WIDER
WORKING PAPERS

Liberalization of Capital Movements and Trade: Real Appreciation, Employment and Welfare

by Pertti Haaparanta and Juha Kähkönen

WP 5 August 1986

World Institute for Development Economics Research
United Nations University

PERTTI HAAPARANTA* AND JUHA KÄHKÖNEN**

LIBERALIZATION OF CAPITAL MOVEMENTS AND TRADE: REAL APPRECIATION, EMPLOYMENT AND WELFARE***

August 1986

For presentation at the European Meeting of the Econometric Society, to be held in Budapest, Hungary, September 1-5, 1986.

* World Institute for Development Economics Research (WIDER).

** Bank of Finland.

*** Financial support from the Yrjö Jahnsson Foundation is gratefully acknowledged.

PERTTI HAAPARANTA* AND JUHA KÄHKÖNEN**

LIBERALIZATION OF CAPITAL MOVEMENTS AND TRADE: REAL APPRECIATION, EMPLOYMENT AND WELFARE***

ABSTRACT

A two-period, two-sector optimizing model is used to study the effects of liberalization of trade and capital movements on the real exchange rate, unemployment, and welfare. The mechanism creating unemployment is assumed to be real wage rigidity caused by wage indexation. Due to this distortion, neither free trade nor free capital mobility is in general optimal. It is shown that in the short run liberalization leads to real appreciation while in the long run the picture is not as clear especially regarding trade liberalization. If real appreciation is associated with an increase in unemployment it is optimal to protect the open sector and restrict foreign borrowing. The optimality of these policies is guided by their effects on employment, even though in general there is no necessary connection between welfare and employment. If the initial situation is very distorted liberalization may increase welfare despite the fact that unemployment increases.

* World Institute for Development Economics Research (WIDER).

** Bank of Finland.

*** Financial support from the Yrjö Jahnsson Foundation is gratefully acknowledged.

I INTRODUCTION

The recent stabilization programs in Latin America resulted in real appreciation, in deep contraction of output and employment (after initial expansion), and in continued high inflation. In explaining these phenomena main attention has been paid to the policies of lowering the rate of crawl of the exchange rate and of liberalizing the domestic banking system (see Buffie (1985) for a recent contribution and for a survey of the literature). But the stabilization programs have also included a package of liberalization of capital movements and trade (along with a large one-shot devaluation of the currency). We will analyze the possible contribution of these aspects of the programs in explaining some of the observed phenomena.

We will employ an optimizing framework, since it allows us to consider jointly the connection between liberalization, employment, real appreciation, and welfare. In this we follow the lines suggested by Edwards and van Wijnbergen (1986) and Greenwood and Kimbrough (1985). Yet, our work differs from these analyses in several respects. First, we will employ the ordinary two-sector model with open and closed sectors, which makes relative prices endogenous. EW employ the ordinary trade model with exogenously given relative prices, and GK analyze a one-good world. Second, we assume that in the short run employment is constrained by real wage rigidity due to wage indexation (see the volume edited by Dornbusch and Simonsen (1983) for the empirical relevance of this assumption). EW and GK consider only the case of continuous full employment, which excludes the possibility of discussing the connection between liberalization, employment and welfare. In popular discussions the most often presented arguments for trade restrictions and controls of capital movements claim that these policies reduce unemployment and improve welfare.

II THE MODEL

The economy lives two periods, the short run (period 1) and the long run (period 2). In both periods it produces two goods, one traded good and one nontraded good. In production three factors of production are utilized: labor, capital, and land. Labor is always mobile between sectors, but the other factors are not in period 1. In period 2 all factors are mobile between the sectors. As is shown by Ruffin (1985), the economy will in the second period behave in the same manner as in the specific factor (Ricardo-Viner) model (for which see Dixit and Norman (1980)). In the first period employment of labor is constrained by a real wage constraint, but in the long run full employment prevails. The economy invests in physical capital in period 1. This investment enhances the productive capacity in period 2.[1] We assume that controls of capital movements only hit investment, not private consumption (EW cite evidence which shows that this is a common procedure through which capital controls are implemented).

In formal terms the model is given by the following set of equations:

(1) $$e(p^1, v, \delta pp^2, \delta p)u + I =$$

$$R^1(p^1, v, L^1) + \delta pR^2(p^2, 1, L, K + I) +$$

$$(v-1)[e_2(p^1, v, \delta pp^2, \delta p)u - R_2^1(p^1, v, L^1)]$$

(2) $$R_3^1(p^1, v, L^1) = w(p^1, v) \equiv v\phi(p^1/v)$$

(3) $$\hat{\delta}p\ R_4^2(p^2, 1, L, K + I) = v$$

(4) $$e_1(p^1, v, \delta pp^2, \delta p)u = R_1^1(p^1, v, L^1)$$

(5) $$e_3(p^1, v, \delta pp^2, \delta p)u = R_1^2(p^2, 1, L, K + I).$$

Equation (1) sets the discounted value of total private expenditure equal to the discounted value of private income. Private consumption expenditure is given by the (homothetic) expenditure function $e(.)u$.[2] Consumption expenditure is allocated to consumption of period 1 nontraded and traded goods and to period 2 nontraded and traded goods (period is indicated by the superscript i, i = 1,2). All commodities are assumed to be substitutes for each other so that $e_{ij} > 0$ when $i \neq j$. At this level of aggregation this is the most reasonable assumption. The world market prices of traded goods are exogenous, but domestic prices depend on the protection of the open sector; p^1 = the price of the period 1 nontraded good relative to the world market price of that period's traded good (in our model p^1 measures the short-run real exchange rate: an increase in p^1 means real appreciation in the short run; for alternative definitions of the real exchange rate see Edwards (1986)), v-1 = export subsidy/ import tariff in the first period (i.e., v = domestic price of the period 1 traded good relative to its world market price), p = the world market price of the period 2 traded good relative to that of the period 1 traded good, p^2 = price of period 2 nontraded good relative to the price of period 2 traded good (real exchange rate in the long run), δ = discount factor facing consumption = world market discount factor, since capital controls only hit investment, and u = level of welfare. We assume that the open sector is not protected in the long run, i.e. we assume that trade is completely liberalized in the long run. Total private expenditure equals consumption expenditure plus investment expenditure I; we assume that only traded goods are used in physical investment.

As indicated in equation (1), the discounted value of income is equal to the value of the first period production, which is given by the GNP function R^1, plus the discounted value of the long-run production R^2 plus the period 1 net tariff revenue.[3] L^1 is the total period 1 employment, L is the supply of labor in the long run, e_2u is the consumption of the period 1 traded good (we use here the notation f_j = the partial derivative of f w.r.t. the jth argument), and R^1_2 is the production of the period 1 traded good.

The revenue from capital controls is handed back in a lump-sum fashion; hence it cancels out in (1).

Equation (2) determines L^1. It sets the marginal revenue from additional employment R_3^1 equal to the wage constraint w. Due to wage indexation the wage level is a linearly homogeneous function of p^1 and v.

Equation (3) determines the value of investment I. Investment is undertaken to maximize the value of the discounted private income. Because of capital controls investors face a discount factor $\hat{\delta}$ which is smaller than the world market discount factor δ. Equation (3) sets the private discounted value of marginal revenue from additional investment, $\hat{\delta} p R_4^2$, equal to the private present value of marginal cost, v.

Equations (4) and (5) are the equilibrium conditions for the nontraded goods markets; e_1 = marginal propensity to consume the period 1 nontraded good, and e_2 = marginal propensity to consume the period 2 nontraded good. In equilibrium consumption must equal production.

Equations (1) - (5) contain five endogenous variables: u, L^1, I, p^1, p^2. It should be noted that we treat the tax on capital movements $\delta-\hat{\delta}$ as exogenous. This contrasts with the models adopted by EW and GK. They assume that there exists an exogenous quota for (private) foreign borrowing, i.e. for the current account deficit. The discount factor $\hat{\delta}$ adjusts so that this quota is achieved. It is assumed that licences are sold in competitive auctions (or are distributed in a manner which replicates the auction solution). We assume that the tax is regarded as a policy variable to keep the model simple (recall that in EW and in GK $\hat{\delta}$ is the only endogenous price) and to avoid the assumption about auctioning of licences.

III LIBERALIZATION OF CAPITAL MOVEMENTS

In this section we analyze the effects of liberalization of capital movements given the degree of open sector protection. We will also ask whether the use of capital controls is desirable in this type of environment.

To begin with, let us reduce the size of the system. Equation (2) can be solved for the current level of employment:

$$R^1_{33}\ dL^1 = (\phi' - R^1_{31})\ dp^1 + [\phi - (p^1/v)\phi' - R^1_{32}]\,dv.$$

Since $R^1_3 = R^1_{31}\ p^1 + R^1_{32}\ v$, this reduces to (taking into account equation (2)):

$$R^1_{33}\ dL^1 = (\phi' - R^1_{31})[\,dp^1 - (p^1/v)dv]$$

or

(6) $$L^1 = L^1(p^1,\ v) \text{ with } L^1_2 = -(p^1/v)L^1_1.$$

Since $R^1_{33} < 0$ we must study the sign of $(\phi' - R^1_{31})$. An increase in p^1 reduces the real product wage in the closed sector but increases the real product wage in the open sector because of indexation. Consequently, total employment L^1 declines if the real wage elasticity of the demand for labor is larger in the open sector than in the closed sector. L^1 increases if this elasticity condition is reversed. We will work here mostly with the assumption that real appreciation (i.e., an increase in p^1) increases unemployment ($L^1_1 < 0$), ceteris paribus. Hence, increased open sector protection ($dv > 0$), ceteris paribus, reduces unemployment. The analysis of wage rigidity could also have been carried out with the tools introduced by Neary (1985), but we have chosen the most convenient way.

Equation (3) can be solved for the amount of investment I:[4]

$$R^2_{44}\ dI = -R^2_{41}\ dp^2 + d(v/\hat{\delta}p).$$

$R^2_{44} < 0$ and, hence, $\partial I/\partial(\hat{\delta}p/v) > 0$. The sign of R^2_{41} is ambiguous. Since $R^2_{41} = R^2_{14}$, the sign depends on whether or not an expansion of the capital stock, ceteris paribus, leads to an expansion of the closed sector production, i.e. on the "Rybczynski effect". $R^2_{14} > 0$ means that the closed sector is capital intensive while $R^2_{14} < 0$ means that it is non-capital-intensive.[5] In most of what follows we assume $R^2_{14} < 0$. Thus, normalizing $\hat{\delta}p/v$ to be one initially,

(7) $$I = I(p^2, \hat{\delta}p/v) \text{ with } I_2 > 0 \text{ and } I_1 = R^2_{14}\ I_2.$$

With the help of equations (6) and (7) the indirect utility as a function of p^1, p^2, $\hat{\delta}$, and v can be solved from equation (1):

(8) $$\begin{aligned}[1 - (v-1)e_2]du &= [R^1_3L^1_1 + (v-1)(e_{21}u - R^1_{21} - R^1_{23}L^1_1)]dp^1 \\ &+ [(\delta pR^2_4 - 1)I_1 + (v-1)\delta pe_{23}u]dp^2 \\ &+ [(p/v)(\delta pR^2_4 - 1)I_2]d\hat{\delta} \\ &+ [R^1_3L^1_2 - (\hat{\delta}p/v^2)(\delta pR^2_4 - 1)I_2 + (v-1)(e_{22}u - R^1_{22} - R^1_{23}L^1_2)]\ dv.\end{aligned}$$

Notice that we have here normalized e(.) = 1 initially.

Let us first consider the effects of changes in capital controls when trade has been liberalized, i.e. when v = 1. Then (8) yields

$$du = R^1_3L^1_1\ dp^1 + (\delta pR^2_4 - 1)I_1\ dp^2 + p(\delta pR^2_4 - 1)I_2\ d\hat{\delta}.$$

Since $\delta > \hat{\delta}$, $\delta pR^2_4 - 1 > 0$ in view of equation (3): capital controls reduce investment so that marginal revenue from investment is above marginal cost when measured at world market prices. Hence

(9) $$u = u(p^1, p^2, \hat{\delta})$$

with sign of u_1 = sign of L^1_1, sign of u_2 = sign of I_1, $u_3 > 0$.

Equations (4) and (5) now become

$$(4') \qquad e_1(p^1, 1, \delta pp^2, \delta p)u(p^1, p^2, \hat{\delta}) = R_1^1(p^1, 1, L^1(p^1, 1))$$

$$(5') \qquad e_3(p^1, 1, \delta pp^2, \delta p)u(p^1, p^2, \hat{\delta}) = R_1^2(p^2, 1, L, K + I(p^2, \hat{\delta}p)).$$

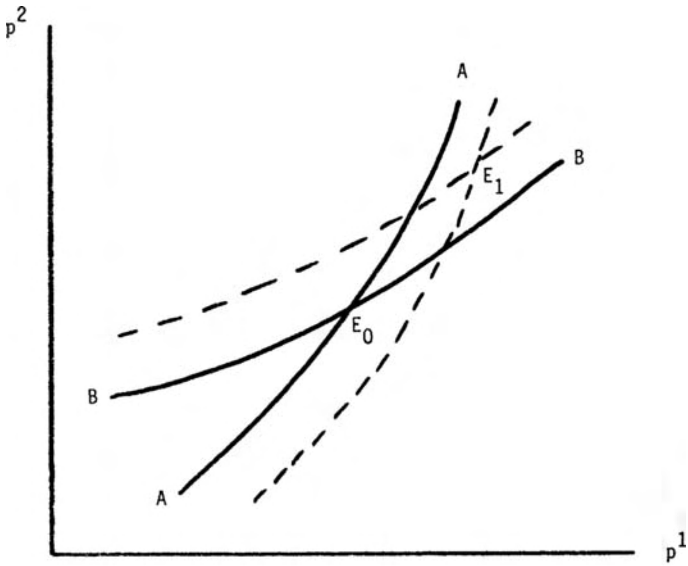
The equilibrium can be described as in Figure 1. The AA curve represents equilibrium condition (4'), and the BB curve condition (5'). Figure 1 is based on the assumptions that $L_1^1 < 0$, $R_{14}^2 < 0$, $e_{31}u + e_3u_1 > 0$, and $e_{13}\delta pu + e_1u_2 > 0$. Walrasian stability requires that the AA curve is steeper than the BB curve (see Appendix I). The initial equilibrium point is denoted by E_0.

Consider now the effects of liberalization of capital movements ($d\hat{\delta} > 0$). This will create excess demand for the current-period nontraded good by $e_1u_3d\hat{\delta} > 0$, causing the AA curve to shift to the right, and excess demand for the period 2 nontraded good by $(e_3u_3 - pR_{14}^2I_2)d\hat{\delta} > 0$, causing the BB curve to shift upward. Hence, the new equilibrium E_1 is characterized by higher values of p^1 and p^2 than initially, i.e. the real exchange rate appreciates both in the short run and in the long run. From the employment function $L^1 = L^1(p^1, 1)$ we can see immediately that relaxing capital controls will increase (decrease) unemployment as $L_1^1 < 0$ $(L_1^1 > 0)$.

While these conclusions are derived from Figure 1 which is based on a number of specific assumptions, the results are, in fact, more general. In Appendix I we show the following:

<u>Result 1.</u> Suppose the economy is Walrasian stable. Then, in the absence of trade distortions, liberalization of capital movements leads to real appreciation both in the short run and in the long run ($\partial p^1/\partial\hat{\delta} > 0$ and $\partial p^2/\partial\hat{\delta} > 0$) if the production of the nontraded good is non-capital-intensive in the long run ($R_{14}^2 = \partial y_N^2/\partial K < 0$). Liberalization increases unemployment if $L_1^1 < 0$ and reduces it if $L_1^1 > 0$.

FIGURE 1. The effects of liberalization of capital movements in the absence of trade distortions



The intuition for the result is that liberalization of capital controls increases the income of the private sector, which increases the demand for all goods. If the economy is stable flexible goods prices must go up. It should be noted that the real appreciation after liberalization takes place no matter whether $L_1^1 \gtrless 0$, i.e. no matter whether an increase in p^1, ceteris paribus, increases or decreases unemployment.

The remaining positive problem to study is what happens if the production of the nontraded good is capital intensive in the long run, i.e. if $R_{14}^2 > 0$. Intuitively, if the controls initially are very tight the expansion of demand due to the increase in income outweighs the expansion of demand due to the increase in investment. Hence real appreciation is again observed in both periods. But if the controls have been mild the real exchange rate may depreciate both in the short run and in the long run.

The effect of liberalization on welfare is

$$\partial u/\partial\hat{\delta} = R_3^1 L_1^1 \cdot (\partial p^1/\partial\hat{\delta}) + (\delta p R_4^2 - 1)[I_1(\partial p^2/\partial\hat{\delta}) + pI_2]$$

and on investment

$$\partial I/\partial\hat{\delta} = I_1 \cdot (\partial p^2/\partial\hat{\delta}) + pI_2.$$

To sign these expressions we must first determine the optimal capital control policy, i.e. the optimal value of $\hat{\delta}$, say δ^*. If $\delta^* > \delta$ investment and capital imports should be subsidized, and if $\delta^* < \delta$ capital imports should be restricted. Consider the change of welfare due to a change in $\hat{\delta}$ evaluated at the point of no controls, i.e. at $\hat{\delta} = \delta$. Then given that $v = 1$ and consequently $\delta p R_4^2 = 1$,

$$\partial u/\partial\hat{\delta} = R_3^1 L_1^1 \cdot (\partial p^1/\partial\hat{\delta})$$

where $R_3^1 > 0$, $L_1^1 \gtrless 0$, and $\partial p^1/\partial\hat{\delta} \gtrless 0$ as $R_{14}^2 \gtrless 0$.[6]

Thus we can draw the following conclusion:

Result 2. In the absence of trade distortions, if production in the closed sector is non-capital-intensive in the long run ($R^2_{14} < 0$) foreign borrowing should be restricted whenever that policy reduces unemployment ($L^1_1 < 0$). If $L^1_1 > 0$ capital imports should be subsidized. In case the closed sector production is capital intensive in the long run ($R^2_{14} > 0$) the conclusion is reversed.

Consider now only the basic case $L^1_1 < 0$, $R^2_{14} < 0$. In this case, by Result 2, the optimal policy is to restrict foreign borrowing, i.e. to set $\delta^* < \delta$. Then, if initially $\hat{\delta} > \delta^*$, liberalization leads to a reduction in welfare and employment whereas investment increases. On the other hand, if $\hat{\delta} < \delta^*$ initially, liberalization results in higher levels of welfare and investment even though unemployment increases. Hence, in a grossly distorted economy real appreciation and an increase in unemployment after liberalization do not imply a reduction in welfare.

Until now we have only considered the effects of relaxing capital controls in the case where trade in goods is already free. The process of trade liberalization, though it started quite early, has been relatively slow, and hence steps towards liberalization of capital controls have also taken place in the presence of barriers to trade in goods and services. Thus it is of considerable interest to analyze the implications of liberalization of capital controls when trade is restricted, i.e. when $v > 1$.

From equation (8), the change in utility is

$$(10) \qquad [1 - (v-1)e_2]du = [R^1_3 L^1_1 + (v-1)(e_{21}u - R^1_{21} - R^1_{23}L^1_1)]dp^1$$

$$+ [(\delta p R^2_4 - 1)I_1 + (v-1)\delta p e_{23}u]dp^2 + [(p/v)(\delta p R^2_4 - 1)I_2]d\hat{\delta}.$$

Since total expenditure is bigger than the expenditure on the period 1 traded good ($eu > ve_2u$) and since e is normalized to to 1 initially, $1 - (v-1)e_2 > 0$. Consider now again only the case with $L^1_1 < 0$, $R^2_{14} < 0$, the extension to other cases being straightforward. The assumption of substitutability in consumption and the properties of the revenue function imply that e_{21}, e_{23}, $R^1_{23} > 0$ and $R^1_{21} < 0$. Thus it is clear that

$$u = u(p^1, p^2, \hat{\delta}),\ u_1 \gtrless 0,\ u_2 \gtrless 0,\ u_3 > 0$$

when $v > 1$, i.e. when the open sector is protected. The ambiguity is due to the effects on the tariff revenue/subsidy tax of changes in p^1 and p^2. For example, an increase in p^1 shifts demand toward traded goods and production away from them. This increases tariff revenue and therefore tends to increase welfare against the adverse employment effects.

But does this ambiguity affect Result 1 concerning the real appreciation caused by relaxation of capital controls? Clearly, if trade is "almost completely" liberalized (i.e. v-1 is "small") Result 1 remains valid even in the presence of trade distortions. But, as shown in Appendix II, the conclusions are unchanged for all values of $v > 1$. Hence

Result 3. Suppose that the economy is Walrasian stable and that the production of the nontraded good is non-capital-intensive in the long run ($R^2_{14} < 0$). Then, if capital controls are eased when the open sector is protected the real exchange rate appreciates both in the short run and in the long run.

The extension of Result 3 to the case where the closed sector production is capital intensive ($R^2_{14} > 0$) is similar to that presented in the discussion after Result 1. Note also that the employment effects of liberalization remain qualitatively the same: unemployment increases if $L^1_1 < 0$ and decreases if $L^1_1 > 0$.

While the presence of trade distortions does not alter the positive aspects of liberalization of capital controls the normative side of the problem is clearly affected. In particular, with $v > 1$ it may be optimal to subsidize foreign borrowing even though with $v = 1$ it is optimal to tax capital imports. Using (9), it is easy to show that this is the case if

$$R_3^1 L_1^1 + (v-1)(e_{21}u + \delta p e_{23}u - R_{21}^1 - R_{23}^1 L_1^1) > 0.$$

Hence it may be optimal to subsidize foreign borrowing despite the fact that unemployment is increased by doing that. This holds if tariff revenue increases enough to overcome the adverse employment effects.

To conclude this section we take up the issue of insulation. A rationale for capital controls can be that they help to insulate the economy from adverse foreign shocks, or from shocks that increase unemployment. In our small-country model the only foreign variables that affect domestic conditions are the international discount factor δ and the intertemporal relative price p. An increase in δ means a higher world interest rate, and an increase in p can be interpreted as a temporary fall in world market prices.

The welfare effects of changes in δ and p, keeping p^1 and p^2 unchanged, are (from (1) after relevant substitutions)

$$du = p(R_2^2 - e_4u)d\delta + \left[\delta(R_2^2 - e_4u) + \hat{\delta}(\delta p R_4^2 - 1)I_2\right]dp.$$

Since we have all the time considered a borrower country, i.e. a country which has a current account deficit in period 1, the intertemporal budget constraint implies that the long-run trade balance must show a surplus ($R_2^2 - e_4u > 0$). Hence a decline in either the world interest rate ($d\delta > 0$) or in the current world market prices ($dp > 0$) increases welfare, ceteris paribus. Consequently both of these disturbances will cause an increase in the excess demand for nontraded goods, which leads to a real appreciation in the short run as well as in the long run. If $L_1^1 < 0$ unemployment increases. Now employment can be insulated by making capital controls stricter. Thus, in the basic case $L_1^1 < 0$, a fall in the world interest rate or in the current-period world market prices causes unemployment to increase, and, somewhat surprisingly, a widening of the distortion created by capital controls is needed to restore employment.

IV TRADE LIBERALIZATION

In this section we investigate the effects of trade liberalization, given the level of capital controls. Since we study a distorted economy, the distortion arising from real wage rigidity, it is clear that free trade is not, in general, optimal.

To start with the simplest case, assume first that initially the economy is distorted by export subsidies and import tariffs ($v > 1$) but no capital controls are used ($\hat{\delta} = \delta$). Equation (8) then yields

$$
\begin{aligned}
(11) \qquad [1 - (v-1)e_2]\,du = {} & [R_3^1 L_1^1 + (v-1)(e_{21}u - R_{21}^1 - R_{23}^1 L_1^1)]\,dp^1 \\
& + [(\delta p R_4^2 - 1)I_1 + (v-1)\delta p e_{23}u]\,dp^2 \\
& + [R_3^1 L_2^1 - (\delta p/v^2)(\delta p R_4^2 - 1)I_2 + (v-1)(e_{22}u - R_{22}^1 - R_{23}^1 L_2^1)]\,dv \\
= {} & \{[(\varepsilon^1 - 1)(R_3^1 L_1^1 - (v-1)(R_{23}^1 L_1^1 + R_{21}^1)] \cdot (p^1/v) \\
& + (\delta p R_4^2 - 1)I_2 R_{14}^2 \varepsilon^2 (p^2/v) \\
& + [(v-1)(p^1 e_{21} u \varepsilon^1 + \delta p p^2 e_{23} u \varepsilon^2 + v e_{22}) - (\delta p R_4^2 - 1)I_2]\tfrac{1}{v}\}\,dv
\end{aligned}
$$

where $\varepsilon^1 = (\partial p^i/\partial v)(v/p^i)$ = elasticity of period i closed sector price w.r.t. v, i = 1, 2.

It is obvious from (11) that the welfare effects of trade liberalization are ambiguous, which is not surprising given that we analyze a second-best situation. It is easy to show that if $\varepsilon^1 < 1$ and $L_1^1 < 0$ (or $\varepsilon^1 > 1$ and $L_1^1 > 0$) trade liberalization ($dv < 0$) increases unemployment but this does not necessarily imply a reduction in welfare, since the substitution effects in consumption and production tend to increase tariff revenue.

To proceed step by step, let us first study what type of trade policies, if any, are optimal for the economy. For that purpose we evaluate (11) at v = 1:

$$du = R_3^1 L_1^1 dp^1 - R_3^1 L_1^1 (p^1/v)dv \qquad \text{so that}$$

$$u = u(p^1, v) \text{ with sign of } u_1 = \text{sign of } L_1^1, \quad u_2 = -(p^1/v)u_1.$$

Assume $L_1^1 < 0$. Then, from (4), the excess demand for the period 1 nontraded good changes by $(e_{12}u + e_1u_2 - R_{12}^1 - R_{13}^1 L_2)dv$, which has the sign of dv. Thus when export subsidies and import tariffs are imposed the demand for the period 1 nontraded good increases. From (5), the excess demand for the period 2 nontraded good changes by $(e_{32}u + e_3u_2 + R_{14}^2 I_2 \delta p)dv$, which cannot be signed unambiguously if $R_{14}^2 < 0$ and which has the sign of dv if $R_{14}^2 > 0$. One may hence expect that $\partial p^1/\partial v > 0$ but the sign of $\partial p^2/\partial v$ is ambiguous. The welfare effects, however, only depend on $\partial p^1/\partial v$. The real exchange rate in period 1 is now p^1/v, and welfare increases if the real exchange rate depreciates, since

$$\partial u/\partial v = R_3^1 L_1^1 (\varepsilon^1 - 1)(p^1/v) > 0.$$

In this expression $\varepsilon^1 < 1$, as is shown in Appendix III. This means that the real exchange rate depreciates when $dv > 0$. All in all, we get the following conclusion:

Result 4. If $L_1^1 < 0$ the optimal trade policy is to set $v > 1$, i.e. to protect the open sector by means of export subsidies and import tariffs. If $L_1^1 > 0$ it is optimal to protect the closed sector, i.e. to set export taxes and import subsidies.

As in the case of capital controls the optimality of trade policy only depends on its employment effects. To be more specific, optimal intervention reduces unemployment.

Let us next turn to the main question of what is the connection between trade liberalization and real appreciation, and welfare. In

Appendix III it is shown that $\varepsilon^1 < 1$ most likely for all values of v larger than 1 regardless of the sign of R^2_{14}. Hence, trade liberalization ($dv < 0$) leads to real appreciation in the short run. If $L^1_1 < 0$ also unemployment increases. The long-run behavior of the real exchange rate is less clearcut. Long-run real appreciation is more likely if $R^2_{14} < 0$, and long-run real depreciation more likely if $R^2_{14} > 0$ (see Appendix III). Thus

Result 5. Trade liberalization is most likely to lead to real appreciation in the short run, but the long-run behavior of the real exchange rate is ambiguous.

Combining results 1 and 5, we may thus conclude that both trade liberalization and liberalization of capital controls make the real exchange rate appreciate in the short run if the economy is initially very distorted. The long-run effects of the policies may, however, differ: Liberalization of capital controls produces qualitatively the same effects in the long run as in the short run, but this does not necessarily hold for the liberalization of trade policies. At any rate, both capital controls and trade liberalization seem to have contributed to the experiences of many of the LDC's referred to in the introductory section.

Consider now briefly the welfare effects of trade liberalization in the case of $L^1_1 < 0$. Since in that case the optimal policy (v^*) is to set $v^* > 1$, if initially $v > v^*$, liberalization makes welfare improve even though the real exchange rate appreciates and unemployment increases. If initially $v^* > v > 1$ then obviously welfare declines with employment.

The final issue to be studied is the impact of trade liberalization in the presence of capital controls, which may be the most relevant case to be studied. Fortunately enough, all the previous results remain basically unchanged. If $\hat{\delta} < \delta$ the pressures for real appreciation are increased when trade is liberalized, since income increases due to the difference between the marginal revenue and marginal cost of investment. The pressures are the same both in the short run and in the long run (see Appendix III for calculations). Hence

Result 6. When trade liberalization is undertaken in the presence of capital controls the real exchange rate appreciates almost certainly in the short run, and the pressures for long-run appreciation are increased.

Since we assume that trade is liberalized in the long run, the previous result can be used to study whether in the presence of capital controls trade liberalization should proceed slowly, i.e. whether $v > 1$ is the optimum solution when $\hat{\delta} < \delta$. Complete trade liberalization would imply that $v = 1$. The problem of slow trade liberalization has been posed in this way by Edwards and van Wijnbergen (1986). In their framework the answer is that import tariffs are optimal in the short run and in the presence of capital controls. Our framework can be used to answer the question whether open sector protection is optimal in the presence of capital controls. Unfortunately the answer is that nothing can be said, in general. Increased open sector protection makes the real exchange rate depreciate in the intermediate run, which increases employment and tends to increase welfare. On the other hand, if the long-run real exchange rate appreciates when the open sector is protected investment declines further from what it is due to capital controls. This latter effect tends to reduce welfare. Hence, open sector protection can either reduce or increase welfare so that there is a conflict between growth and employment. Of course, if open sector protection makes the long-run real exchange rate depreciate the reduction in investment is not so notable, and the employment effects tend to dominate. In this case the protection of the open sector is most likely warranted. But, in general we get

Result 7. There is no reason to expect slow liberalization of import tariffs and export subsidies to outperform rapid liberalization of trade in the presence of capital controls. On the other hand, there is no reason to expect that free trade is optimal either. The optimal policy may well be to protect the closed sector.

V CONCLUDING COMMENTS

The main point of this paper is to demonstrate that the policies of trade and capital movement liberalization may well help to explain the experience of several LDC's. It is shown that both forms of liberalization can account for the real appreciation observed in these countries, and it is also shown that they can increase unemployment. The relation between welfare and liberalization is complicated, since under free trade capital controls should be utilized and under free capital mobility the open sector should be protected. Yet, no unambiguous policy recommendations for controls of capital movements in the presence of trade policies and for trade policies in the presence of capital controls are possible. The main result concerning welfare is thus that the policy of completely free trade and free capital mobility is not optimal. This is because of the distortions created by wage indexation: employment is below optimal due to real wage rigidity. Both increased capital controls and open sector protection increase employment (if real appreciation increases unemployment) but they also create welfare losses, which, however, are small for small deviations from free trade and free capital mobility. Hence stricter capital controls and open sector protection may be warranted in that case.

In our future work we will extend the above framework to differentiate between exported and imported goods, and to allow for the presence of intermediate imported inputs in production (the importance of the latter aspect has been shown by Buffie (1984) in the context of trade liberalization). In this way we can study separately the effects of export subsidies and import tariffs.

FOOTNOTES

1. Of course a small open economy can change its productive capacity almost instantaneously: ships can be bought and sold within days if needed etc. The price one has to pay for such a rapid investment is that its productivity is below the productivity of the slower investment. In this way one could try to differentiate between short-run and long-run investment and controls of short-term and long-term capital movements.

2. See e.g. Dixit and Norman (1980) for a discussion of the definition and properties of the expenditure and revenue functions.

3. Note that tariff revenue should include the component (v-1)I, and the value of investment expenditure on the left hand side should equal vI. Equation (1) is obtained after cancelling the relevant terms.

4. It is here that the assumption about the third factor of production, land, becomes significant. It guarantees that R^2_{44} does not vanish (see e.g. Dixit and Norman (1980)).

5. Ruffin (1985) shows that $R^2_{14} < 0$ holds if the unit labor input in the closed sector relative to that in the open sector is larger than the corresponding land input ratio which in turn must be larger than the capital input ratio.

6. To verify the last statement see the expression for $\partial p^1/\partial\hat{\delta}$ in Appendix I. When $v = 1$ and $\delta = \hat{\delta}$ initially, $u_3 = 0$ so that $\partial p^1/\partial\hat{\delta} = -|A|^{-1} e_{13}\delta p u R^2_{14} I_2$. Thus the sign of $\partial p^1/\partial\hat{\delta}$ = - sign of R^2_{14}.

REFERENCES

BUFFIE, E.F., "The Macroeconomics of Trade Liberalization", Journal of International Economics, Vol. 17 (1984), 121-137.

BUFFIE, E.F., "Price-Output Dynamics, Capital Inflows and Real Appreciation", Oxford Economic Papers, Vol. 37 (1985) 529-551.

DIXIT, A.K. and V. NORMAN, Theory of International Trade (Cambridge, U.K.: Cambridge University Press, 1980).

DORNBUSCH, R. and M. SIMONSEN, eds., Inflation, Debt, and Indexation, (Cambridge, U.S.A.: MIT Press, 1983).

EDWARDS, S., "Economic Liberalization and the Real Exchange Rate in Developing Countries", Paper prepared for presentation at the Carlos Diaz Alejandro Memorial Conference, Helsinki, August 23-25, 1986.

EDWARDS, S. and S. van WIJNBERGEN, "The Welfare Effects of Trade and Capital Market Liberalization: Consequences of Different Sequencing Scenarios", International Economic Review (1986).

GREENWOOD, J. and K.P. KIMBROUGH, "Capital Controls and Fiscal Policy in the World Economy", Canadian Journal of Economics, Vol. 18, No. 4 (1985), 743-765.

NEARY, J.P., "International Factor Mobility, Minimum Wage Rates, and Factor-Price Equalization: A Synthesis", Quarterly Journal of Economics, Vol. 100 (August 1985), 551-570.

RUFFIN, R.J., "International Factor Movements", Ch. 5 in R.W. Jones and P.B. Kenen, eds., Handbook of International Economics, Vol. I (Amsterdam: North-Holland, 1985).

APPENDIX I

Throughout this appendix we assume $v = 1$. Let us postulate the following Walrasian adjustment process:

$$\dot{p}^1 = k_1(e_1 u - R_1^1)$$

$$\dot{p}^2 = k_2(e_3 u - R_1^2)$$

where e_1, e_3, u, R_1^1 and R_1^2 are the functions described in (4') and (5') and where $k_1, k_2 > 0$. The necessary and sufficient conditions for the equilibrium (the stationary point of the above dynamic system) to be locally stable are that

(i) $\quad k_1 a_{11} + k_2 a_{22} < 0$ and

(ii) $\quad |A| = a_{11}a_{22} - a_{12}a_{21} > 0$

where $\quad a_{11} = e_{11}u + e_1 u_1 - (R_{11}^1 + R_{13}^1 L_1^1)$

$$a_{12} = e_{13}\delta p u + e_1 u_2$$

$$a_{21} = e_{31}u + e_3 u_1$$

$$a_{22} = e_{33}\delta p u + e_3 u_2 - (R_{11}^2 + R_{14}^2 I_1).$$

These conditions are assumed to hold. Then, from (4') and (5'),

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} dp^1 \\ dp^2 \end{bmatrix} = - \begin{bmatrix} e_1 u_3 \\ e_3 u_3 - pR_{14}^2 I_2 \end{bmatrix} d\hat{\delta}.$$

Note that the slopes of the AA and BB curves in Figure 1 are $-a_{11}/a_{12}$ and $-a_{21}/a_{22}$, respectively. Thus the second stability condition requires the AA curve to have a bigger slope than the BB curve.

After some manipulations (in particular, using the fact that $u_2 = u_3 I_1/(pI_2)$) we get

$$\partial p^1/\partial\hat{\delta} = |A|^{-1}[e_1 u_3(R^2_{11} - e_{33}\delta pu) + e_{13}\delta pu(e_3 u_3 - pR^2_{14} I_2)]$$

$$\partial p^2/\partial\hat{\delta} = |A|^{-1}[e_3 u_3(R^1_{11} + R^1_{13} L^1_1 - e_{11}u) + e_{31}ue_1 u_3 + pR^2_{14} I_2(e_{11}u + e_1 u_1 - R^1_{11} - R^1_{13} L^1_1)].$$

As shown in the text, $u_1 < 0$ and u_3, $I_2 > 0$. By the convexity of the revenue function w.r.t. prices, R^1_{11}, $R^2_{11} > 0$. Similarly, by the concavity of the expenditure function w.r.t. prices, $e_{11} < 0$. $e_{13} = e_{31} > 0$, since the nontraded goods in periods 1 and 2 are assumed to be substitutes in consumption. $R^1_{11} + R^1_{13} L^1_1 > 0$, since the supply curve of the nontraded good must be upward sloping. Thus both of the above expressions are positive if $R^2_{14} < 0$.

The effect on employment can be seen directly from the employment function $L^1 = L^1(p^1, 1)$:

$$\partial L^1/\partial\hat{\delta} = L^1_1 \cdot \partial p^1/\partial\hat{\delta}.$$

APPENDIX II

In this Appendix we derive the effect of liberalization of capital movements ($d\hat{\delta} > 0$) on p^1 and p^2 assuming that there are barriers to trade in goods and services ($v \neq 1$). The relevant equilibrium conditions are

$$e_1(p^1, v, \delta pp^2, \delta p)u(p^1, p^2, \hat{\delta}) = R_1^1(p^1, v, L^1(p^1, v))$$

$$e_3(p^1, v, \delta pp^2, \delta p)u(p^1, p^2, \hat{\delta}) = R_1^2(p^2, I, L, K + I(p^2, \hat{\delta}p/v))$$

whence

$$\partial p^1/\partial\hat{\delta} = |A|^{-1} \cdot [e_1u_3(R_{11}^2 - e_{33}\delta pu) + e_{13}\delta pu(e_3u_3 - pR_{14}^2I_2)$$
$$- (p/v)R_{14}^2I_2e_1(v-1)e_{23}u]$$

$$\partial p^2/\partial\hat{\delta} = |A|^{-1} \cdot [e_3u_3(R_{11}^1 + R_{13}^1L_1^1 - e_{11}u) + e_{31}ue_1u_3$$
$$+ (p/v)R_{14}^2I_2(e_{11}u + e_1u_1 - R_{11}^1 - R_{13}^1L_1^1)].$$

The expression for $|A|$ is the same as in Appendix I, and $|A| > 0$ by the assumed (Walrasian) stability.

The only additional term in $\partial p^1/\partial\hat{\delta}$ compared with the case of $v = 1$ in Appendix I is the last term in the square brackets which is positive if $R_{14}^2 < 0$ and $v > 1$; as shown in Appendix I, $R_{14}^2 < 0$ guarantees that the other terms are positive, too. Thus $\partial p^1/\partial\hat{\delta} > 0$ if $R_{14}^2 < 0$ and $v > 1$. On the other hand, if $R_{14}^2 > 0$ and $v - 1$ is "large" $\partial p^1/\partial\hat{\delta} < 0$.

The expression for $\partial p^2/\partial\hat{\delta}$ is the same as that in Appendix I except that the last term is divided by v. Hence, as when $v = 1$ $\partial p^2/\partial\hat{\delta} > 0$ if $R_{14}^2 < 0$.

APPENDIX III

Consider the model in its full generality, i.e. with $\hat{\delta} < \delta$, $v > 1$.

Define $\tilde{x} \equiv dx/x$ for any variable x. The indirect utility function is

$$u = u\ (p^1, p^2, v)$$

Define $\tilde{u}_1 \equiv (\partial u/\partial p^1)(p^1/u)$ etc.

Then the general results from the comparative statics are:

(A) $$\tilde{v} - \tilde{p}^1/\tilde{v} = |A|^{-1}$$

$$\times \{(e_{33}\delta pp^2 u + e_3 u\tilde{u}_2 - B)(e_{11}p^1 u + e_{12}vu)$$

$$- (e_{31}p^1 u + e_{32}vu)e_{13}\delta pp^2 u$$

$$+ e_1 u[(\tilde{u}_1 + \tilde{u}_3)(e_{33}\delta pp^2 u - B) - (e_{31}p^1 u + e_{32}vu)\tilde{u}_2]$$

$$- e_3 u(\tilde{u}_1 + \tilde{u}_3)e_{13}\delta pp^2 u - (\hat{\delta}p/v)R^2_{14}I_2(e_{13}\delta pp^2 u + e_1 u\tilde{u}_2)\}$$

where $B \equiv (R^1_{11} + R^1_{13}L^1_1)p^1 > 0$ and

(B) $$\tilde{p}^2/\tilde{v} = |A|^{-1}$$

$$\times \{-(e_{11}p^1 u - B)e_{32}vu + (e_{12}vu + B)e_{31}p^1 u$$

$$+ e_3 u[(e_{12}vu + B)\tilde{u}_1 - (e_{11}p^1 u - B)\tilde{u}_3] + e_1 u(e_{31}p^1 u\tilde{u}_3 - e_{32}vu\tilde{u}_1)$$

$$- (\hat{\delta}p/v)\ R^2_{14}I_2[(e_{11}p^1 u - B) + e_1 u\tilde{u}_1]\}$$

$|A| > 0$ by the stability argument.

<u>Case 1</u> $\hat{\delta} = \delta$, $v = 1$

Here (see equation (8) in the text) $\tilde{u}_1 = R_3^1 L_1^1 p^1$, $\tilde{u}_2 = 0$, $\tilde{u}_3 = R_3^1 L_2^1 v$ and hence $\tilde{u}_1 + \tilde{u}_3 = 0$.

$\varepsilon^1 < 1$ is equivalent to $\tilde{v} - \tilde{p}^1/\tilde{v} > 0$. This holds certainly in this case if $R_{14}^2 < 0$. If $R_{14}^2 > 0$ it may not hold even though it is still the most likely outcome, since all other terms except the last one in A are positive.

A look at (B) convinces us that its sign cannot be determined. The second and third lines in { } are positive. If $L_1^1 < 0$ the first line is positive but the last line is negative in case $R_{14}^2 < 0$ and positive if $R_{14}^2 > 0$. Hence if $R_{14}^2 > 0$ and $L_1^1 < 0$ there will be long-run real depreciation with trade liberalization. If $R_{14}^2 < 0$ and $L_1^1 < 0$ real depreciation with liberalization is again the most likely alternative though by no means certain. If $L_1^1 > 0$ the long run behavior of the real exchange rate is most uncertain.

<u>Case 2</u> $\hat{\delta} = \delta$, $v > 1$

Here $$\tilde{u}_1 = C\{R_3^1 L_1^1 p^1 + (v-1)[e_{21} p^1 u - (R_{21}^1 p^1 + R_{23}^1 L_1^1 p^1)]$$

$$\tilde{u}_2 = C(v-1)(I_1 p^2 + e_{23}\delta p p^2 u)$$

$$\tilde{u}_3 = C$$

$$\times \{R_3^1 L_2^1 v + (v-1)[- I_2(\delta p/v) + e_{22} v u - (R_{22}^1 v + R_{23}^1 L_2^1 v)]\}$$

where $1/C \equiv eu - (v-1)\, e_2 u > 0$.

Hence $\tilde{u}_1 \gtrless 0$, $\tilde{u}_2 \gtrless 0$, $\tilde{u}_3 \gtrless 0$ but $\tilde{u}_1 + \tilde{u}_3 < 0$ and $\tilde{u}_1 + \tilde{u}_2 + \tilde{u}_3$

$$= (v-1)[e_{21} p^1 u + e_{22} v u + e_{23}\delta p p^2 u + I_1 p^2 - I_2(\delta p/v)] < 0.$$

Since the term $\tilde{u}_1 + \tilde{u}_3$ dominates the other terms and $\tilde{u}_2 + \tilde{u}_3$ gets larger in absolute value when v grows, $\varepsilon^1 < 1$ for large $v - 1$. In case 1 it was shown that, for small $v - 1$, $\varepsilon^1 < 1$ holds for certain.

A look at (B) shows that the sign of $\tilde{p}^2/\tilde{v}$ is more ambiguous than in case 1.

<u>Case 3</u> $\hat{\delta} < \delta$, $v = 1$

Here
$$\tilde{u}_1 = CR_3^1L_1^1p^1$$

$$\tilde{u}_2 = Cp^2(\delta pR_4^2 - 1)I_1$$

$$\tilde{u}_3 = C[R_3^1L_2^1v - (\hat{\delta}p/v)(\delta pR_4^2 - 1)I_2]$$

Consider only the case $L_1^1 < 0$.

$\tilde{u}_1 + \tilde{u}_3 = - C(\hat{\delta}p/v)(\delta pR_4^2 - 1)I_2 < 0$. If $R_{14}^2 < 0$ then $\tilde{u}_2 < 0$. In (A) all other terms except the last one are positive. Hence real depreciation in the short run is the most likely outcome with $dv > 0$. $\tilde{p}^2/\tilde{v}$ cannot be signed unambiguously.