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EXTERNAL SHOCKS, POLICY RESPONSE AND ECONOMIC PERFORMANCE*

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EXTERNAL SHOCKS, POLICY RESPONSE AND ECONOMIC PERFORMANCE

ABSTRACT

This paper examines the responsiveness of real income and the balance of payments to external shocks in a small open economy. It is shown that tariff restrictions and wage rigidities tend to increase responsiveness and quota restrictions tend to reduce it. The implications for policy response are considered and a micro-theoretic foundation for the distinction between expenditure-reducing and expenditure-switching policies is provided.

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EXTERNAL SHOCKS, POLICY RESPONSE AND ECONOMIC PERFORMANCE

1. Introduction

What are the effects of external shocks? Which policy regimes reduce a country's vulnerability to such shocks? And how should governments respond to them? These questions lie at the heart of economic policy-making in open economies. And they are especially topical at the present time, when more and more developing countries are engaging on programmes of trade liberalisation. Increasing openness in this way is a two-edged sword, on the one hand giving a country the opportunity to profit from international trade but on the other hand exposing it to the vagaries of the world economy.

Of course, exposure to shocks is not necessarily the same as vulnerability to shocks. On the contrary, there is a school of thought which argues that more open economies are likely to cope better with shocks. This argument was put forward by Balassa (1981) and Balassa and McCarthy (1984), who developed empirical procedures for measuring external shocks (subsequently extended by McCarthy and Dhareshwar (1992) and McCarthy and Zanalda (1993)) and found evidence of a positive link between openness to trade and economic performance. Similar conclusions were reached by Sachs (1985) who noted that the Newly Industrialising Countries of East Asia and the economies of Latin America were faced with shocks of the same order of magnitude in the 1970s and early 1980s. He argued that the superior economic performance of the former could be explained by their greater export orientation, coupled with a political culture more conducive to maintaining competitiveness. These contributions and others in the same vein (e.g., Edwards (1992)) are persuasive but they fail to justify their findings in terms of a fully articulated model. Summarising the debate in this area, Rodrik (1993) concludes that "we lack a good understanding of how and why certain configurations of economic policy render the economy more resilient to external shocks than others."

The purpose of this paper is to attempt to fill this gap by constructing a series of models which illuminate the relationship between domestic policies and external shocks. The models involved derive from the standard theory of distortions and welfare, and in particular from its applications to the "Dutch Disease." However, they attempt to make this literature more relevant to a policy-making context in which the economy responds asymmetrically to favourable and unfavourable shocks; in which current shocks may be either permanent or temporary; and in which volatility of the external environment is as much a problem as the magnitude of individual shocks.

We begin in Section 2 by considering how trade distortions modify the impact of external shocks on a small open economy. The model allows for shocks to the level of export demand as well as to the terms of trade and the level of foreign transfers. It turns out that the form of the trade restrictions – whether they distort prices or quantities – greatly affects their influence on the transmission of external shocks. Section 3 then extends this analysis to allow for sluggish adjustment of domestic wages. If wages are sticky downwards in the short run, then a symmetric distribution of external shocks is translated into an asymmetric distribution of domestic income, as employment bears some of the burden of adjustment to unfavourable shocks. Section 4 extends the analysis to an intertemporal framework and looks at the effects of both permanent and temporary shocks. Finally, Section 5 draws together the implications of the previous sections for changes in the balance of payments deficit and for the appropriate domestic policy response to external shocks, providing in the process a firm micro-theoretic foundation for the traditional distinction between expenditure-switching and expenditure-reducing policies.

2. External Shocks and Trade Restrictions

2.1 The Static Model

The setting assumed is a small open economy, which faces given prices p^* for its imports m and a given price q^* for its exports, x. Imports are subject to trade restrictions, which drive their home prices p above their world levels ($p=p^*+t$) and exports are subject to a binding sales constraint, set by world market conditions. For simplicity, we assume that exportables are not consumed at home and that any government revenue from trade restrictions is returned costlessly to the household sector. In the case of tariffs, where $t=p-p^*$ is an instrument of government policy, the household sector may reasonably be assumed to receive all the revenue, $t'm$.[1] However, in the case of quotas, where imports

[1] We allow for many different import goods, so m, p and t are column vectors and a prime (′) denotes a transpose. Some elements of m may also be interpreted as export goods which are not subject to a sales constraint, in which case the corresponding m_i is negative and t_i is an export subsidy.

m are given and t is determined endogenously, we assume that because of rent-seeking only a fraction $(1-\omega)$ of the quota rents, $(p-p^*)'m$, is retained in the economy.

Turning to the behavioural specification of the models, consider first the one-period case. Consumer behaviour is summarised by an expenditure function, $e(p,u)$, which equals the minimum cost of attaining a given level of utility in the face of given domestic prices. This function has the standard property that its price derivatives, e_p, equal the (compensated) demand functions which are decreasing in own price. Private-sector production is assumed to be carried out under competitive conditions. When wages are flexible, the resulting level of GNP is a function $g(p,q^*,x,\ell)$ of prices (home prices of importables, world prices of exportables), of the level of export sales, and of the economy's endowment of labour, ℓ.[2] The derivatives of the GNP function with respect to import prices equal the economy's competitive supply functions, g_p, which are increasing in own price; while its labour derivative gives the competitive wage rate, w, which is decreasing in the level of employment ($g_{\ell\ell}<0$).[3] As for the derivatives with respect to export prices and sales, these equal respectively the volume of sales and the difference between world prices and domestic producer prices, q^*-q.[4]

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2 The formal model is consistent with many domestic factors, in which case ℓ is a vector. However, the interpretation of the model is simpler if we think of labour as the only intersectorally mobile factor in the short run, so the model is a version of the specific-factors model. Issues of capital accumulation are considered explicitly in the two-period models.

3 These are standard properties of the GNP function, also known as a revenue or restricted profit function. See Dixit and Norman (1980). A refinement would be to include an additional argument, σ, in the GNP function, representing the level of a publicly-provided service. The derivative with respect to σ may be thought of as the marginal productivity of public investment in social overhead capital (infrastructure, telecommunications, education and training, environmental protection, etc.). The output of σ could then be related to a public-sector product function. This extension would be relevant to an investigation of issues of supply-side policy. For a similar approach, see Clarida and Findlay (1993).

4 These results may be proved by relating the export-sales-constrained GNP function $g(p,q^*,x,\ell)$ to a standard (unconstrained) GNP function whose arguments are domestic prices and factor endowments only, $g^u(p,q,\ell)$. The difference between the two consists of the excess of export sales receipts over the value of export production at domestic producer prices:

$$(2.1) \qquad g(p,q^*,x,\ell) = g^u(p,q,\ell) + (q^*-q)x,$$

Equilibrium in the economy requires that the aggregate consumer spend its income. The latter includes the value of private sector production. In addition, the consumer sector receives a fraction $(1-\omega)$ of the revenue from trade restrictions $t'm$ (with ω equal to zero in the case of tariffs, as already discussed) and an exogenous transfer from abroad, f. The latter may be thought of as foreign aid, plus external borrowing, less interest payments on existing external debt. Formally, the consumer sector's budget constraint, which is also the economy's balance-of-payments equilibrium condition, is:

$$(2.2) \qquad e(p,u) \quad = \quad g(p,q^*,x,\ell) + (1-\omega)t'm + f,$$

where the level of imports equals:

$$(2.3) \qquad m \quad = \quad e_p(p,u) - g_p(p,q^*,x,\ell).$$

Equation (2.2) may now be totally differentiated to give the effects on real income or utility of *external shocks*, i.e., changes in p^*, q^*, x or f; and of changes in *trade policy*, t or m. Consider first the case where imports are unrestricted (so $t=0$). Writing dy for $e_u du$, the change in utility measured in expenditure units (hence the change in real income), we obtain:

$$(2.4) \qquad dy \quad = \quad -m'dp^* + xdq^* + (q^*-q)dx + df.$$

The first two terms give the effects of changes in the terms of trade: real income falls with import prices and rises with export prices. Moreover, the responsiveness of real income depends on the openness of the economy (as measured by average trade shares); and so a typical developing country, which runs a current account deficit, is more vulnerable to rises in import prices than to falls in export prices.[5] The third term shows that a relaxation of the export sales constraint, due to a strengthening of world demand, raises real income to the extent that export prices exceed marginal production prices (which is a measure of the extent to which the export sales constraint is binding). Finally, the fourth term states simply that

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where the domestic producer prices (or "virtual prices") q are endogenously determined by the restriction: $g_q^u(p,q,\ell) = x$. Differentiating equation (2.1) gives the results quoted in the text. The techniques used here are similar to those of Neary (1985).

[5] This may be seen by rewriting the first part of equation (2.4) in terms of proportional changes (denoted by a circumflex): $\hat{y} = -\theta_m\hat{p}^*+\theta_x\hat{q}^*$, where θ_i gives the share of imports ($i=m$) or exports ($i=x$) in national income and where θ_m is typically greater than θ_x.

any change which raises f (such as an increase in foreign aid or a fall in world interest rates) raises real income by an equal amount.

2.2 External Shocks in the Presence of Tariffs

Equation (2.4) gives a reasonably familiar decomposition of changes in real income in an open economy. Moreover, it might be thought to imply that trade restrictions should make an economy *less* responsive to external shocks, since they lower the shares of imports and exports in real income (and also reduce the severity of a given sales constraint, so reducing q^*-q). However, matters become more complicated when pre-existing distortions are present. Consider first the case where imports are subject to tariffs. A term $t'dm$ must now be added to (2.4), where the change in imports is, from (2.3):

$$(2.5) \qquad dm \quad = \quad m_p dp + m_I dy - g_{px} dx.$$

Here, m_p and m_I are the (compensated) price-responsiveness and the income-responsiveness of demand for imports, respectively; and g_{px} is the effect on importables production of a relaxation of the export sales constraint, which is likely to be negative if the two sets of goods are substitutes.[6] Now, combine (2.4) and (2.5) to obtain the full expression for the effects of shocks and policy changes in the presence of pre-existing tariffs:

$$(2.6) \qquad (1-t'm_I)dy \quad = \quad -(m'-t'm_p)dp^* + xdq^* + (q^*-q-t'g_{px})dx + df + t'm_p dt.$$

Comparing the first four terms on the right-hand sides of (2.6) and (2.4), there are two opposing effects on the relative responsiveness of real income to external shocks in a free-trading and a tariff-constrained economy. On the one hand, as already noted, tariffs tend to lower trade shares, so reducing responsiveness. On the other hand, the induced income effects, represented by the term $(1-t'm_I)$ (which is positive but less than one) tend to increase responsiveness. The second effect is the only one which applies for shocks to f and it is likely to dominate for other shocks provided tariffs are finite but not too close to being prohibitive. Hence we may conclude that *income is more responsive to external shocks when*

6 Differentiating equation (2.1) gives: $g_{px} = g^u_{pq}(g^u_{qq})^{-1}$. The term in brackets is positive (since the export supply function is upward-sloping) and the terms in g^u_{pq} are negative if importables are substitutes in production for the export good. Note that (2.5) has no term in the world price of exports: a change in q^* has an income effect (from (2.4)) but no substitution effect, since production of exportables is sales- rather than price-constrained at the margin: $g_{pq^*}=g_{q^*p}=0$.

imports are restricted by tariffs than under free trade.[7] Since this holds for both positive and negative shocks in this model, it follows that:

Proposition 1: For a given distribution of external shocks, pre-existing tariff distortions tend to increase the variance of income.

The final term in equation (2.6) can be used to discuss tariff policy. However, we postpone a discussion of policy issues until Section 5.

2.3 External Shocks in the Presence of Quotas

The case where imports are subject to quantitative restrictions with some of the rents lost to the economy for rent-seeking or other reasons, requires a different procedure. Equation (2.5) for the change in import demand still holds, but now it must be inverted to solve for the change in domestic prices ($dp=dp^*+dt$) which equilibrates the market for import-competing goods. And since a fraction ω of the rents are lost, equation (2.4) must be augmented, not by $t'dm$ but by $(1-\omega)t'dm-\omega m'dt$. Making these substitutions, the change in real income is given not by (2.6) but by:

$$(2.7) \qquad (1-\tau'm_I)dy = -(1-\omega)m'dp^* + xdq^* + (q^*-q-\tau'g_{px})dx + df + [(1-\omega)t-\tau]'dm,$$

where τ' equals $\omega m'(m_p)^{-1}$, the difference between the market and shadow prices of importables, or the *shadow premia of importables* for short.[8] In the case of tariffs the shadow premia were simply the tariffs themselves (reflecting the well-known fact that shadow prices equal world prices) and t and τ play a similar role in the formal results, as a

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7 For changes in q^* and f, this is clear from the fact that the inverse of $(1-t'm_I)$ is greater than one. (This term is the *tariff multiplier* or *shadow price of foreign exchange*.) For changes in p^* if only a single good is subject to tariffs, the greater response of income is accentuated since tm_p is negative; more generally, the same is likely to be true provided world price fluctuations are greater for tariff-constrained goods (so t and dp^* are not "too far" from proportionality). As for changes in x, the result follows provided g_{px} is negative, reflecting substitutability between importables and exportables, as discussed in footnote 6.

8 The shadow prices give the welfare effect of a gift of additional units of the importables, *not* the effect of relaxing the quotas by one unit. Formally they may be derived by adding an additional term, $p'\mu$, to the right-hand side of (2.2), subtracting μ from the right-hand side of (2.3) and checking that the impact effect of a change in μ on y equals $(p-\tau)'$.

comparison of (2.6) and (2.7) shows. However, unlike tariffs, the τ shadow premia are presumptively negative, since extra units of the importable with no relaxation of the corresponding quota drive domestic prices down, leading to less rent loss and so (assuming ω is greater than zero) to a further rise in welfare. Hence the shadow prices of quota-constrained importables may be expected to *exceed* their market prices. It follows from equation (2.7) that *in the presence of quantitative import restrictions, real income is less responsive to external shocks than under free trade, and is less responsive the greater the share of rents which is lost through rent-seeking.*[9] The intuitive reason for this result, by contrast with the earlier one with tariffs, is that when the quantities of imports are frozen, the adjustment to any shocks must be borne by prices. If all rents accrue to domestic residents, then the change in prices merely redistributes income internally. However, the greater the share of rents which are lost, the more the effects of an external shock are dissipated.[10] As in the case of tariffs, we may apply this result to an economy which faces an exogenous sequence of shocks:

Proposition 2: For a given distribution of external shocks, pre-existing quantitative import restrictions reduce the variance of income below that under free trade and do so by more the greater the share of rents which is lost through rent-seeking.

Clearly these results have important implications for countries contemplating trade liberalisation. In particular, they suggest that the process of "tariffication" (converting quotas to equivalent tariffs as a first step in a trade liberalisation programme) may expose an economy to greater volatility. However, it is important to emphasise that Propositions 1 and 2 do *not* imply that quotas can be recommended over tariffs as a means of cushioning the economy from external shocks.[11] A more accurate way of summarising our results is that a free-trading economy adjusts *optimally* to shocks (according to equation (2.4)); a tariff-

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9 In this case, the two effects discussed in Section 2.2 work in the same direction. The responsiveness of income is reduced both because import and export shares are lower and because income effects tend to dampen the fluctuations of income. The latter holds provided we assume, plausibly, that the term $m'(m_p)^{-1}m_I$ is positive and that ω is greater than zero. Under these assumptions, the shadow price of foreign exchange in this case, equal to the inverse of the coefficient of dy, $(1-\tau' m_I)^{-1}$, is *less* than one.

10 Similar results for the effects of domestic shocks are derived in Neary (1988).

11 Quite apart from the other deficiencies of quotas relative to tariffs. For an overview, see Anderson (1988).

constrained economy tends to *over*-adjust, whereas a quota-constrained economy (in which some rent-seeking occurs) tends to *under*-adjust. Finally, it is straightforward to extend our results to an economy in which some goods are tariff-constrained and others are quota-constrained, in which case the results are an amalgam of the results for the two extreme cases.[12]

2.4 External Shocks and Competitiveness

The last issue to be considered in this section is the effect of exogenous shocks on the relative competitiveness of different sectors. This is a possible source of concern even in the aftermath of favourable shocks which raise aggregate income and welfare since they can nevertheless pose problems for sectors whose external environment has not improved. In a manner familiar from writings on the "Dutch Disease," such sectors face a deterioration in their relative competitiveness, or a real exchange rate appreciation. Considerations of learning-by-doing or asymmetric adjustment in future periods may then justify some intervention to redistribute the benefits of the shock between sectors.

To get an understanding of this it is helpful to calculate the change in the wage relative to the numeraire, dw, which may be viewed as a measure of the competitiveness of sectors which neither face sales constraints nor benefit from domestic protection. In the case of both free trade and tariffs, this is found to be:

$$(2.8) \qquad dw \;=\; g_{tp}dp^* + g_{tx}dx.$$

Under a specific-factors type of production structure, the terms in g_{tp} and g_{tx} are positive, so any favourable shock tends to *reduce* the competitiveness of sectors which are fully exposed to foreign competition.

In the presence of quotas, matters are more complicated, since external shocks now affect the prices of quota-constrained goods. Solving for this from (2.5), combined with the change in income from (2.7), gives the change in wages as:

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12 In that case the shadow price of foreign exchange equals $(1-t_1'x_{11}-\tau_2'x_{21})^{-1}$, where τ_2' equals $-t_1'm_{12}(m_{22})^{-1}+\omega m_2'(m_{22})^{-1}$ and m_{ij} is the responsiveness of demand for type-i imports with respect to changes in the prices of type-j imports. The shadow premia for quota-constrained (type-2) goods, τ_2, are now positive or negative depending on whether the tariff or quota influences predominate. See Anderson and Neary (1992), especially equation (1.10), for details.

$$(2.9) \qquad dw = -(1-\omega)\phi m'dp^* + \phi xdq^* + [\bar{g}_{tx}+\phi(q^*-q-\tau'g_{px})]dx + \phi df.$$

Here ϕ equals $-(1-\tau'm_I)^{-1}g_{tp}(m_p)^{-1}m_I$, the effect on wages of a unit transfer and $\bar{g}_{tx}$ equals $g_{tx}+g_{tp}(m_p)^{-1}g_{px}$, the effect on wages of a unit relaxation of the export sales constraint, taking into account the induced changes in the prices of the quota-constrained goods. For plausible parameter values we would expect both ϕ and $\bar{g}_{tx}$ to be positive. Hence, under quotas, positive shocks to export prices or sales and positive transfers tend to raise wages, once again reducing the competitiveness of exposed sectors. Only positive shocks to the world prices of the quota-constrained goods have the opposite effect, because by lowering real income they reduce home prices and so tend to reduce the incentive to hire labour in the quota-protected sector.

3. External Shocks in the Presence of Sticky Wages

Having considered the response of the economy to shocks when factor prices are flexible, we must now turn to consider the case where wages are sticky, a more likely response to unfavourable external shocks. The domestic market wage, expressed in terms of the numeraire, may now be identified with the inverse of the real exchange rate, so a wage cut is equivalent to a real depreciation.

If the wage rate is sticky, then equation (2.8) may be inverted to give the change in total employment, ℓ, as a function of external shocks and domestic policies:

$$(3.1) \qquad d\ell = (g_{\ell\ell})^{-1}[dw - g_{\ell p}dp - g_{\ell x}dx].$$

Recalling that $g_{\ell\ell}$ is negative and that $g_{\ell p}$ and $g_{\ell x}$ are positive, (3.1) shows that downward pressure on employment will come from falls in either p or x.

To see how changes in employment feed through to real income, we can now return to the basic equilibrium condition (2.2), but allowing for adjustments in total employment as given by (3.1). For the case of free trade, this yields:

$$(3.2) \qquad dy = -[m'+w(g_{\ell\ell})^{-1}g_{\ell p}]dp^* + xdq^* + [(q^*-q)-w(g_{\ell\ell})^{-1}g_{\ell x}]dx + df + w(g_{\ell\ell})^{-1}dw.$$

Recall that this model is relevant only when external shocks put *downward* pressure on wages; otherwise, the flexible-wage model of Section 2 applies. Hence for positive shocks to import prices or export sales, equation (2.4) gives the response of real income. However, for negative shocks to p^* or x, equation (3.2) is relevant. This reveals an asymmetry in the response to import and export shocks. A fall in the world price of imports, though beneficial for the usual reason that it represents an improvement in the terms of trade, is harmful to the extent that it discourages production in import-competing sectors and so raises unemployment. As the first coefficient on the right-hand side of (3.2) shows, the net outcome is indeterminate, though for plausible parameter values the harmful effect is likely to dominate.[13] In the case of a fall in the price of an export good which is not sales-constrained, the same coefficient shows that both effects encourage a fall in income (since m_i is now negative). Similarly, the coefficient of dx in (3.2) shows that a slump in foreign demand for a sales-constrained export has a negative effect on real income which is exacerbated by the induced fall in employment. For both export and import shocks, a comparison of equations (2.4) and (3.2) shows that the assumed asymmetric response of domestic wages translates a symmetric distribution of external shocks into an asymmetric distribution of real income. Summarising these results:

Proposition 3: Downward rigidity of wages increases the responsiveness of income to export shocks, while real income may fall following both positive and negative shocks to import prices.

How are these results affected by the presence of trade restrictions? Consider first the case of tariffs. We might expect the full effect of external shocks to be given by an amalgam of the effects in the preceding equations, (2.6) (which assumed tariffs but wage flexibility) and (3.2) (which assumed wage stickiness but free trade). This turns out to be broadly the case, except that the market wage in (3.2) must be replaced the *shadow wage*:

$$(3.3)\quad (1-t'm_I)dy = -[m'-t'm_p+\bar{w}(g_{\ell\ell})^{-1}g_{\ell p}]dp^* + xdq^* + [(q^*-q)-t'g_{px}-\bar{w}(g_{\ell\ell})^{-1}g_{\ell x}]dx + df + [t'm_p-\bar{w}(g_{\ell\ell})^{-1}g_{\ell p}]dt + \bar{w}(g_{\ell\ell})^{-1}dw.$$

Here $\bar{w}$ is the shadow wage rate, equal to $w-t'g_{p\ell}$. It gives the impact effect on income of

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[13] It is helpful to look at the effects of changes in p^* and x in proportional terms. Rewriting the relevant terms of (3.2) gives: $\hat{y} = -(\theta_m-\theta_\ell\lambda_m\epsilon_{\ell p})\hat{p}^* + (\theta_q+\theta_\ell\lambda_x\epsilon_{\ell x})\hat{x}$. Here, θ_q is the share in GNP of the rents accruing to exporters, θ_ℓ is labour's share in GNP, λ_i is the share in total employment of sector i and $\epsilon_{\ell j}$ is the elasticity of employment with respect to variable j. Since θ_ℓ is likely to exceed θ_m, we can conclude that a fall in the world price of imports which are produced at home in significant volume is likely to *reduce* real income, for reasonable values of the price-elasticity of employment demand, $\epsilon_{\ell p}$.

increasing employment by one unit and differs from the market wage because it takes account of induced changes in the output of the protected sectors. For plausible parameter values (such as those of the specific-factors model) the shadow wage will be *below* the market wage. (Indeed, although I will assume otherwise, it could be negative, the case of immiserising growth where protection is so severe that real income would rise if employment were reduced.) The employment effects in (3.3) will then be weaker than the corresponding effects in (3.2). Nevertheless, in all cases but one, the combination of tariffs and wage stickiness tends to increase the responsiveness of income to shocks. The exception is the case of a fall in the world prices of tariff-constrained goods, where the tariff effect ($t'm_p$ in the coefficient of dp^*) tends to enhance and the employment effect ($-\bar{w}(g_{tt})^{-1}g_{tp}$) to dampen the responsiveness of income.

Turning to the case of quotas, the full expression for the change in income must be derived by differentiating (2.2) and (2.3) and combining with (3.1). Once again, the result is an amalgam of elements from equations (2.7) and (3.2), although the expressions for the shadow prices are now different:

$$(3.4) \quad (1-\tau'm_I)dy = -(1-\omega)m'dp^* + xdq^* + [(q^*-q)-\tau'g_{px}-\bar{w}(\tilde{g}_{tt})^{-1}g_{tx}]dx + df + [(1-\omega)t-\tau]'dm + \bar{w}(\tilde{g}_{tt})^{-1}dw.$$

The vector of shadow premia of importables now equals:

$$(3.5) \quad \tau' = [\omega m'+w(g_{tt})^{-1}g_{tp}](\tilde{m}_p)^{-1},$$

where $\tilde{m}_p$ equals $m_p+g_{pt}(g_{tt})^{-1}g_{tp}$, the price responsiveness of import demand, taking account of the induced change in employment. As for the shadow wage rate, it now equals:

$$(3.6) \quad \bar{w} = w - \omega m'(m_p)^{-1}g_{pt}.$$

Note that this is presumptively *greater* than the market wage: an extra worker raises output of the quota-constrained sector and so drives domestic prices and rents lost downwards, thus raising income by more than the direct effect captured by the market wage. The final term in (3.4) requiring explanation is $(\tilde{g}_{tt})^{-1}$, which equals $[g_{tt}+g_{tp}(m_p)^{-1}g_{pt}]^{-1}$, the effect on employment of a unit increase in wages, taking into account the induced changes in the prices of the quota-constrained goods.

What is the implication of (3.4) for the responsiveness of income to external shocks? The key step in answering this question is to establish a presumption as to the sign of the shadow premia of importables in (3.5). In the flexible-wage case, these equalled $\omega m'(m_p)^{-1}$ and were presumptively negative. However, the additional employment effect in (3.5) is likely to dominate for plausible parameter values, for exactly the same reasons as were given in discussing the coefficient of dp^* in (3.2). This implies that income is likely to be *more* responsive to all shocks (with the possible exception of shocks to the prices of the quota-constrained goods themselves) in cases where the wage is downwardly sticky. We may summarise these results as follows:

Proposition 4: Downward rigidity of wages is likely to increase the responsiveness of income to most external shocks in the presence of either tariffs or quotas.

4. External Shocks and Intertemporal Adjustment

The analysis to this point has illuminated the relationship between domestic economic structure and the responsiveness of open economies to external shocks. However, the static framework precludes consideration of a whole range of issues. In the remainder of the paper, therefore, the model is extended to a two-period context. The approach I adopt has been used by a variety of authors,[14] and permits explicit consideration of intertemporal substitution in consumption and production.

Consider first the behaviour of consumers. We adopt the convention throughout that lower-case and upper-case variables refer to the first and second period respectively, while bold variables refer to both periods together. Thus in the case of prices, p and P are the vectors of current and future prices, respectively, and $\mathbf{p}$ is the vector of prices in both periods, $\mathbf{p}'=(p',P')$. The future price vector P is expressed in present value terms, with future spot prices denoted by p_2. Hence, P equals δp_2, where δ is the discount factor, equal to the inverse of one plus the world interest rate: $\delta=(1+r^*)^{-1}$. Assuming that domestic agents can borrow or lend at the world interest rate, the outcome of utility maximisation by the aggregate consumer can be characterised in terms of a two-period expenditure function, $\mathbf{e}(\mathbf{p},\mathbf{u})$, where $\mathbf{u}$ is the consumer's lifetime utility. This can be written as the sum of current and future expenditure:

$$(4.1) \qquad \mathbf{e}(\mathbf{p},\mathbf{u}) = e(\mathbf{p},\mathbf{u}) + E(\mathbf{p},\mathbf{u}),$$

[14] See Sachs (1981), Svensson and Razin (1983), Neary and van Wijnbergen (1986) and Edwards (1989).

though without restrictions on intertemporal preferences not much can be said about the sign of the derivatives of first- and second-period expenditure. For some purposes it is convenient to impose a separable structure on the function e, and the resulting simplifications will be noted in footnotes where necessary.[15]

Turning to production, following Neary and van Wijnbergen (1986), we consider a two-period production structure in which investment is chosen optimally to maximise the present value of production:[16]

$$(4.2) \qquad g(p,q^*,x,\ell) \;=\; Max_I \, [g(p,q^*,x,\ell) - p_I I + G(P,Q^*,X,L,I)].$$

Solving for the optimal level of investment and then differentiating the resulting equation gives the following:

$$(4.3) \qquad dI \;=\; -(G_{II})^{-1}[G_{IP}dP + G_{IX}dX + G_{IL}dL].$$

The term $(G_{II})^{-1}$, the responsiveness of investment to an increase in its cost, is negative (reflecting diminishing returns to investment). Thus investment is encouraged by improvements in future prices, sales or employment and by a fall in world interest rates (a rise in δ).[17]

In considering external shocks in this model, it is necessary to distinguish between permanent and temporary shocks. As far as their effects on real income are concerned, permanent shocks are (except for the higher dimensionality) identical to the once-off shocks considered in the one-period model of previous sections. For example, the consumer sector's budget constraint becomes in this model:

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15 Following Svensson and Razin (1983), homogeneous separability allows us to write $e(p,u)$ as $E[\pi(p),\Pi(P),u]$, where $\pi(p)$ and $\Pi(P)$ are linearly homogeneous sub-expenditure functions for periods 1 and 2 respectively. Since the scalar cross-derivative $E_{\pi\Pi}$ must be positive, this implies that every current good is a net substitute for every future good: $e_{pP} = E_{\pi\Pi}\pi_p\Pi_P' > 0$.

16 For simplicity, we assume that investment goods are imported freely at a given price p_I. An extension of the model would allow some or all investment goods to be non-traded. In that case, a favourable shock gives rise to a domestic "construction boom." See Bevan, Collier and Gunning (1990) and van Wincoop (1993).

17 We assume, plausibly, that the cross-terms G_{IP} and G_{IX} are positive. Note that, as long as the export sales constraint continues to bind in the second period, investment is unaffected by changes in future export prices: G_{IQ*} is zero.

$$(4.4) \qquad e(p,u) \quad = \quad g(p,q^*,x,\ell) + (1-\omega)t'm + f,$$

where f equals $f+\delta F$, the present value of current and future transfers. Equation (4.4) is formally identical to equation (2.2). Hence, we may immediately conclude that the effects on real income of *permanent* shocks in the intertemporal model are identical to those of one-period shocks in the static model. In particular, *the results derived in Sections 2 and 3 comparing the effects of external shocks and policy responses in the presence of tariffs and quotas also apply to the same comparison for the case of permanent shocks in a two-period model.*

Matters are less clearcut in the case of *temporary* external shocks, although somewhat similar conclusions apply.[18] To be specific, consider the effects of changes in world prices of imports in the presence of tariffs. For a *permanent* shock (with dp^* equal to dP^*), the response of income is:

$$(4.5) \qquad (1-t'x_I)dy \quad = \quad -(m'-t'm_p)dp^*,$$

which yields results broadly similar to those derived from (2.6). By contrast, in the case of temporary shocks to the terms of trade, the response of income is:

$$(4.6) \qquad (1-t'x_I)dy \quad = \quad -(m'-t'm_p-T'M_p)dp^*.$$

Following a rise in import prices, the presumptive fall in current imports tends to raise the absolute value of the coefficient of dp^* in (4.6) (m_p is negative definite so we expect $t'm_p dp^*$ to be negative). However, if imports in the two periods are net substitutes (as they must be under homogeneous separability),[19] then future imports will increase, so tending to reduce the absolute value of the coefficient. However, provided within-period effects dominate (and future tariffs are not significantly higher than current ones), the coefficient is likely to be greater in absolute value than $-m'$. Thus, the result of Proposition 1 continues to apply even for temporary shocks. Of course, a temporary shock is likely to have a smaller effect than a permanent one, as given by (4.5), since in that case imports are likely to fall in both periods.

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[18] For a related analysis, see Bevan, Collier and Gunning (1990).

[19] The responsiveness of future imports, M_p, equals $e_{Pp}-g_{Pp}$, which reduces to e_{Pp} since future production is unaffected by current prices. Under homogeneous separability this is a positive matrix (from a previous footnote).

A different type of shock is a change in the world interest rate. This has two effects. The first, already considered in Section 2, is the change in income arising from the change in repayments on existing foreign debt. The second, which can only be considered in a dynamic model, is the change in intertemporal prices, since a rise in δ is equivalent to a uniform fall in the present value of future prices: $dy/d\delta = (dy/dP)'(dP/d\delta) = (dy/dP)'P/\delta$. Concentrating on the second effect, the response of income is given by the following:

$$(4.7) \qquad (1-t'x_I)dy \;=\; -[B-(t'm_P+T'M_P)P](d\delta/\delta),$$

where B equals $P'M$, next period's balance of payments deficit (in domestic prices). For a typical developing country, which is committed to running a balance of payments surplus in the future in order to finance debt repayment, B is negative. Hence, in the absence of tariffs, a *fall* in the world interest rate (a *rise* in δ) has a positive intertemporal effect on income. The additional terms which arise in the presence of tariffs may work in the opposite direction, however. Intertemporal substitution in both production and consumption will encourage more imports today ($t'm_PP$ is likely to be positive, and must be so under homogeneous separability) but less tomorrow ($T'M_PP$ is likely to be negative). Assuming that within-period effects dominate, the net outcome is that tariffs *reduce* the responsiveness of income to changes in the world interest rate. This is an exception to the result of Proposition 1 for the single-period model that tariffs tend to increase the responsiveness of income to external shocks (though the fact that the tariff multiplier is less than unity may work in favour of the result). In the case of quotas, the result in the one-period model, Proposition 2, is confirmed, since the effect on income is now:

$$(4.8) \qquad (1-\tau'x_I)dy \;=\; -(1-\omega)B(d\delta/\delta).$$

Thus, a fall in the world interest rate tends to raise the real income of a currently indebted country, to the extent that it reduces the loss of quota rents in the future. The greater the fraction of rents lost (ω), the more the country is insulated from interest rate changes.

So far, it would appear that both types of trade restriction tend to reduce the responsiveness of income to world interest shocks. However, when wage rigidity is allowed, a rather different story emerges. In the case of interest rate shocks, it is future wage rigidity that is relevant. The second-period wage rate must satisfy the marginal productivity condition:

$$(4.9) \quad W = g_L = G_L[P,X,L,I(P,X,L)].$$

Differentiating this and inverting to get the determinants of changes in next period's employment gives:

$$(4.10) \quad dL = (\bar{G}_{LL})^{-1} [dW - \bar{G}_{LP}dP^* - \bar{G}_{LX}dX].$$

where each of the terms $\bar{G}_{Li}$ $(i=L,P^*,X)$ is defined as $[G_{Li} - G_{LI}(G_{II})^{-1}G_{Ii}]$, reflecting the fact that all three changes influence future employment in two ways: both directly by affecting future production and also indirectly by affecting investment in the current period. In the case of a fall in the interest rate (a rise in δ), the change in employment is $-(\bar{G}_{LL})^{-1}$ $\bar{G}_{LP}P(d\delta/\delta)$ and both effects tend to raise future employment. Thus the induced income effects of an interest rate change are more powerful than were those shown in equation (4.7): typically, the responsiveness of income to the world interest rate will be greater (for all types of trade regime) when future wages are sticky than when they are flexible.

5. Policy Responses to External Shocks

The results of this paper underline some familiar policy messages. Irrespective of the nature of external shocks, public-sector production should be determined by reference to shadow prices, tariffs should be reduced[20] and quotas relaxed. Moreover, if the rent-loss parameter ω is allowed to vary, it may be checked that income is in all cases negatively related to it. This has implications for a policy of "tariffication" or converting quotas to equivalent tariffs, since this policy may be represented by a reduction in ω with no change in the actual level of imports. Hence, the equations imply that tariffication in this sense is always welfare-improving, notwithstanding the finding in Section 2 that it may in some circumstances increase the economy's vulnerability to external shocks.

A different application of the approach adopted in the paper is to note that it allows a consideration of the implications of viewing the balance of payments as a constraint on

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[20] The recommendation concerning tariffs is subject to the familiar qualification that non-proportional reductions in tariffs could lower real income, since the term $t'm_p dt$ is not a quadratic form and so could be negative even if all elements of the vector dt are negative. However, for practical purposes, near-proportional reductions and/or concertina-type reductions (lowering the highest tariff rates first) are likely to ensure an improvement in real income. Similar qualifications apply to the rent-loss component of the gain from quota relaxations, $-\tau' dm$. (See equations (2.7) and (3.4).)

policy. So far, I have not considered the balance of payments explicitly, since it does not affect the relationship between external shocks and welfare, provided the economy is assumed to be able to borrow freely on international capital markets. In reality this is rarely the case, however. Without modelling formally the capital-market constraints which face our small open economy, we can obtain some understanding of the policy choices posed by external shocks by looking at their effects on the balance of payments deficit.

In the model of Section 4, the current balance of payments deficit is given by the following:

$$(5.1) \qquad b \;=\; e(p,u) + p_I I(P,X,L) - g(p,q^*,x,\ell) + \gamma - f.$$

Here, γ is a parameter representing current government expenditure (net of tax revenue) on traded goods (where f is, as before, an exogenous transfer from abroad). The equation thus shows that the balance-of-payments deficit equals absorption (consumption plus investment) minus GNP (or investment minus savings) plus the government deficit less net international transfers.[21]

Introducing the γ parameter allows us to consider the effects of fiscal policy. However, we assume that the model exhibits Ricardian equivalence: households anticipate that current expenditure must be financed by future taxes. Hence there is an offsetting (negative) future expenditure, Γ, such that the net present value of the government deficit, $\gamma+\delta\Gamma=0$, is zero. The equation also allows us to consider exchange-rate policy, when we recall that the levels of employment depend on the current and future real wage, w and W. So far, we have viewed the real wage in each period as an exogenous parameter. However, it can also be seen as a variable which is, at least in principle, amenable to government policy, to the extent that wage controls in conjunction with nominal exchange rate changes can influence the real exchange rate. From this perspective, equation (5.1), with real income u determined by (4.4) and changes in employment, $d\ell$ and dL, determined by (3.1) and (4.10), gives the balance of payments as a function of exogenous shocks and of three policy variables: public spending γ and the current and future real wage, w and W (the inverse of each of which is

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21 Equation (5.1) is also consistent with the elasticities approach, since consumption minus income can be broken down into the sum of surpluses and deficits on individual commodities: $b = p^{*\prime}m - q^{*\prime}x + p_I I + \gamma - f$. This perspective may be convenient in some practical applications where it is desired to examine the trade deficit on a disaggregated basis.

the real exchange rate, a measure of the economy's competitiveness in each period).

We now differentiate (5.1) to obtain the effect of external shocks and policy changes on the current balance of payments deficit:

$$(5.2) \quad db = \alpha_1' dp^* + \alpha_2 dq^* + \alpha_3 dx + \alpha_4 df + \beta_1' dP^* + \beta_2 dQ^* + \beta_3 dX + \beta_4 dF + \chi_1 d\gamma + \chi_2 dw + \chi_3 dW,$$

with the values of the coefficients given in Table 1. These may be interpreted straightforwardly, once it is recalled that the endogenous component of b equals investment minus savings. Consider, for example, the coefficients α_i and χ_2, which give the effects of temporary shocks (i.e., changes in current variables). For the most part, these equal the corresponding coefficients in equation (3.2), giving the effects of current shocks on income, multiplied by $-(1-c)$, where c equals $p'm_1$, the marginal propensity to consume current output. Thus for every one dollar increase in income, the balance of payments deficit falls by one dollar times the marginal propensity to save (or the marginal propensity to consume future output). To these income effects must be added a substitution effect in the case of a rise in import prices, $p'e_{pp}$, which along with the employment effect tends to reduce the balance of payments deficit.[22] As for the coefficients representing the effects of anticipated future changes, they reflect adjustments in both savings and investment (with the terms $\bar{I}_j$ $(j=P,X)$ standing for $I_j - I_L(\bar{G}_{LL})^{-1}\bar{G}_{Lj}$, the change in investment taking account of the adjustment in future employment). Finally, adding α_i to β_i (and also adding χ_2 to χ_3) gives the effects of permanent shocks on the current deficit.[23]

It is clear from the coefficients of import prices and export sales in equation (5.2) that

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[22] This prediction reverses the so-called Harberger-Laursen-Metzler effect. See Svensson and Razin, especially equation (A.4). They suggest that the result is more ambiguous than here because they do not have an employment effect and they do not follow my convention of viewing terms such as $p'e_{pp}dp$ in a negative definite matrix as "likely" to be negative when dp is positive.

[23] From the table, it may be seen that these sums generalise a result derived by Svensson and Razin for the effect of a permanent change in the terms of trade under full employment: assuming a symmetric stationary state (so that variables such as import and export levels are equal in the two periods), the income effect of any permanent shock depends only on the difference between the marginal propensities to consume current and future output (c and $1-c$).

current and future wage rigidities exacerbate the effects of external shocks on the balance of payments. To see the policy implications of this, it is useful to plot equation (5.2) in the space of the two current policy variables, w and γ, for a given value of the deficit b (which it is convenient to set at zero) and given values of all the other exogenous variables. Since the coefficients χ_1 and χ_2 are positive, this gives the downward-sloping External Balance (EB) locus in Figure 1. At points above and to the right of the locus, the loss of competitiveness and the higher government deficit give rise to a balance-of-payments deficit, and conversely for points below and to the left of the locus. The same diagram also plots an Internal Balance (IB) locus, which shows combinations of w and γ that maintain real income (as given by equation (4.4)) at a given level. This is independent of government spending because of the basically Classical nature of the model (i.e., Ricardian equivalence and the absence of domestic price changes). Upward movements in Figure 1 correspond to reductions in real income.

The diagram which has been derived in this way is not original: it is none other than the Swan (1963) diagram, familiar in discussions of open-economy macroeconomics. This shows clearly that, in general, to attain both internal and external balance a combination of *expenditure-switching* policies (i.e., changes in w) and *expenditure-reducing* (or increasing) policies (i.e., changes in γ) is necessary. However, the derivation of the diagram is novel in that it has been carried out in a fully-specified micro model. Hence, we can examine the implications of current and expected external shocks as well as of micro policy measures on the external and internal balance loci.

Figure 1 shows the effect of a particular shock - a reduction in current foreign aid f - on the two loci. From (5.2) (with α_4 positive), this tends to raise the current deficit and so the EB locus shifts downwards to EB′. The IB locus also shifts downwards as equilibrium real income falls. There is no necessity for the economy to move onto the new EB locus. Provided it is free to borrow on international markets, it can remain above EB′, running a current balance-of-payments deficit to be financed by a future surplus. Exactly how the economy responds to the shock now depends on the policies adopted to accommodate it. If neither w nor γ adjust, then the economy remains at point A: relative to the new loci, EB′ and IB′, this corresponds to a fall in income and a balance-of-payments deficit. The nature of the external and internal pressures facing policy-makers will then determine what mix, if any, of expenditure-reducing and expenditure-switching policies (deflation and devaluation) will be adopted.

Figure 2 illustrates the effects of a different shock, which cannot be examined in the standard Swan diagram: a change in the world interest rate. To the extent that the economy begins the first period with outstanding debt, interest rates changes operate just like changes in f. To focus initially on the specifically intertemporal effects, therefore, assume that the economy begins the first period with no outstanding debt. As in Section 4, a rise in the world interest rate is equivalent to a uniform fall in future prices and so its effect on the current balance of payments is given by $\beta_1{}'P$. From Table 1, this combines adjustments in income, employment, consumption and investment. The last three effects are positive for changes in the future prices of individual goods and the first, $-cM'P$, becomes $-cB$ which is also positive. Hence, the overall effect $\beta_1{}'P$ is positive. If we now consider a *rise* in the world interest rate (a fall in δ), the resulting intertemporal effects unambiguously improve the current balance-of-payments deficit, so causing a rightwards shift of the EB locus as shown in Figure 2. As for the change in income, it has already been shown in Section 4 that this must fall and so the IB locus shifts downwards. Once again, with no policy response the economy remains at point A, which now represents a situation of a lower level of income combined with a balance-of-payments surplus. A devaluation to restore income to its former level will lead to a larger surplus at B. Finally, in the realistic case where the country has an initial foreign debt, the net result combines elements from Figures 1 and 2: income unambiguously falls and the deficit is more likely to worsen the greater the initial debt overhang.

6. Summary and Conclusion

This paper has addressed the question of the vulnerability of an open economy to external shocks. In the absence of trade or factor-market distortions, a country's openness to international trade is synonymous with its vulnerability to trade (as can be seen from the coefficients of the external shock terms in equation (2.4).) However, once pre-existing distortions are admitted, this simple relationship ceases to hold and a country's vulnerability to external shocks depends on much more than just its degree of openness. I have shown in this paper that, in many cases, vulnerability is *increased* by the presence of pre-existing distortions. This is true even of some types of trade restrictions (primarily non-prohibitive tariffs) which might be thought to insulate a country from foreign shocks. It is also especially true of labour-market distortions which reduce the flexibility of employment adjustment. The resulting swings in the real exchange rate, interacting with trade restrictions, lead to income effects which are likely to exacerbate the domestic impact of external fluctuations.

From a welfare perspective, the effects of external shocks on real income are all that matters. However, in practical policy-making, the effects on the balance of payments are also crucial, since countries do not have access to unlimited foreign borrowing. In Section 5 of the paper, I considered the effects of external shocks on the balance-of-payments deficit and looked at the policy implications. Wage rigidities exacerbate the response of the deficit and call for a combination of expenditure-switching and expenditure-reducing policies to offset the effects of external shocks. Of course, no policy package can fully compensate an open economy for unfavourable shocks. The message from the models in this paper is that flexible adjustment to shocks rather than insulation is likely to be the best strategy.

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Exogenous Variable	Coefficient
Current import prices	α_1': $(1-c)[m'+w(g_{tt})^{-1}g_{tp}] + p'e_{pp}$ (<0)
Future import prices	β_1': $-c[M'+W(\bar{G}_{LL})^{-1}\bar{G}_{LP}] + p'e_{pP} + p_I\bar{I}_P$ (>0)
Current export prices	α_2: $-(1-c)x < 0$
Future export prices	β_2: $cX > 0$
Current export sales	α_3: $-(1-c)[q^*-q-w(g_{tt})^{-1}g_{tx}] < 0$
Future export sales	β_3: $c[Q^*-Q-W(\bar{G}_{LL})^{-1}\bar{G}_{LX}] + p_I\bar{I}_X > 0$
Current transfer	α_4: $-(1-c) < 0$
Future transfer	β_4: $c > 0$
Current fiscal expansion	χ_1: $1 > 0$
Current real wage	χ_2: $-(1-c)w(g_{tt})^{-1} > 0$
Future real wage	χ_3: $(cW+p_I I_L)(\bar{G}_{LL})^{-1} < 0$

Table 1: Coefficients of Equation (5.2), Relating Changes in the Current Balance of Payments Deficit to Changes in Exogenous Variables

Notes: Symbols are explained in the text. The signs given after the coefficients (especially those in brackets) are subject to qualifications noted in the text.

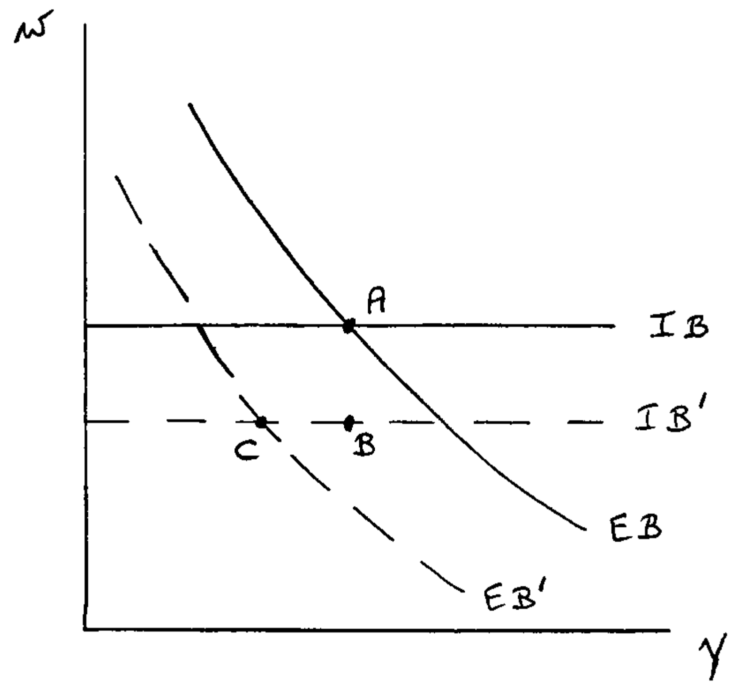

Figure 1: Effects of a Reduction in Foreign Aid

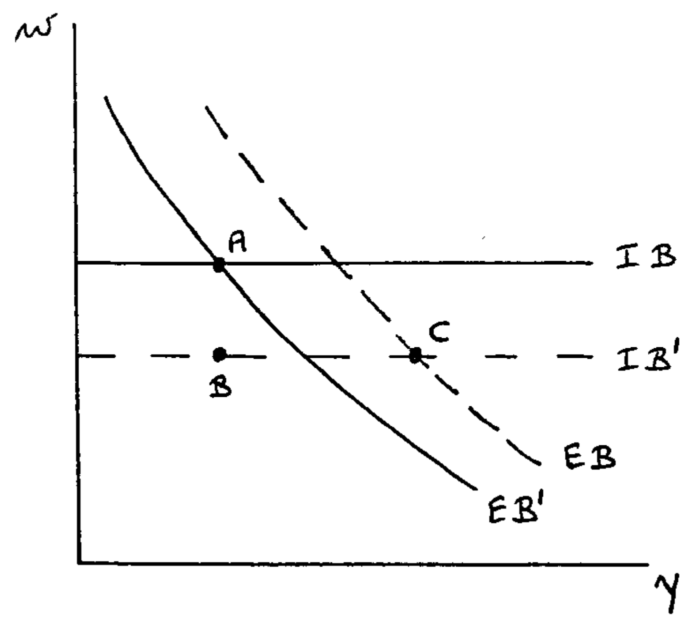

Figure 2: Intertemporal Effects of a Rise in the World Interest Rate