate a simple framework with rigid prices, unemployed resources, and the absence of terms of trade effects.

Our model for the home country consists of the following equations:

(1) $$Y = A(D, i, W) + G + X(r) - I(D, W, G, r)$$

(2) $$M = L(i, A, W)$$

(3) $$B = X(r) - I(D, W, G, r) + K(i)$$

(4) $$dM = dM' + dR(1 - s)$$

(5) $$dR = B$$

(6) $$G - T = dM' + dV - s\,dR$$

(7) $$dW = G - T + X(r) - I(D, W, G, r)$$

(8) $$D = Y - T,$$

where

Y = national income
A = sum of private consumption and investment expenditure
D = disposable national income
i = the rate of interest
W = aggregate net worth or assets of the private sector
C = government expenditure
r = price of domestic currency in terms of foreign currency

X = value of exports in domestic currency
I = value of imports in domestic currency
M = total stock of domestic money
M' = the autonomous component of the money supply
R = domestic currency value of foreign exchange reserves
B = domestic currency value of the balance of payments
K = domestic currency value of net capital inflow
T = yield of taxes minus transfers
V = the stock of government bonds absorbed by the private sector (including foreigners)
s = the sterilization coefficient.

A methodological point should be made clear at the outset. In our model, we are equating values of flow variables (like, say, G) with changes in stock variables (like, say, M'). This is possible because we are considering changes in stock variables during the same time period (usually a year) over which the various flow magnitudes are defined. In other words, we are confining ourselves to one-period changes and the multipliers in this paper must be interpreted as one-period multipliers.

Equations (1) and (2) give, respectively, the usual product and money market equilibrium conditions. The demand for money function, however, deserves an explanation. We have made the transactions demand for money depend upon private domestic expenditure (A)[3] rather than national income (Y). The reason for adopting the above specification is that one should expect that the demand for money will be lower if a given Y is sustained by higher foreign spending and lower domestic spending. Since private domestic spending (A) is a function of disposable income (D) rather than national income (Y), government policies which have differential effect on D relative to Y will have interesting effects in our model which are not apparent under alternative specifications. We have also incorporated W in the money demand function. It is assumed that an increase in the wealth of the community causes an increase in the demand for goods, money and bonds as people usually like to hold an increase in their wealth in the form of various types of assets. One can reasonably assume (denoting the partial derivative of A with respect to D as A_D, etc.) that $0 \leqq A_D \leqq 1, 0 \leqq I_D \leqq A_D, A_i \leqq 0, A_W \geqq 0, 0 \leqq I_W$

$\leqq A_W, (X_r - I_r) \leqq 0, 0 \leqq I_G \leqq 1, L_A \geqq 0, L_i \leqq 0, 0 \leqq L_W \leqq 1.$

Equation (3) defines the balance of payments as the balance of trade (i.e., exports minus imports), plus net capital inflow (K). The net capital inflow is assumed to be an increasing function of i, the domestic rate of interest (the foreign rate of interest being unchanged by 'small country' assumption). To simplify analysis we assume away interest payments on past foreign loans by assuming that the country is a zero net creditor to start with.[4]

We make the usual simplifying assumption that there is a 100 per cent reserve banking system. Thus, in equation (4) we write dM, the change in the quantity of money, as the sum of dM', the autonomous component of the money supply, and $dR(1-s)$, the nonsterilized part of the change in foreign exchange reserves. In a fixed exchange rate system, under the assumption that people do not hold any foreign exchange, any change in the stock of foreign exchange, not offset by sterilization operations by the government, must generate an equal change in the quantity of money. Under a flexible rate system there cannot be any change in exchange reserve by definition. Thus equation (4) is applicable for both kinds of exchange rate regimes.

Equation (5) expresses the gain (loss) of foreign exchange reserves as the balance of payments surplus (deficit).

Equation (6) expresses the government budget constraint that a government budget deficit must be financed by a combination of money creation and additional bond issues. Note that dV, the entire sales proceeds of additional government bonds, cannot be used to finance the budget deficit. An amount sdR of those proceeds must be kept idle by the government to sterilize reserve gains. Therefore, the budget deficit $(G-T)$ must be equal to dM', the autonomous change in money supply, plus $(dV-sdR)$, the sales proceeds of additional government bonds that can be used to finance the budget deficit.

Equation (7) defines dW, the change in the wealth of the private sector, as the sum of the government budget deficit and the balance of trade surplus. The underlying definition of W is that it consists of the stock of money and bonds held by the private sector. What constitutes the proper definition of wealth is, as is well known, a rather thorny question and the above definition has been chosen mainly for its simplicity. Further, this definition has also been frequently used in the literature.[5,6]

The government budget deficit clearly injects an equal amount of money and/or bonds into the private sector. A balance of trade surplus (deficit), in a similar way, must be matched by an equal amount of net accumulation (decumulation) of bonds, gold and/or foreign exchange from the rest-of-the-world in order to balance international accounts and thus will increase (decrease) the stock of wealth by the same amount. Note also that in the present model where we do not allow any difference in the wealth effects of bonds and money (or of domestic bonds and foreign bonds) the government cannot offset or even affect the change in wealth, as defined in equation (7), by any kind of 'sterilization' or 'swap' operations which merely affect the composition of assets.

To simplify the analysis we further assume $G = T$ and $B = X - I = 0$ initially so that for our purposes of deriving one-period multipliers (5), (6) and (7) can be expressed as

$$(5') \qquad dR = dB$$

$$(6') \qquad dG - dT = dM' + dV - s\,dR$$

$$(7') \qquad dW = dG - dT + dX - dI.$$

Finally, in equation (8) we define disposable income as income minus taxes plus transfers.

We do not need any equilibrium condition for the bond market in our model. This is so because whenever the commodity and the money markets are in equilibrium due to Walras' law.

We shall derive one-period multipliers corresponding to the following four alternative government policies.

(i) Balanced Budget Expansion: $dG = dT > 0, dM' = 0, dM = (1—s)\,dR, dV = s\,dR.$

(ii) Bond-financed Budget Deficit: $dG > 0, dT = dM' = 0, dM = (1 - s)\ dR, dV = dG + s\,dR.$

(iii) Money-financed Budget Deficit: $dG > 0, dT = 0, dM' = dG, dM = dG + (1 - s)\ dR, dV = s\,dR.$

(iv) Cpen Market Operations: $dG = dT = 0, dM' > 0, dM = dM' + (1 - s)\, dR, dV = -dM' + s\,dR.$

Policies (i) and (ii) may be considered as variants of 'pure' fiscal policy since M', the autonomous component of the money supply, remains constant in both cases. Under flexible rates this would imply a constant M. Under fixed exchange rates, however, M changes (provided $s \neq 1$) due to the impact of the change in reserves on the money supply. Policy (iv), on the other hand, may be termed as 'pure' monetary policy since M' is increasing while both G and T remain constant. Policy (iii) is essentially a combination of policies (ii) and (iv) as the government budget deficit is being entirely financed by an increase in M'.

It will be assumed throughout (unless otherwise noted) that the restrictions on the various partial derivatives of the system hold with strict equalities (e.g., $0 < A_D < 1$, etc.).

II. Flexible Exchange Rate

Under the flexible rate system the exchange rate varies in such a way that $B = dB = 0$. Totally differentiating equations (1), (2), (3), (8) and then using (4), (5′), (6′), (7′) and the restriction $dB = 0$ we can reduce the system to three equations in three endogenous variables dY, di and dr, given dG, dT and dM'. The reduced form system can be written as

$$(9)\begin{bmatrix} 1 - A_D + I_D & -A_i + K_i(A_W . I_W) & -(X_r . I_r) \\ L_A A_D & L_i + A_i L_A - K_i(A_W L_A + L_W) & 0 \\ -I_D & K_i(1 + I_W) & (X_r - I_r) \end{bmatrix} \begin{bmatrix} dY \\ di \\ dr \end{bmatrix}$$

$$= \begin{bmatrix} dG(1 - I_G + A_W - I_W) + dT(-A_D + I_D + I_W - A_W) \\ dM' - dG\,(A_W L_A + L_W) + dT(A_W L_A + L_W + L_A A_D) \\ dG(I_W + I_G) - dT(I_D + I_W) \end{bmatrix}.$$

The determinant of the above system is

$$(10)\ \Delta_1 = (X_r - I_r)[L_i(1 - A_D) + A_i L_A - K_i\{L_A(A_W + A_D) + L_W(1 - A_D)\}] > 0.$$

The multipliers corresponding to the four alternative (i) through (iv) are, respectively,

$$(11)\quad \frac{dY}{dG} = \frac{(X_r - I_r)[L_i(1 - A_D) + A_i L_A - K_i\{L_A(A_W + A_D) + L_W(1 - A_D)\}]}{\Delta_1} = 1$$

$$(12)\quad \frac{dY}{dG} = \frac{(X_r - I_r)[L_i(1 + A_W) - A_i(L_W - L_A)]}{\Delta_1} \gtrless 0$$

$$(13)\quad \frac{dY}{dG} = \frac{(X_r - I_r)[(L_i - K_i)(1 + A_W) + A_i(1 + L_A - L_W)]}{\Delta_1} > 0$$

$$(14)\quad \frac{dY}{dM'} = \frac{(X_r - I_r)[A_i - K_i(1 + A_W)]}{\Delta_1} > 0.$$

Several interesting points emerge from the above exercise.

First, note that we get a unit balanced budget multiplier in our model. This is interesting since the unit multiplier result is usually derived only in a closed economy model which also neglects the monetary sector. Here we are considering an open economy model which takes into account the repercussions in the monetary sector and we still get the same result. The explanation is simple. With D remaining constant as Y increases by $dG = dT$, the private sector's demand for money and imports remains unchanged.[7] The government's demand for money does not increase by assumption in our model. With constant money supply, the rate of interest does not change. A_i and K_i, though non-zero, cannot affect anything. Increase in G causes an increase in the demand for imports. But the exchange rate alters to maintain balance of payments equilibrium. With unchanged capital flows this implies unchanged balance of trade. The wealth effect is also inoperative since $dG = dT$ and $dX = dI$.[8] Once Y rises by $dY = dT$, there will be no further tendency for Y to change.

Second, a look at (12) shows that bond-financed government expenditure can be *contractionary* in our model since it is possible to have $L_W > L_A$ and $|A_i(L_W - L_A)| > |L_i(1 + A_W)|$. A comparison of (11) with (12) also reveals that bond-financed government expenditure can be *less* expansionary than tax-financed government expenditure. Note that this possibility crucially depends on L_W and/or L_A being positive since with $L_W = L_A = 0$ the numerator in (11) is clearly smaller than that in (12).[9] Moreover, with L_W and/or L_A being positive the likelihood of this unorthodox possibility depends positively on the value of K_i. In the limiting case of $K_i \to \infty$, dY/dG in (11) remains unity but dY/dG in (12) tends to zero, and bond-financing becomes definitely less expansionary than tax-financing. There are three reasons in the present model for a higher demand for money and hence a higher rate of interest with a bond-financed budget deficit *vis-à-vis* balanced budget expansion. The increase in wealth due to the budget deficit causes an increase in the demand for money through peoples' attempts at portfolio balance. The demand for money also increases as higher wealth induces greater spending on commodities which, in turn, requires more transactions balances. Finally, since the tax yield remains constant with bond-financed government expenditure but increases with balanced budget expansion, the disposable income and hence the transactions demand for money becomes greater at the same level of Y with bond-financed expenditure *vis-à-vis* tax-financed expenditure. The higher rate of interest, associated with bond-financed expenditure as against tax-financed expenditure, causes greater capital inflow and hence, under a flexible exchange rate system, a greater balance of trade deficit. The primary expansionary effect of bond-financed expenditure will be greater than that of tax-financed expenditure. But, the secondary contractionary influence through the resultant trade deficit whose size depends upon K_i might tip the balance the other way if the interest-rate-sensitivity of capital flows is sufficiently high. Money-financed government expenditure, however, can never be contractionary in the present model since $L_W \leqq 1$.

Third, as $K_i \to \infty$, dY/dG in (13) and (14) approach the same value $[(1 + A_W)/L_A(A_W + A_D) + L_W(1 - A_D)]$. This is due to the fact that policy (iii) is essentially a combination of policies (ii) and (iv). We have already seen that dY/dG for policy (ii) approaches zero as $K_i \to \infty$. Hence, it is quite understandable that policy (iii) will have the same effect as policy (iv) as $K_i \to \infty$. Under flexible exchange rates with perfect capital mobility, a dollar increment in money supply will have the same expansionary impact, irrespective of whether it is brought about through a budget deficit ('outside' money creation) or through open market operations ('inside' money creation).

III. Fixed Exchange Rate

Under the fixed exchange rate system $dr = 0$. Totally differentiating (1), (2), (3), (8) and then using (4), (5′), (6′), (7′) and $dr = 0$ we get the following three equations in three variables dY, di and dB where dG, dT and dM' are the exogenous policy parameters:

$$(15)\quad \begin{bmatrix} 1 - A_D + I_D & -A_i K_i (A_W - I_W) & -A_W + I_W \\ L_A A_D & L_i + A_i L_A - K_i (A_W L_A + L_W) & A_W L_A + L_W + s - 1 \\ -I_D & K_i(1 + I_W) & -(1 + I_W) \end{bmatrix}$$

$$\begin{bmatrix} dY \\ di \\ dB \end{bmatrix} = \begin{bmatrix} dG(1 - I_W + A_W - I_W) + dT(-A_D + I_D + I_W - A_W) \\ dM' - dG(A_W L_A + L_W) + dT(A_W L_A + L_W + L_A A_D) \\ dG(I_W + I_G) - dT(I_D + I_W) \end{bmatrix}.$$

The determinant of the system is

$$(16)\quad \Delta_2 = -A_i[L_A(1 + I_W) + I_D(1 + L_A - s - L_W)] + [K_i(1 - s) - L_i][(1 - A_D)(1 + I_W) + I_D(1 + A_W)] \gtreqless 0.$$

The sign of Δ_2 is, in general, indeterminate since $(1 + L_A - s - L_W)$ can be positive or negative. With $L_W = 0$ and/or $s = 0$, $(1 + L_A - s - L_W)$ and hence Δ_2 must be positive, however.

The multipliers corresponding to policies (i) through (iv) are, respectively,

$$(17)\quad \frac{dY}{dG} = \frac{1}{\Delta_2}[-A_i\{L_A(1 + I_W) + (I_D - I_G)(1 + L_A - s - L_W)\} + \{K_i(1 - s) - L_i\}\{(1 - A_D)(1 + I_W) + (I_D - I_G)(1 + A_W)\}] \gtreqless 0,$$

$$(18)\quad \frac{dY}{dG}=\frac{1}{\Delta_2}[\{-L_i+K_i(1-s)\}\{(1-I_G)(1+A_W)\}$$
$$-A_i\{(1-I_G)(L_A-L_W)-(1-s)(I_W+I_G)\}]\gtreqless 0,$$

$$(19)\quad \frac{dY}{dG}=\frac{1}{\Delta_2}[\{-L_i+K_i(1-s)\}\{(1-I_G)(1+A_W)\}$$
$$-A_i\{s(I_G+I_W)+(1-I_G)(1-L_W+L_A)\}]\gtreqless 0,$$

$$(20)\quad \frac{dY}{dM'}=\frac{1}{\Delta_2}[-A_i(1+I_W)]\gtreqless 0.$$

Note that even under the usual assumption of $I_D \leqq I_G$, *contractionary* balanced budget expansion is a possibility under fixed exchange rates. With no sterilisation ($s=0$), balanced budget expansion must, however, be expansionary if $I_D \geqq I_G$ (a sufficient condition). The unit balanced budget multiplier holds if $I_G=0$. As Y rises by $dG=dT$ and D remains constant, the public sector's demand for imports goes up with consequent contractionary influence unless $I_G=0$. Recall that this restriction was not necessary for unit multiplier under flexible rates.

Comparing (17) with (18) it can be checked that (assuming $\Delta_2>0$ and both policies (i) and (ii) to be expansionary) policy (ii) will be more expansionary than policy (i) if and only if

$$(21)\quad \{-L_i+K_i(1-s)\}\{(1+A_W)-(1+I_W)(1-A_D)\}$$
$$-A_i\{(s-1)(I_W+I_D)+(L_A-L_W)(1-I_D)-L_A(1+I_W)\}$$
$$>0.$$

Since $-A_i\{\ \}$ can be negative the above condition need not necessarily be satisfied. As in the case of flexible rates, bond-financed government expenditure could be less expansionary than tax-financed expenditure.

There is an important contrast to be noted here. Under flexible rates the likelihood of policy (i) being more expansionary than policy (ii) increases as K_i increases. In the limiting case of $K_i \to \infty$, we found policy (i) to be definitely more expansionary than policy (ii). Under fixed rates the balance tips the other way. As K_i increases (provided $s \neq 1$) the likelihood of (21) being satisfied clearly increases. In the limiting case of

$K_i \rightarrow \infty$, (21) will definitely be satisfied since $(1 + A_W) > (1 + I_W)$ and $(1 - I_D) > (1 - A_D)$. Under fixed rates, the higher rate of interest associated with bond-financed expenditure *vis-à-vis* tax-financed expenditure leads to greater capital inflow, a greater balance of payments surplus and hence a gain in reserves and (unless completely offset by sterilization operations) a secondary monetary expansion. In contrast, under flexible rates it led to a greater balance of trade deficit and a secondary contractionary influence. Thus, international capital mobility has quite opposite implications for the relative stabilizing impact of bond-financed government expenditure *vis-à-vis* tax-financed expenditure under the two alternative exchange rate systems.

Note, finally, that as $K_i \rightarrow \infty$, dY/dM' tends to zero. This explains why the multipliers for policies (ii) and (iii) approach the same value $\{(1-I_G)(1+A_W)\}/\{(1-A_D)(1+I_W)+I_D(1+A_W)\} > 0$ under fixed rates with perfect capital mobility. Since policy (iii) is a combination of policies (ii) and (iv), and policy (iv) becomes totally ineffective as $K_i \rightarrow \infty$, the effectiveness of policy (iii) must approach that of policy (ii). Under perfect capital mobility injection of additional money is highly effective (in its impact on Y) if brought about through a budget deficit but completely ineffective if done through open market operations. Unlike the flexible rate case, the distinction between 'inside' and 'outside' money creation is of great significance when there is a high degree of international capital mobility.

NOTES

1. In the sense of comparing the initial equilibrium values of the variables with those of a situation where the net addition to wealth again becomes zero, however distant that situation might be.
2. For example, McKinnon and Oates (1966), McKinnon (1969).
3. We can allow the demand for money to depend upon $(A+G)$ instead of A without affecting the analysis of this paper provided (a) we assume that in the background the government is always printing the amount of money needed to satisfy its own demand and (b) M is redefined as the amount of money left for the private sector to absorb.

4. Since the initial value for foreign indebtedness can be assumed to be as small or large as one likes and it is not endogenous to our system, assuming it to be zero may not be unduly restrictive for our purposes.
5. See, for example, McKinnon and Oates (1966), Ott and Ott (1965). Silber (1970).
6. That this definition presupposes some kind of a 'taxillusion' is also well-known. See, for example, McKinnon and Oates (1966, p. 16, footnote 16) for more on this point.
7. If the demand for money is made a function of *Y* instead of *A* or *D*, the multiplier will be less than unity. Making *I* a function of *Y* instead of *D* does not, however, affect the unit multiplier result under flexible rates.
8. The assumption that net capital inflow is zero to start with is crucial here. If net capital inflow is initially non-zero, it will continue to be non-zero with its associated wealth effect and the multiplier will not be unity under balanced budget expansion.
9. If demand for money is made a function of *Y* instead of *A* or *D* the possibility of a loan financed budget deficit being less expansionary than balanced budget expansion will depend crucially on *Lw* being non-zero.

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Foreign Trade Regimes and Economic Development : India

J N Bhagwati T N Srinivasan

This book is part of a series resulting from the research project on exchange control, liberalisation and economic development in less developed countries. The three major topics analysed are: the economic efficiency and distributional implications of the methods of exchange control employed in the country under study; developing an analytical framework to distinguish between devaluation and liberalisation, and thereby identifying the political and economic ingredients of effective government policies; and a study of the relationship of the exchange control regime to growth and their possible effects on savings, investment allocation, research and development, and entrepreneurship.

The authors analyse the impact of India's foreign trade regimes since the postwar period on her economic performance. They depart from earlier studies on the subject in two principal respects: (a) the June 1966 devaluation and import liberalisation episode and subsequent developments are examined in considerable depth, and, (b) the dynamic aspects of the consequences of India's restrictive foreign trade regime are analysed systematically.

The June 1966 policy package is demonstrated to have been far more successful than is generally believed. The exploration of savings, investment and other dynamic effects leads to the conclusion that the static inefficiencies of Indian trade and exchange rate policies cannot be shown to have been offset by dynamic advantages. The analysis therefore leads to the conclusion that a departure from the restrictive trade regime is both desirable and feasible. In an introductory chapter, the authors provide an overview of the economy since 1950. Among the topics discussed are: the anatomy of exchange control, the liberalisation episode, and the growth effects. In a separate appendix, the authors have defined the concepts used and delineated the phases under study.

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