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## BOOMING SECTOR AND DUTCH DISEASE ECONOMICS: SURVEY AND CONSOLIDATION

By W. M. CORDEN

### Introduction

THIS paper aims to consolidate a growing literature on booming sector economics and the Dutch Disease. The term Dutch Disease refers to the adverse effects on Dutch manufacturing of the natural gas discoveries of the nineteen sixties, essentially through the subsequent appreciation of the Dutch real exchange rate.<sup>1</sup> The paper is also intended to fill some theoretical gaps, notably in sections 5 (immigration), 6 (endogenous terms of trade effects), 7 (domestic absorption) and 10 (dynamics). The issues have been widely discussed in many countries, notably the oil exporters. The key article in the British discussion on the effects of North Sea oil is Forsyth and Kay (1980).<sup>2</sup>

Booming Sector models can also illuminate many historical episodes where there have been sectoral booms, with adverse general equilibrium effects on other sectors. Thus there is wide scope for application in economic history. For example, Forsyth and Nicholas (1983) have interpreted the consequences on Spanish industry of the inflow of American treasure in the sixteenth century in Dutch Disease terms. Cairnes (1859) recognised that the gold discoveries in Australia in the eighteen fifties had Dutch Disease effects on some Australian industries, and this episode has recently been studied in Maddock and McLean (1983).

\* This is an expanded version of a paper prepared for an International Economic Association Symposium in New York, December 1982, circulated as Working Paper in Economics and Econometrics, No. 979, Australian National University, 1982, and published in condensed form in the *International Social Science Journal*, Vol XXXV No. 3, 1983, pp. 441–54. I am indebted to comments from John Black, John Flemming, Peter Forsyth, Vijay Joshi and John Martin, and especially to Peter Neary and Frances Ruane.

<sup>1</sup> The first printed reference to the term I have found is in the article “The Dutch Disease” in *The Economist* November 26th 1977, pp. 82–3. A fuller account of the Dutch case, including Dutch policy discussion, is in Ellman (1981). Incidentally, it might be argued that the true Dutch Disease in the Netherlands was not the adverse effects on manufacturing of real appreciation but rather the use of Booming Sector revenues for social service levels which are not sustainable, but which it has been politically difficult to reduce.

<sup>2</sup> Early papers are McKinnon (1976) on Kuwait, and Gregory (1976) and Snape (1977) on Australia. Enders and Herberg (1983) draw attention to an early paper on Norway—Eide (1973), in Norwegian—and the issues have been discussed, for example, in OECD reports on Norway. Several articles in the *Bulletin of Indonesian Economic Studies* have dealt with the issues. The international literature in this field is extensive, and a fairly comprehensive list is in the bibliography. A general book referring to the “oil or industry” issue with respect to Canada, Mexico, the Netherlands, Norway and Britain, is Barker and Brailovsky (1981).

The starting point in the analysis here will be a Core Model, presented earlier in more detail in Corden and Neary (1982).<sup>3</sup>

### 1. The Core Model: Spending Effect and Resource Movement Effect

There are three sectors, the Booming Sector (B), the Lagging Sector (L) and the Non-Tradeable Sector (N). The first two produce tradeables facing given world prices. Output in each sector is produced by a factor specific to that sector, and by labour, which is mobile between all three sectors and moves between sectors so as to equalise its wage in all three employments. Measured in terms of L the wage is  $W$  and the three rents are  $R_b$ ,  $R_L$  and  $R_n$ . All factor prices are flexible and all factors are internationally immobile.

A boom in B has the initial effect of raising aggregate incomes of the factors initially employed there. This boom can be thought of as happening in one of three ways. (1) There has been a once-for-all exogenous technical improvement in B, represented by a favourable shift in the production function, this improvement being confined to the country concerned. (2) There has been a windfall discovery of new resources (i.e. increase in supply of the specific factor). (3) B produces only for export, with no sales at home, and there has been an exogeneous rise in the price of its product on the world market relative to the price of imports. Unless indicated otherwise, we shall have case (1) in mind below.

*Spending Effect.* If some part of the extra income in B is spent, whether directly by factor owners or indirectly through being collected in taxes and then spent by the government, and provided the income elasticity of demand for N is positive, the price of N relative to the prices of tradeables must rise. This is a *real appreciation*. It will draw resources out of B and L into N, as well as shifting demand away from N towards B and L.

In Figure 1 the vertical axis shows  $P_n$ , namely the price of N relative to that of L. The supply curve is derived from the transformation curve between N and the two tradeables. The demand curve shows the demand for N at various prices of N when expenditure is always equal to income.<sup>4</sup> The spending effect has shifted the demand curve from  $D_0$  to  $D_1$  and thus has raised  $P_n$ , drawing resources out of L into N.

*Resource Movement Effect.* In addition, the marginal product of labour rises in B as a result of the boom so that, at a constant wage in terms of

<sup>3</sup> See part II of Corden and Neary (1982) where the Ricardo-Viner-Jones assumption is made (one mobile factor combined with a specific factor in each industry). This type of model was first presented in Snape (1977). In general, the earlier paper and the present one can be regarded as "plain man's general equilibrium theory" and a referee has asked me to point out that changes are generally in the intuitive direction (apart from the paradoxes and unexpected results noted), well-behaved cases are being assumed and rogue income effects are excluded.

<sup>4</sup> Since income depends on output, the demand curve is not independent of the supply curve. For a particular price ratio we draw the budget line tangent to the transformation curve, this determining supply of N. This also fixes income in terms of tradeables or in terms of N at that price. Demand for N is then determined by the chosen consumption point at that price ratio and income level.

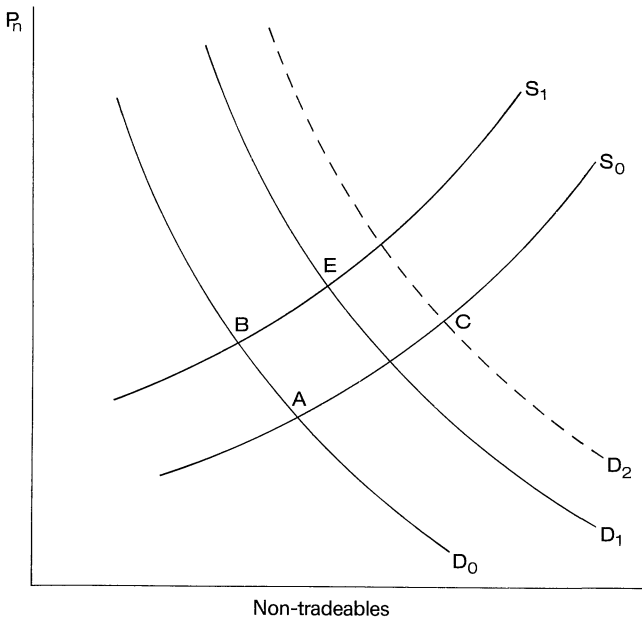


FIG. 1

tradeables, the demand for labour in B rises, and this induces a movement of labour out of L and out of N. This effect has two parts.

(1) The movement of labour out of L into B lowers output in L. This can be called *direct de-industrialisation* because it does not involve the market for N and thus does not require an appreciation of the real exchange rate.

(2) There is a movement of labour out of N into B at a constant real exchange rate. This is represented in Figure 1. The resource movement effect has shifted the supply curve from  $S_0$  to  $S_1$ , and thus creates excess demand for N additional to that created by the spending effect, and so brings about additional real appreciation. Thus it brings about an additional movement of labour out of L into N, reinforcing the de-industrialisation resulting from the spending effect. The two effects combined, leading to a movement of labour from L to N, bring about, what can be called, *indirect de-industrialisation*, which supplements the direct de-industrialisation that resulted from the movement of labour from L to B. As is evident from Figure 1, the output of N could finally be higher or lower than initially. The spending effect tends to make it higher and the resource movement effect to make it lower.<sup>5</sup>

<sup>5</sup> A complication concerning the relationship between the spending effect and the resource movement effect was overlooked in Corden and Neary (1982). It concerns the effects that a changed income distribution at a constant price of N has on spending on N.

The spending effect on its own is unambiguous, since (to isolate it) it is assumed that no labour is employed in B (or any labour is specific): hence, before  $P_n$  rises, the income of only one factor changes, all extra spending thus coming out of  $R_b$ . But the resource movement effect,

Footnotes continued on p. 362

Coming to factoral income distribution, both effects lower the real rents of the specific factor in L, this being the essential problem of the Dutch Disease, at least as seen from the point of view of this factor. In addition, both effects raise the wage  $W$  defined in terms of L, because both increase the demand for labour. But  $P_n$  rises, so—bearing in mind that wage-earners also consume N—there is a question whether the “true” real wage  $W^*$  (the real wage defined in terms of a consumption basket of tradeables and N) rises or falls. The answer is unambiguous in the case of the resource movement effect: since output of N falls as a result of that effect, the real wage in terms of N—i.e.  $W/P_n$ —must rise, and since  $W$  also rises,  $W^*$  must then rise. On the other hand the spending effect causes  $N$  to rise, and hence  $W/P_n$  to fall, so that, with  $W$  having risen,  $W^*$  could have risen or fallen. Finally, it can be shown that the real rent in N could rise or fall.

One can readily imagine the special case—commonly found in papers analysing an oil boom—where the Booming Sector does not employ a factor that is mobile to the rest of the economy. As Neary (1983) puts it, these models “do not allow any participation by the booming sector in domestic factor markets.” In effect, it is an “enclave”. There is then *only* a spending effect, there is no direct de-industrialisation, and the key mechanism of resource reallocation is the real appreciation. Provided spending on non-tradeables goes up initially, output of N must finally be higher than in the pre-boom situation.<sup>6</sup>

It has to be underlined that the Lagging Sector can be producing both non-boom exportables and importables, and it need not consist only of manufacturing industry. In Australia and Nigeria, for example, a significant component would be producing tradeable agricultural products. The term “de-industrialisation” can thus be misleading (with a major effect possibly

*Footnotes continued from p. 361*

before  $P_n$  changes, raises  $W$ , and lowers  $R_1$  and  $R_n$ . Spending on N out of  $R_b$  and  $W$  will rise and out of  $R_1$  and  $R_n$  will fall. Only in the special case where the marginal propensities to spend on N are the same and positive for all factors will the spending effect be independent of the resource movement effect, and must it always be positive. This was the assumption implicit in Corden and Neary (1982).

In the general case, with marginal propensities differing, the spending effect will depend on the resource movement effect via income distribution. When the marginal propensities to spend on N of initial losers are sufficiently higher than of gainers the spending effect could actually be negative.

<sup>6</sup> The various model-building papers listed in the bibliography can be classified by whether they have a spending effect only, or whether they also have a resource movement effect. Spending effect only: Gregory (1976), McKinnon (1976), Forsyth and Kay (1980), Buiter and Purvis (1982), Bruno and Sachs (1982), Corden (1981a), van Wijnbergen (1982a, 1982b, 1984), Eastwood and Venables (1982), Enders and Herberg (1983). Both effects: Snape (1977), Stoeckel (1979), Long (1983), Corden and Neary (1982) Neary and Purvis (1981, 1982), Cassing and Warr (1982).

The spending effect is the equivalent of the consequence of a “transfer” to the country concerned, so that this part of the analysis is a version of “transfer problem” theory, on which see Johnson (1958a) and references cited there. But transfer theory did not make the small country assumption. It allowed, therefore, also for the effects of a fall in spending in the foreign country, and the principal question asked concerned the effects on the terms of trade.

being de-agriculturalisation!), and should be regarded as no more than shorthand. Furthermore, if products are subject to binding quantitative restrictions, so that their domestic prices are not determined by world market prices, but rather by domestic demand and supply conditions, they should be treated as non-tradeables even though they are potentially tradeable. It might also be noted that locally-produced manufactures are often close but not perfect substitutes for imports. They might be thought of as containing both a tradeable and a non-tradeable element so that they could, on balance, be beneficiaries from the spending effect.

The Core Model can be varied in numerous ways, so that none of the outcomes can be regarded as inevitable. We now introduce a number of complications.

## **2. The Paradox Model: more than one factor intersectorally mobile**

Let us now suppose that more than one factor is mobile between at least two of our three main sectors. There are various possibilities here, but just one case—a slight variation of our Core Model—will be explored here. This is presented more fully in Corden and Neary (1982) and will be called the Paradox Model. Again we have three sectors, B, L and N, again B has its own specific factor and labour is mobile between all three industries. But this time capital is mobile between the two non-boom industries, L and N. Thus these two industries both employ labour and capital in varying proportions, making up a mini-Heckscher-Ohlin economy, one industry being capital-intensive and the other labour-intensive.

Within this particular structure the resource movement effect can have some paradoxical results. At a constant real exchange rate it will cause the output of the capital-intensive industry to expand, this being the result of the movement of labour out of the mini-Heckscher-Ohlin economy into B because of the boom.<sup>7</sup> If L happens to be the capital-intensive industry there will then be a tendency to *pro-industrialisation* because of the resource movement effect. Of course this can be offset by the spending effect which, through the mechanism of real appreciation, will move both capital and labour from L into N. But, on balance, output of L could expand. It can also be shown that, if N happened to be the relatively capital-intensive industry in the Paradox Model, the boom could cause a real depreciation.

## **3. Decomposition of the Lagging Section**

Similar factors operate when the Lagging Sector is decomposed into several industries and, in addition, more than one factor is allowed to be mobile between its component industries. It is then perfectly possible that some of the non-boom tradeable industries actually expand even though the sector as a whole contracts.

<sup>7</sup> This represents an application of Rybczynski (1955).

Consider the following case from Snape (1977) and Cassing and Warr (1982). The sector consists of  $M$  and  $X$ , both of which employ labour and capital, both these factors being mobile between the two industries but employed in different proportions to each other. (Thus the Lagging Sector makes up a mini-Heckscher–Ohlin economy). In addition labour is used in  $B$  and  $N$ , as in our Core Model, and  $B$  and  $N$  each have a specific factor. The boom brings about the usual movement of labour out of the Lagging Sector as a whole. But this time there will be a rearrangement within the Lagging Sector. With the stock of capital for the sector as a whole fixed and the amount of labour reduced, it follows from Rybczynski (1955) that the labour-intensive industry will contract output but the capital-intensive industry will expand.

#### 4. International capital mobility

A move in the direction of realism is to allow for some degree of international capital mobility. Consider the simple case where each sector employs sector-specific capital but each of the three kinds of capital is internationally mobile to some extent. Thus capital does *not* move between industries, but there is some degree of *international* mobility for each type of capital.

First it is necessary to note what happens to rents in the Core Model—i.e. when the supply of the specific factor (the capital stock) is fixed in each sector. Rents in  $L$  fall, rents in  $B$  are likely to rise (and must rise when measured in terms of tradeables), while rents in  $N$  could go either way, but would rise if output of  $N$  rose. Assume now that, before international capital mobility, rents in  $L$  fall and in  $B$  and  $N$  rise, output moving in the same direction as rents.

International capital mobility will then lead to a flow of capital *out of*  $L$  but into  $B$  and  $N$ . This will reinforce the output effects but moderate the effects on returns to capital. De-industrialisation will be greater but the adverse effects of the boom on profitability in the Lagging Sector will be less because of the capital outflow. In the case of  $N$  capital mobility will make the supply curve more elastic and so lead to a further rise in output as well as moderating the real appreciation required for restoration of equilibrium.

The extreme case of a perfectly elastic supply of capital from the rest of the world is worth noting as a limiting case.<sup>8</sup> Consider first  $L$ . In this case the rate of return on capital in  $L$  will not fall at all, the whole adjustment to the boom being through a fall in output. Given our assumption that there are only two factors in  $L$ —internationally mobile capital and intersectorally mobile labour—and if, in addition, there are constant returns to scale, the wage in terms of  $L$ —i.e.  $W$ —must then also stay unchanged. Coming to  $N$ , perfect capital mobility would actually fix the price of  $N$  in terms of

<sup>8</sup> See Neary and Purvis (1981), Bruno and Sachs (1982) and Cassing and Warr (1982).

tradeables, at least (again) if there are only two factors employed in N and there are constant returns to scale. In other words, the supply curve for N is horizontal, all changes in demand being absorbed by output changes. There is then no possibility of a real exchange rate change.

## 5. Immigration

Some degree of migration in response to booms is very common, especially when there are regional booms and the migrants come from other parts of the country—as can be found in the history of Brazil, Canada and the United States. But the following analysis was inspired by the issues raised in Maddock and McLean (1983), which deals with the effects of the Australian gold rushes in the middle of the nineteenth century, when massive immigration resulted.

It was shown in Section 1 that in the Core Model the boom may raise the “true” real wage  $W^*$ . Both the spending effect and the resource movement effect must raise  $W$  (the wage in terms of tradeables); bearing in mind that  $P_n$  rises, the spending effect could raise or lower  $W^*$ , while the resource movement effect must raise it. Let us now assume that  $W^*$  does rise and that this attracts migrants until  $W^*$  is again restored to where it was before the boom. The subsequent analysis is, of course, relevant for the case where  $W^*$  is not fully restored as a result of migration.

First, let us consider the effects of immigration on its own, working within the assumptions of the Core Model. At constant  $P_n$  migration will increase both demand for and supply of N. In general one cannot say which will increase more, and thus whether immigration will lead to real appreciation or depreciation. Finally output of both L and of N will be greater than before migration, and  $R_b$  and  $R_n$  will thus be higher.<sup>9</sup>

This raises the interesting question whether migration could fully offset the de-industrialisation effects of the boom by fully restoring the output of L. In fact, could there be an overshooting effect, with L finally being higher than originally? A related question is whether  $P_n$  must be fully restored, or could even fall relative to the pre-boom situation.

The change in output of L depends on what happens to  $W$  (an increase in  $W$  leading to a fall in L), so the principal question is whether the restoration of  $W^*$  to its pre-boom level implies a rise, fall, or constancy of  $W$ . The simple answer—to be expounded below—is that *if there were no extra demand for N* either as a result of the spending effect (i.e. if this effect were zero) or as a result of migration—i.e. there were no *migrants’ spending effect*—then restoration of  $W^*$  would also lead to restoration of  $W$  and of  $P_n$ . But provided there is some spending effect or migrants’ spending effect the restoration of  $W$  and of  $P_n$  will not be complete even when sufficient migrants have come in to restore  $W^*$ . Thus some de-industrialisation

<sup>9</sup> This is not necessarily so in the Paradox Model. If L is labour-intensive relative to N, output of N at a constant  $P_n$  will fall as a result of immigration.



remains, essentially because of the extra demand for non-tradeables. Overshooting is not possible.

First it should be noted that a constant  $W^*$  requires the fulfilment of one of three conditions as follows:

$$\hat{P}_n = \hat{W} = 0; \quad \hat{N} = 0 \quad (i)$$

$$\hat{P}_n > \hat{W} > 0; \quad \hat{N} > 0 \quad (ii)$$

$$\hat{P}_n < \hat{W} < 0; \quad \hat{N} < 0 \quad (iii)$$

where the hats indicate the proportional change from the pre-boom to the post-boom post-migration situation. This says that a rise in the real wage in terms of tradeables, i.e.  $\hat{W} > 0$ , must be associated with a fall in terms of non-tradeables, i.e.  $\hat{P}_n > \hat{W}$ , and vice versa. Furthermore, when the real wage in terms of nontradeables falls, output of N must rise, and vice versa.

Let us first assume that there is a resource movement effect, but neither kind of spending effect—i.e. there is no extra demand for N at a given  $P_n$  either as a result of the boom or of the migration. Thus in Figure 1 the demand curve stays at  $D_0$ . The resource movement effect of the boom shifts the supply curve from  $S_0$  to  $S_1$ , bringing equilibrium from A to B. Migration then shifts the supply curve back again, so that, as the migrants come in, equilibrium moves along  $D_0$ , and  $P_n$  falls. The movement will stop when  $W^*$  is back where it was. It can be readily shown that only at A will this condition be fulfilled. Before A is reached  $\hat{P}_n > 0$  but  $\hat{N} < 0$ , while beyond A,  $\hat{P}_n < 0$  but  $\hat{N} > 0$ , so conditions (ii) and (iii) cannot be fulfilled. Thus the resource movement effect will exactly restore the product and factor prices of the pre-boom situation provided migration restored the real wage  $W^*$ . It might be noted that this would also be the result of capital inflow if the mobile factor were capital, rather than labour.

Now let us introduce the two spending effects. The spending effect of the boom shifts the demand curve to  $D_1$ , while the migrants' spending effect shifts it further, say to  $D_2$ . At C output of N and  $P_n$  must be higher than at A, even though  $P_n$  need not be higher than at E (i.e. migration on its own could raise or lower  $P_n$ ). Comparing C with A we note that the real wage in terms of N must have fallen, since output of N has risen; hence  $W$ , the real wage in terms of tradeables, must have risen. Thus condition (ii) is fulfilled. With  $W$  higher, L must be lower at C than at A, so that some de-industrialisation must remain.

Before leaving the subject of migration, one might also note the "Alberta case".<sup>10</sup> The rents from the Booming Sector may go primarily to the government, then being redistributed to the population in the form of tax reductions, improved public facilities and so on. This attracts migrants seeking to share in the rents. These migrants will tend to go into both N and L, so that output of L (and rents in that sector) could recover, as well as a real appreciation being moderated or even avoided. This effect operates

<sup>10</sup> See Helliwell (1981).

even when the pre-tax (and constant public facilities) real wage  $W^*$  stays constant before migration. In various historic episodes of regional or even national booms one might expect that migration was induced both by the rise in  $W^*$ —the *gold rush effect*—as well as by the *Alberta effect*.

## 6. Endogenous terms of trade effects

The small country assumption can now be removed, even though we return to the assumption of a fixed national factor stock. As mentioned earlier, the boom may have been caused by an exogenous terms of trade improvement, i.e. rise in the price of B. Now we want to allow for an *endogenous* terms of trade change. This will have two parts to it.

Firstly, extra exports of B owing to technical progress in B or any other reason may lower the world price of B. This is an obvious effect, and we can suppose that it has already been incorporated in the calculation of the size of the boom. We now assume that the country is small in the world market for the Booming Sector product, say oil, so that  $P_b$  is given.

The second part of the terms of trade effect is concerned with what happens within the Lagging Sector. It is now necessary to distinguish exportables from importables. The Lagging Sector is assumed to produce both importables,  $M$  (which are perfect substitutes for imports) and exportables,  $X$ . The term “exportables” is used here only for Lagging Sector products; in addition there are, of course, exports of the Booming Sector product. We use  $P_m$  as the numeraire, and the question is what happens to  $P_x$ . It will be shown that it is likely to rise, at least in an extended Core Model, so that there will be an endogenous terms of trade improvement.<sup>11</sup>

At constant prices the demand for  $X$  will rise owing to the spending effect. This refers to spending on  $X$ , rather than on  $N$ , as elsewhere in this paper. Staying within an extended Core Model (with  $X$  and  $M$  each now having a specific factor, and labour mobile to all four industries), output of  $X$  will fall owing to the resource movement effect; this is direct de-industrialisation. There will thus be excess demand not only for  $N$  (as in the Core Model) but also for  $X$ , and both prices will rise. The fact that  $P_n$  has to rise—i.e. that there will be a real appreciation expressed in terms of  $P_m$ —strengthens the rise in  $P_x$ . This is another way of saying that the real appreciation raises demand for, and reduces supply of,  $X$  in the way shown in the simple version of the Core Model with respect to the effect on  $L$ .

The presumption of an endogenous terms of trade improvement is somewhat reduced in an extended version of the model discussed in Section 3 where the Lagging Sector was decomposed. The Lagging Sector as a whole becomes more capital-intensive as labour moves into the Booming Sector

<sup>11</sup> There is a big, favourable terms of trade effect in Forsyth and Kay (1980). Their Lagging Sector produces exportables at a given domestic price and the nominal appreciation lowers the sterling price of imports. It seems doubtful that, other than in the short-run, the U.K. is so far removed from the small country case. There are also favourable endogenous terms of trade effects in Buiter and Purvis (1982) and Bruno and Sachs (1982).

and (after  $P_n$  has risen) into N. If, within the Lagging Sector  $X$  is capital-intensive relative to  $M$ , then at constant  $P_x$  output of  $X$  would rise, and output of  $M$  fall even more, an example of the Rybczynski (1955) effect. The net result of higher output of  $X$ , even with increased demand for  $X$ , as before, could be excess supply of  $X$  and thus a fall in  $P_x$ .<sup>12</sup>

## 7. Domestic absorption effect

So far we have assumed that the Booming Sector product is wholly exported. Let us now allow for the case where part of it is consumed at home and where the source of the boom is an exogenous rise in the world price. We return to the small country model. Thus we are now considering the effects of an oil price rise on an exporting country. The procedure is to superimpose on the Core Model a *domestic absorption effect*—namely the effect of the price rise of a product that is produced and sold at home, even though the actual price may be determined in the world market. There will only be such an effect if the price to domestic consumers is actually allowed to rise, whether partly or wholly, in line with the world price.

It is useful to keep the domestic absorption effect separate from our main analysis for two reasons. Firstly, the basic Booming Sector analysis is more general, also applying to products where there is no significant home consumption and to booms that do not originate in a price rise. Secondly, even in the case of the oil price rise—to which the domestic absorption effect is particularly relevant—many exporting countries have detached domestic from world price changes, sometimes not raising the price of oil to domestic consumers at all, and sometimes raising it after a lag or to a lesser extent than the world price rise. An analysis which assumes that domestic prices always move with world prices would not allow for such cases.

*Booming Sector product is final consumption good.* Initially we assume that the product is a final consumption good, not an input. We are now looking only at the effects of a higher price for home sales, not of exports.

First we consider the spending effect. The Booming Sector is taxing consumption of product B by the rest of the economy. There will be a positive spending effect out of  $R_b$  and a negative spending effect out of the other factors. If the marginal propensities to spend on N were the same out of  $R_b$  as out of  $R_1$ ,  $R_n$  and  $W$  combined, there would be no net spending effect as a result of the domestic absorption effect. But if the marginal propensities to spend on N differed the net spending effect could go either way, leading finally to real appreciation or depreciation. To these income effects must be added a substitution effect: the higher price of B faced by domestic consumers may lead to substitution in favour of L and N, this increasing the likelihood of appreciation.

<sup>12</sup> There is also the possibility of a fall in the demand for  $X$  at constant  $P_n$  if the marginal propensities to consume  $X$  out of  $R_b$  and out of  $W$  are less than that out of returns to capital. At this point the standard theory of the effects of biased growth on the terms of trade, with all its complexities, is relevant. See Johnson (1958b, 1962).

Finally, the resource movement effect will be exactly the same as in the Core Model: the marginal product of labour in B will initially rise relative to that in L and N. The resource movement effect of the home price rise must then be added to the resource movement effect of the export price rise, so that the various resource allocation and income distribution effects will be greater than in the Core Model.

*Oil as intermediate good.* The matter is more complicated once we allow the Booming Sector product to be an input in L and N, rather than a final consumption good. B will now be called oil. This time consumers are not directly affected, even though they will be indirectly affected through a change in  $P_n$ . As before, there is a positive spending effect out of  $R_b$ . With a higher price of oil, values added per unit (the *effective prices*, as distinct from the nominal prices) in L and N are squeezed at a constant price of  $P_n$ , so that  $R_1$ ,  $R_n$  and  $W$  fall, leading to a negative spending effect from these sources. As earlier, the positive and negative spending effects may or may not cancel out.

The resource movement effect will be greater than when oil was a final consumption good. Not only does the marginal productivity of labour in B rise, but it falls in L and N owing to the declines in the two effective prices.

In addition there are two substitution effects. Firstly, there may be a resource movement effect between L and N if one is more oil-intensive than the other. Thus output of N at constant  $P_n$  will tend to rise if N is relatively less oil-intensive, and in that case the real appreciation will finally be less. Secondly, L and N will tend to be substituted for oil, this adding to the rise in demand for N and thus the tendency to real appreciation.

## 8. Classical unemployment

In the models presented so far all factor prices have been flexible, so involuntary unemployment has been ruled out. We now allow for "classical" unemployment resulting from real wage resistance. There are plausible cases where the boom would increase unemployment, and others where it would reduce it. The general principle is the same in all cases. If the boom would have raised the real wage in the flexible-factor price model, then with a rigid real wage it would reduce unemployment instead, while if it would have reduced the real wage in the flex-price model, it would generate unemployment in the fix-price case. Two interesting cases will now be considered.<sup>13,14</sup>

*Unemployment in the Lagging Sector.* Suppose that some types of labour

<sup>13</sup> Real wage resistance might also be introduced into the Core Model. The question then is whether the 'true real wage' would rise or fall in the absence of such rigidity. As noted earlier, in general it could go either way. See van Wijnbergen (1982a) on real wage resistance in this type of model.

<sup>14</sup> A referee, thinking specifically of the Netherlands, has pointed out another channel through which unemployment can result and the manufacturing sector can be adversely affected. The Booming Sector revenues finance high unemployment and other benefit levels. This, in turn, raises voluntary unemployment, and so reduces the labour supply, raises the real wage, and leads to a contraction of output and profits in manufacturing.

are specific to the Lagging Sector in the medium-run at least, and practise real wage resistance. This case has been in the forefront of Dutch Disease discussion. If the real wage were flexible it would fall, both because of the movement of mobile factors into other sectors and because of the rise in  $P_n$  even with no inter-sectoral factor movements. With real wage resistance of the specific factors the Dutch Disease then manifests itself, partly at least, in extra unemployment of such factors. Unemployment would be intensified if workers in the Lagging Sector actually sought real wage *increases* so as to maintain their wage relative to those of workers specific to the Booming Sector, where market forces will have raised real wages.<sup>15</sup>

*Unemployment in non-tradeables: foreign exchange constraint.* A very interesting case yields a result that is the opposite of the previous one. Suppose that N is produced mainly by labour specific to non-tradeables. We focus on the spending effect. In the flex-price case the boom will raise the real wage of such labour (i.e. raise  $R_n$  in the Core Model) because the demand for non-tradeables has gone up. Now introduce real wage resistance and initial unemployment. The spending effect will then increase employment in that sector. Combining this with real wage resistance of labour specific to the Lagging Sector, there is then a *positive* employment effect in the Non-Tradeable Sector and a *negative* employment effect in the Lagging Sector.

This result can be related to the popular “foreign exchange constraint” model.<sup>16</sup> Suppose that there are simply two sectors, an exporting Booming Sector distinct from the rest of the economy (so that there is no potential resource movement effect), and a Domestic Output Sector which produces for the home market and within which there are no relative price changes. We can imagine the Non-Tradeable Sector to have expanded at the expense of the Lagging Sector until the latter has disappeared. The nominal price of domestic output is fixed, perhaps as a result of a fixed nominal wage combined with a fixed percentage profit margin and constant returns. There is initially unemployment and a fixed nominal exchange rate. If the real wage were flexible downwards, full employment combined with continuous balance of payments equilibrium could be obtained with nominal demand expansion combined with appropriate devaluation (or a floating exchange rate that would depreciate as a result of the expansion). But real wage resistance prevents this: the expectation that nominal wages would increase to compensate for the devaluation-induced rise in import prices in domestic-

<sup>15</sup> Nankani (1979) has noted this problem for a number of developing mineral-exporting countries: high real wages in their minerals sectors tend to spread to the rest of the economy (in spite of some wage dualism and low employment levels in minerals) and then generate unemployment.

<sup>16</sup> Various papers by Thirlwall contain or imply such a model. See, for example, Thirlwall (1980). This approach is applied to the Australian case in Shann (1982), where further references are given. I am indebted to this paper for making me aware of the relevance of this approach.

currency terms rules out an exchange rate change and lies behind a fixed exchange rate policy.

Demand expansion to increase employment is thus prevented by adverse balance of payments effects—i.e. by the “foreign exchange constraint”. Additional export income resulting from the boom, if spent on non-tradeables, will then expand this constraint and allow extra demand expansion.

While this sort of model is usually presented in “foreign exchange constraint” terms (implying that the problem could be solved with import controls) the key assumption, often only implicit, is real wage resistance. Furthermore, because of its assumption of rigid prices it is sometimes thought of as being “Keynesian”, though real wage resistance is, of course, a thoroughly non-Keynesian assumption.

## 9. Keynesian unemployment

The experiences of Britain in 1980 and 1981 generated interest in a case where a money supply rigidity (because of the pursuit of money growth targets) is associated with a boom or the expectation of it. Combining this with *nominal* wage rigidity downwards (and thus having two nominal rigidities) it is then possible to get Keynesian unemployment through a number of channels. In all cases the unemployment could be remedied by increasing the money supply. The boom can thus give rise to short-term unemployment caused essentially by a failure of monetary policy.<sup>17</sup>

## 10. Dynamics: spending, saving and investment

So far the analysis has been static. The rise in the value of output and hence income of the Booming Sector, the spending effect, the resource movement effect, and hence the real appreciation, have all happened at the same time. The balance of payments on current account (strictly the balance of trade) has stayed constant, at zero.<sup>18</sup>

In fact, output, expenditure, resource movements, the exchange rate, and the current account may follow particular time paths, the paths differing with the source of the boom and the expectations about it. Before going into details, a general picture can be given.

*Changes in spending and the current account.* The spending effect may anticipate, or alternatively follow with a lag, the rise in the value of output of B. This spending effect will bring about real appreciation and Dutch Disease effects as indicated in our static analysis. The resource movement

<sup>17</sup> See Corden (1981a), Eastwood and Venables (1982), Neary and van Wijnbergen (1984) and Neary (1984), all concerned with employment effects when the money supply is fixed. Short-run monetary aspects (“transitional dynamics”) of a boom are also analysed in Turnovsky (1983).

<sup>18</sup> Of course this was not so during the process of capital inflow, but our analysis in Section 4 was, in fact, timeless, the outcome, rather than the process of capital inflow being described.

effect could also anticipate, but is more likely to follow with a lag, the initial rise in output; it will, of course, raise output further, and will bring about further real appreciation and Dutch Disease consequences. The current account outcome is the net result of the spending and the value of output changes.

Changes in the current account need not coincide with changes in the real exchange rate. For example, in period 1 (the announcement period) spending may rise to a new, higher, level owing to the expectation of a boom, in period 2 (the boom period) output (or its value in foreign currency terms) may rise, surpassing the new spending level, and in period 3 output may fall again—the boom having been temporary—while spending may continue at its higher level. In periods 1 and 3 there will thus be a current account deficit—with decumulation of financial assets—and in period 2 a surplus, with financial asset accumulation. There will be a once-for-all real appreciation in period 1 owing to the spending effect, a further real appreciation in period 2, and a depreciation in period 3, the last two changes attributable to the resource movement effect.

Spending reflects both consumption spending and domestic investment. For the moment let us assume that domestic investment does *not* change, and just concentrate on changes in consumption and in the value of output, assuming rational behaviour by public and private decision-makers.

The outline just presented applies to a temporary oil price rise in the case of an oil exporting country (“oil” representing any Booming Sector product that is exported). In period 1 (the announcement period) the price rise is expected, so consumption rises, in period 2 (the boom period) the price actually rises, and in period 3 the price falls back again. It will be rational to run current account deficits (relative to what would have happened otherwise) in periods 1 and 3, and a surplus in period 2. The precise pattern of consumption over time will depend on the world rate of interest and inter-temporal time-preferences along Fisherian lines. The rise in spending may take place with a lag, and may vary with expectations about the future price pattern. Mistakes can certainly be made, and one can also imagine over-shooting tendencies while the learning process is still going on.<sup>19</sup>

If the price rise is expected to be permanent there is no case for running so large a surplus in period 2, nor a deficit in period 3; rather consumption should rise more initially, with a greater deficit in period 1, and there should be surpluses to offset this in later periods. A once-for-all technical improvement that is expected to retain its value permanently, or the discovery of a

<sup>19</sup> The 1981–82 experiences of Mexico and other countries suggest that mistakes can certainly be made. Booms were being anticipated by extra public spending and by wage increases obtained by unions. Logically one would need to distinguish spending increases motivated rationally by price and output increases that could be reasonably expected at the time, though the expectations actually turned out to be wrong; and those increases that must be regarded as irrational from a national point of view (though not necessarily from the short-term points of view of particular political or trade union decision makers) in the light of information and reasonable expectations held at the time.

new resource that is believed to be inexhaustible, will have the same sort of effect as an oil price rise expected to be permanent.<sup>20</sup>

*Exhaustible resource.* Consider now the discovery of an exhaustible resource. A rational response to the discovery in the announcement period would be a rise in consumption, even before any of the resource is extracted. But there is likely to be uncertainty about the size of the resource, not to speak of the price at which it can be sold. This uncertainty will be reduced or will disappear once actual output takes place; hence risk-averse behaviour is likely to involve some positive response of consumption to actual output, so that the whole of the rise in spending may not take place in the announcement period.

Optimal output decisions will depend on the considerations familiar in the optimal depletion literature.<sup>21</sup> Essentially it is a matter of optimally converting assets under the ground or the sea into foreign financial assets (or reduced foreign liabilities), achieving at any point in time an optimal portfolio taking into account current and expected prices of the two assets. At the same time the rise in consumption will be financed by reducing foreign assets. The resource movement effect will, again, tend to depend on the actual rise in output (i.e. exhaustion of the resource).

*Domestic investment: productivity effect and portfolio effect.* Finally, let us allow for changes in domestic investment. There are two distinct effects to be considered here, the productivity effect and the portfolio effect.

In the Core Model rents of specific capital have risen in the Booming Sector, fallen in the Lagging Sector, and may have risen in the Non-Tradeables Sector. The expected productivity of new investment in the three sectors will change commensurately, so that appropriate investment responses result. With a world capital market, freedom of capital movements and a given world rate of interest, such investment or disinvestment will manifest itself in the current account.

Let us assume now that the favourable Booming Sector effects on total investment dominate. There will thus be a rise in investment in the announcement period, hence bringing about a greater rise in output in later periods. In fact, no rise in physical output is likely to be possible as a result of technical progress, and no extraction of resources, without such prior investment. In the case of an oil price rise the boom need not await prior investment; in that case the extent of investment will depend, among other things, on how temporary the price rise is expected to be. This increase in

<sup>20</sup> Svensson (1982) analyses the effects of an oil price rise (both temporary and permanent) on the evolution over time of the trade balance of a small oil-importing country (with no domestic production of oil). This case has obvious parallels with the trade balance effects on an exporting country.

<sup>21</sup> See Dasgupta and Heal (1979) and literature cited there. Dasgupta, Eastwood and Heal (1978) specifically consider the optimal depletion issue in the open economy. They find that if the rate of return on foreign assets is exogenous (essentially a small country assumption, since the country faces a given asset price) the depletion rate should be independent both of the discount rate and of the elasticity of marginal utility.



domestic investment thus adds to the spending effect, and hence the real appreciation and the current account deficit, in period 1.<sup>22</sup>

Next we come to the portfolio effect. So far we have assumed that savings are invested on a world capital market where foreign and domestic financial assets are perfect substitutes and their prices are given to the small country. Extra savings are invested in foreign financial assets, while borrowing to finance investment comes from this same capital market, the two types of transactions being quite independent. The net result is reflected in the current account. We now allow realistically for the case where foreign and domestic assets are not perfect substitutes and the small country concerned wishes to maintain a balanced portfolio. For given productivity of domestic investment and a given world rate of interest it will wish to invest some of its increased savings abroad and some at home. A complication is that accumulations and decumulations of foreign financial assets can take place quickly, while domestic investment in real assets requires lead time and cannot be varied so readily.

This consideration suggests that in period 2, when foreign financial assets are being accumulated, there will also be extra domestic investment to maintain a portfolio balance; the spending effect will then be higher and the current account surplus less. In period 3 there would be domestic disinvestment, along with decumulation of foreign assets (relative to the non-boom path). In parallel, one might expect that there would also be domestic disinvestment in the announcement period 1, so reducing the current account deficit. But the "lead-time" consideration suggests otherwise: the expectation of the boom may lead to such portfolio-balancing investment beginning already in period 1. All this is very relevant for public investment in periods 1 and 2.<sup>23</sup>

## 11. Protection of the Lagging Sector

It is natural that government will be urged to protect the Lagging Sector, or parts of it, from the adverse effects of a boom. We now assume that resource depletion and spending decisions have been made, taking into account optimal saving and investment considerations as perceived by the private sector and policy makers, and that these decisions have not been influenced by considering the adverse effects on the Lagging Sector. The

<sup>22</sup> The distinction between the investment boom and the later export boom has been important in Australian discussion. See Corden (1982). In addition, an expected export boom, and hence an expected appreciation, is likely to generate speculative capital inflows. This effect was probably operative in both Britain and Australia. It has not been incorporated in the analysis in this paper, but has been noted in the various analyses of the British case, and is analysed in detail in Turnovsky (1983).

<sup>23</sup> Gelb (1981) deals with the adjustment and policy choices of the capital-importing oil exporters, including Indonesia, Nigeria and Venezuela. It is noted that, in response to the two oil price rises, there were big increases in the public sector and in public investment, leading to large rises in the demand for non-tradeables (construction and services). In retrospect, at least, there was over-shooting in public spending, leading eventually to budget deficits.

question is whether policies should be further adjusted to reduce the adverse impact on the Lagging Sector, i.e. actually to *protect* it.

Three arguments for protection appear relevant. (1) The “conservative social welfare function” argument is that real income or rent losses to particular factors resulting from an unexpected shock should be avoided. The case against is that such a redistribution objective is better pursued directly, by taxing the Booming Sector factor and using the revenue to subsidise losing factors of production, and that, in any case, conservatism is a doubtful basis for a social welfare function.<sup>24</sup> (2) The employment argument can be made when there is real wage resistance in the Lagging Sector. The case against is that it would be better to subsidise employment directly, and that short-term unemployment may be needed as a signal to induce a desirable resource reallocation. (3) A version of the infant industry argument might apply when the boom is expected to be temporary and the decline and later recovery of the Lagging Sector are thought to lead to non-optimal decumulation of physical and human capital during the boom period. The qualifications to this argument are the same as those that apply to the infant industry argument in general: the validity of the argument requires externalities, lack of information or foresight on the part of factors in the Lagging Sector, or imperfection of the capital market.<sup>25</sup>

If it is nevertheless desired to protect the Lagging Sector to some extent, the first-best method would be to subsidise output of the sector directly, perhaps financing the subsidy from the taxes levied on the specific factor in the Booming Sector. Two popular protectionist approaches are thus plainly inferior.

The first is *exchange rate protection*, namely a policy of avoiding real appreciation, and hence protecting tradeables at the expense of non-tradeables.<sup>26</sup> It could be brought about by exchange rate intervention supported by sterilisation, whether through open market operations or a budget surplus, either of which could bring about the required reduction in spending. The objections, compared to direct subsidisation of the Lagging Sector, are that it would lead to excessive accumulation of foreign assets and that it would protect not only the Lagging Sector but also the Booming Sector.

The other widely advocated policy is to increase *ordinary protection* by raising tariffs or tightening import quotas. The avoidance of a loss to import-competing industries will then be at the expense of Lagging Sector exportables as well as of the Booming Sector.

The Lagging Sector exportables will then be hit twice; first by the real appreciation (which will now be greater than before) and then by the direct

<sup>24</sup> See Corden (1974), pp. 107–112.

<sup>25</sup> See van Wijnbergen (1982b, 1984) where this type of argument for subsidisation with reference to oil exporting countries is advanced and the optimal allocation of capital over time between the traded and the non-traded sectors is worked out. On qualifications to the infant industry argument, see Corden (1974), Ch. 9.

<sup>26</sup> Corden (1981b).

resource loss to importables. The adverse effect on importables will have been moderated only by intensifying the adverse effect on Lagging Sector exportables. If the main concern is with conserving real incomes or rents then it is clearly not a logical policy. The central problem is the adverse effect on the Lagging Sector as a whole, and it does not seem justified to shift the burden wholly on to one part of it in order to shelter the other part. From a Pareto-efficiency point of view, ordinary protection imposes, of course, the usual cost of protection, unless any of the standard second-best arguments for protection are applicable.<sup>27</sup>

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## APPENDIX

### Trade reversal and Britain's North Sea Oil

If the preceding analysis is applied to an oil boom it could be interpreted as referring either to the effect of an oil discovery at a given world price of oil, to a rise in the price of oil when oil is an exportable, or to a combination of the two. But when oil is and stays an importable an actual or expected rise in the price of oil would have a negative wealth and hence spending effect. Let us now consider the more complex and much-discussed British case: first there was the discovery of oil reserves implying various potential levels of profitable output at various price levels for a limited period. Then there were the oil price rises. The combined effect was to turn oil from an importable into an exportable.<sup>28</sup>

Let  $P_0$  be the original oil price relative to the general price-level—i.e., the level ruling before 1973—while  $P_1$  is the higher price now, assumed to stay at the new level. While there was actually a limited period when oil had been discovered and yet the price had not risen, to simplify here we suppose that there are three periods, namely period I before the discovery and the price rise, period II beginning with the discovery and the price rise and ending when the oil runs out, and the oil-less period III.<sup>29</sup>

<sup>27</sup> The issue of whether a boom justified more or less protection has been much discussed in Australia. See Gregory (1976) and Corden (1982).

Protection is also a well-known "Cambridge-U.K." prescription. Protectionist arguments are advanced in various contributions in Barker and Brailovsky (1981).

<sup>28</sup> I follow here the main argument in Bank of England (1982) and Byatt et al. (1982). See also Flemming (1982). These papers—as well as Forsyth and Kay (1981)—also discuss the indirect effects on the British real exchange rate of a redistribution of world income away from countries that compete with the U.K. as exporters. See also Bond and Krobil (1982) on the U.K. case.

The central argument that the simple Dutch Disease model does *not* apply to the U.K. seems quite convincing, in spite of Forsyth and Kay (1980) and others, including the present writer in earlier incarnations. One should also note Niehans (1981) who seems to have shown that the severe U.K. real appreciations of 1979 and 1980 can be explained mainly by a monetary squeeze, not Dutch Disease effects.

It is also possible that some part of the real appreciation was explained by over-optimistic expectations about oil exports. See footnote 31.

<sup>29</sup> At the beginning of period II expectations change both with respect to potential output at various prices and with respect to future prices. It is not just the actual current price rise that is relevant, but the expectations regarding all prices for the future.

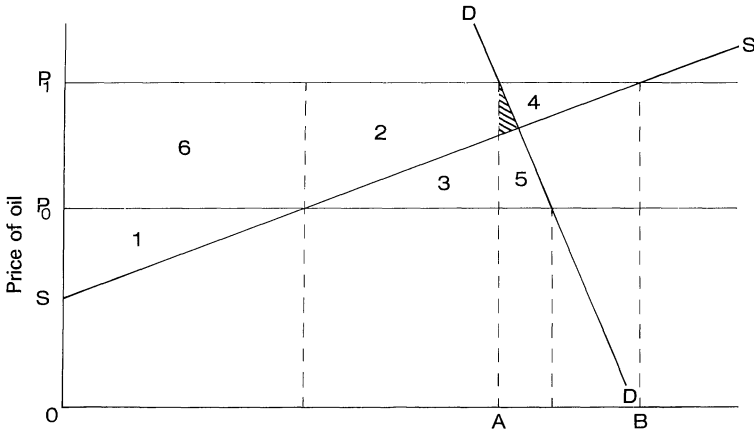


FIG. 2. Quantity of oil demanded and supplied by the U.K. Note that the shaded triangle is included both in area 4 and in area 5.

Figure 2 represents period II for Britain. The oil demand curve  $DD$  is drawn for the aggregate expenditure level appropriate for that period. The supply curve indicates the marginal cost of North Sea oil at various levels of output. Before the oil discovery this curve did not exist (or was infinitely high). While in period I oil was wholly imported, in period II there are exports of  $AB$ . On the oil which replaces imports there is a gain of area 1, less area 3, while there is a loss of area 5 owing to reduced consumption of oil (including the higher costs of alternative energy sources). On exports the gain is area 4. Thus there could be a gain or loss compared to period I. The usual estimates now being made suggest that there would be a clear loss, essentially because North Sea oil is substantially dearer to produce than the pre-1973 imports it replaced (i.e., 3 is greater than 1 and area 1 may, in fact, be non-existent), while exports are not expected to be high.

It follows that the net result has been to reduce U.K. real income in period II relative to period I. This is so even though most of the surplus (areas  $1+6+2+4$ ) will end up as tax revenue. In period III, of course, real income will fall further, namely by the whole of this surplus. With wealth (i.e., expected future income) suddenly reduced at the end of period I, spending should fall to a lower level. Spending would be below income in period II and above it in period III if the aim is to even out the path of spending (though it might stay above it transitionally at the beginning of period II). Hence a current account surplus should be expected in period II and a deficit in period III. Some of the savings of period II would go to finance domestic investment so that the spending level would not fall as much as would be the case if all savings were in foreign financial assets.

The surprising result has thus emerged that equilibrium in Britain required a fall in spending and hence a *real depreciation*, implying *pro-industrialisation* in terms of our simple model. There is no Dutch Disease problem for Britain! It should be added that the resource movement effect can probably be ignored in the case of oil, since the use by the oil industry of domestic inputs, including labour, would be low in relation to their use by the rest of the economy. Directly imported inputs—including capital—do not, of course, have any resource movement effect. On the other hand, there is a resource movement effect through the expansion of substitutes.

Can one take an alternative view? One approach is to suppose that the economy has adjusted to the oil price rise (or the expectation of a price rise) in period I, this adjustment presumably including a fall in spending and a real depreciation; and then the effects of the emergence of North Sea oil at the beginning of period II are analysed. This second stage is a normal "boom" situation, leading to higher spending, real appreciation, and the Dutch Disease, always

compared to period I.<sup>30</sup> The more period III (when the boom is at an end) is discounted, the greater the increase in spending and hence the appreciation in period II will be. The objection to this approach in the case of Britain is that the expectation of the price rise did not clearly come before the oil discoveries.

Another approach is based on the expectation that Britain will become a substantial net exporter so that, in due course, period II will yield an income gain relative to period I. Provided period III is sufficiently discounted the combined effects of the price rise and development of North Sea oil could then lead to a rise in spending in period II and hence to real appreciation and the Dutch disease.<sup>31</sup>

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<sup>30</sup> This was the approach in Forsyth and Kay (1980) and also, explicitly, in Corden (1981a).

<sup>31</sup> When I discussed the U.K. North Sea oil issue in Corden (1981b), a paper first written in 1978, I took for granted that the U.K. would become a large exporter, so that Dutch Disease problems should be expected. The same view lay behind the approach in Corden (1981a). These papers were written under the influence of optimistic assessments of North Sea oil prospects current in 1978 and 1979. Of course, the widely shared optimism at the time may help to explain the actual sterling real appreciation, which turned out to be excessive in retrospect. I should have adhered to Corden and Oppenheimer (1976, pp. 36–8), written in 1974, where the key point that Britain would not necessarily be better off was clearly put.

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