

## **THE NARROW MOVING BAND, THE DUTCH DISEASE, AND THE COMPETITIVE CONSEQUENCES OF MRS. THATCHER**

### **Notes on Trade in the Presence of Dynamic Scale Economies**

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This paper presents a model of trade in which comparative advantage, instead of being determined by underlying attributes of countries, evolves over time through learning-by-doing. In this model, arbitrary patterns of specialization, once established, tend to become entrenched over time. The model sheds light on three widely held views that do not make sense in more conventional models. First is the view that temporary protection of selected sectors can permanently alter the pattern of comparative advantage in the protecting country's favor. Second is the view that seemingly favorable developments, such as the discovery of exportable natural resources, may lead to a permanent loss of other sectors and reduce welfare in the long run. Third is the possibility that a temporary overvaluation of a currency due to tight money can lead to a permanent loss of competitiveness in some sectors.

### **1. Introduction**

When an economist tries to talk with businessmen about international trade, he often senses a frustrating failure to make a connection. Partly this is a matter of differences in vocabulary and style, but it also reflects a more fundamental difference in outlook. Economists, schooled in general equilibrium analysis, have what we might call a 'homeostatic' view of international trade. By this I mean that they believe that there is a natural pattern of specialization and trade, determined by underlying characteristics of countries, and that automatic forces tend to restore this natural pattern. Trade policy, exchange rate movements, or other shocks may temporarily distort trade, but when these disturbing factors are removed the natural pattern will reassert itself.

Businessmen, by contrast, are schooled in the competition of individual firms, where equilibrating forces are much less apparent. A wrong decision or a piece of bad luck may result in a permanent loss of market share. Indeed, if large market share itself conveys advantages, the effects of temporary disturbances will grow rather than fade away over time. When businessmen look at international trade, they naturally tend to see competition among

nations as competition among firms writ large. As a result, they are far more alarmist in their outlook than economists. They fear that foreign tariffs and subsidies or an overvalued exchange rate will lead to permanent loss of markets, and may indeed propagate into a general loss of competitiveness.

Now it is clear that in this case economists know something that businessmen do not – namely, that there are economy-wide resource constraints, and that as a result factor prices are endogenous. Japan cannot have a competitive advantage over the U.S. in everything, because if it did, there would be an excess demand for Japanese labor. Japanese relative wages would rise (perhaps via an exchange rate adjustment), and this would restore U.S. competitiveness in some sectors. It is precisely the recognition of resource constraints which leads economists to emphasize *comparative* rather than *absolute* advantage as the basis for trade.

Yet while businessmen are surely wrong in treating competition among nations as an enlarged version of competition among firms, economists may not have captured the whole of the story either. The homeostatic view of international competition rests ultimately on models which rule out by assumption the kinds of dynamics of competition which are the main concern of corporate strategy. Perhaps if these dynamics were allowed to play a role, something of the businessman's view of competition would turn out to make sense after all. Obviously nations are not firms – they cannot be driven altogether out of business. But perhaps a nation can be driven out of *some* businesses, so that in fact temporary shocks *can* have permanent effects on trade.

The purpose of this paper is to present a simple model of international specialization which incorporates at the national level one of the key elements of strategic analysis at the level of the firm. This is the role of the learning curve. That is, there are dynamic economies of scale in which cumulative past output determines current productivity.<sup>1</sup> In order to bring out the unconventional possibilities clearly, the model is both simplistic and extreme. It can, however, be used to illustrate some of the possibilities missed by more conventional approaches. In particular, I use the model to show how one might justify heterodox analyses of three current policy issues: the effects of Japanese industrial targeting, the consequences of oil discoveries for industrial competitiveness, and the long run penalties of an overvalued currency.

The paper is in seven sections. The second section sets out the model's assumptions. The third shows how comparative advantage and the pattern of specialization are determined. The next three sections then provide illustra-

<sup>1</sup>This is not the first such analysis. Bardhan (1970) analyzed trade and industrial policy in the presence of learning effects. His model was, however, oriented more towards development policy in small LDCs than towards the issues addressed in this paper.

tions of applications of the analysis. A final section draws conclusions and presents suggestions for further research.

## 2. A model of dynamic comparative advantage

Consider a world consisting of two countries, Home and Foreign. We will suppose that each of these countries has only one factor of production, labor. Labor can be used to produce any of  $n$  traded goods, together with a non-traded good.

At any point in time, we assume that these are constant returns to the production of each traded good,

$$X_i(t) = A_i(t)L_i(t), \quad x_i(t) = a_i(t)l_i(t), \quad i = 1, \dots, n, \quad (1)$$

where  $X_i$  is output of traded good  $i$  in the home country,  $L_i$  is labor devoted to that good's production, and lower case letters indicate corresponding quantities in the foreign country.

While there are constant returns at any point in time, however, we assume that there are dynamic increasing returns, taking the form of an industry learning curve. In each industry in each country, the productivity of resources depends on an index of cumulative experience,

$$A_i(t) = K_i(t)^\varepsilon, \quad a_i(t) = k_i(t)^\varepsilon, \quad 0 < \varepsilon < 1. \quad (2)$$

I will assume in this paper that the learning curve is entirely an industry phenomenon, completely external to firms, so that perfect competition continues to prevail. This is obviously not an ultimately satisfactory formulation, and some discussion of the difference it makes will be given in the concluding section of the paper.

Discussion of external economies in trade often assumes that these economies do not spill across national boundaries. This is, however, not realistic – surely firms can learn from the experience of firms in other countries, though perhaps not as well as they can from other domestic firms. Further, it will be useful as a technical matter to allow for international diffusion of knowledge in our later analysis. Thus I will suppose that both domestic and foreign production enters into the index of experience,

$$K_i(t) = \int_{-\infty}^t [X_i(z) + \delta x_i(z)] dz, \quad k_i(t) = \int_{-\infty}^t [\delta X_i(z) + x_i(z)] dz, \quad 0 \leq \delta \leq 1, \quad (3)$$

where  $\delta$  can be interpreted as a measure of the internationalization of

learning. If  $\delta=0$ , we have the often assumed case of purely national learning effects; if  $\delta=1$ , the learning curve should be defined in terms of aggregate world variables. In what follows I will assume that  $\delta$  in fact lies somewhere between these extremes.

To complete the model, we need to specify how wages are determined, how expenditure is determined, and the composition of demand. Later in this paper we will want to explore the consequences of sticky wages and unemployment. For now, however, we will assume full employment. Each country has an exogenously given labor force at any point in time,  $L(t)$  and  $l(t)$ , respectively. These labor forces will be assumed both to grow exponentially at the rate  $g$ .<sup>2</sup>

Expenditure will (until section 6) be assumed equal to income. A constant share  $1-s$  of income will be assumed spent on non-traded goods. Each traded good will receive a constant and equal share  $s/n$  of expenditure.

### 3. Dynamics of specialization

To analyze international specialization in this model, I proceed as follows. First I analyze the dynamics of relative productivity change, taking the allocation of resources in each country as given. Then I analyze the allocation of resources, taking relative productivities as given. Finally, as a last stage, I show how these interact.

Let us begin, then, with the determination of relative productivities over time. From (2) we know that relative productivity is simply a function of the relative experience indexes  $K$  and  $k$ ,

$$A_i(t)/a_i(t) = [K_i(t)/k_i(t)]^\epsilon. \quad (4)$$

Thus we must focus on the dynamics of  $K$  and  $k$ . From (3), we have

$$dK_i(t)/dt = X_i(t) + \delta x_i(t), \quad dk_i(t)/dt = x_i(t) + \delta X_i(t). \quad (5)$$

The relative change in the experience indices can therefore be written as

$$\frac{dK_i(t)/dt}{K_i(t)} - \frac{dk_i(t)/dt}{k_i(t)} = \frac{X_i(t) + \delta x_i(t)}{K_i(t)} - \frac{x_i(t) + \delta X_i(t)}{k_i(t)}. \quad (6)$$

Now suppose that the relative labor allocation  $L_i(t)/l_i(t)$  is held fixed. Then  $K_i(t)/k_i(t)$  will tend to converge on a steady state. Setting the left hand side of

<sup>2</sup>A growing population, or technological progress independent of output, is necessary to make the steady state analysis of this paper possible.

(6) to zero and substituting from (1) and (2), we have

$$\left(\frac{K_i}{k_i}\right)^{\epsilon-1} = \frac{l_i}{L_i} \left[ \frac{1-\delta k_i/K_i}{1-\delta K_i/k_i} \right]. \tag{7}$$

To interpret (7), we can use fig. 1. The curve LHS represents the left hand side of (7), RHS the right hand side. Clearly, the steady state value of  $K_i/k_i$  always lies between  $\delta$  and  $1/\delta$  – which is not surprising given our specification of international spillovers. The steady state value does, however, depend on the allocation of resources. An increase in  $L_i/l_i$  is illustrated by the dotted line in the figure; it leads to a higher steady state relative  $K_i$ . Since the experience indices in turn determine relative productivity, this means that we can write the steady state relative productivity  $A_i/a_i$  as a function of the relative sizes of sectoral labor forces,

$$A_i/a_i = \alpha(L_i/l_i), \tag{8}$$

where the function  $\alpha(\cdot)$  is implicitly defined by (7). From the analysis above it is clear that  $\alpha(\cdot)$  is increasing in  $L_i/l_i$ , that  $\alpha(0) = \delta$ , and that  $\alpha(\infty) = 1/\delta$ .

Now let us turn to the determination of the allocation of labor. At any point in time this model will simply be Ricardian in character. We can rank tradeable industries by their relative productivities  $A_i(t)/a_i(t)$ . What we then

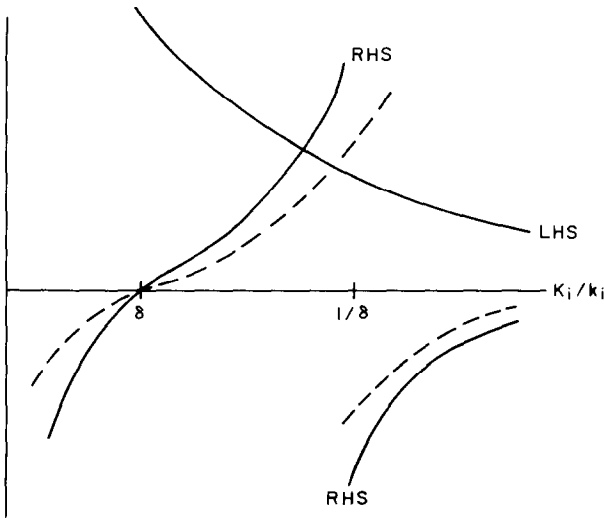


Fig. 1. Long run determination of relative productivity.

require is that for the marginal industry

$$A_i(t)/a_i(t) = W(t)/w(t), \tag{9}$$

where  $W(t)$  is the wage rate at time  $t$ . Let  $\sigma(t)$  be the share of the world tradeable sector located in the home country, i.e., the number of tradeable sectors in which the home country has a comparative advantage relative to  $n$ , the total number of tradeable sectors. Then we can, as in fig. 2, show the equilibrium condition (9) as the downward sloping schedule  $AA$ .

The other equilibrium condition is, of course, balance of payments equilibrium. In a way familiar from Dornbusch, Fischer and Samuelson (1977) we may write this condition as

$$\frac{W(t)}{w(t)} = \frac{\sigma}{1 - \sigma} \frac{\bar{L}(t)}{\bar{L}(t)}, \tag{10}$$

which yields the upward-sloping schedule  $BB$ .

We are now in a position to describe the dynamics of specialization over time. In the absence of any ‘extrinsic’ dynamics – that is, shocks arising from outside sources – these are very simple, almost embarrassingly so. Basically, once a pattern of specialization is established, it remains unchanged, with changes in relative productivity acting to further lock the pattern in. To see this, suppose that at some point the situation looks like that shown in fig. 2.

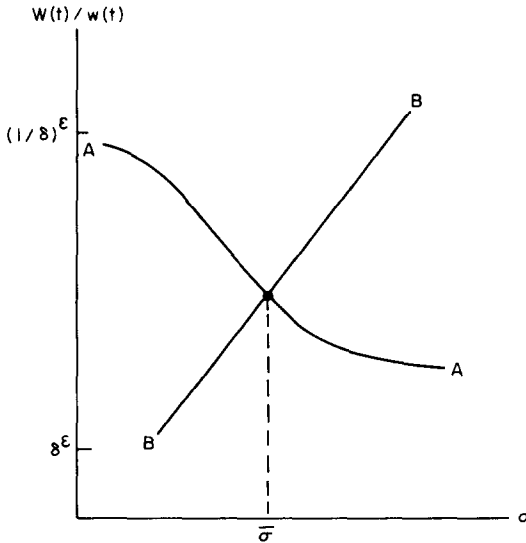


Fig. 2. Short run specialization.

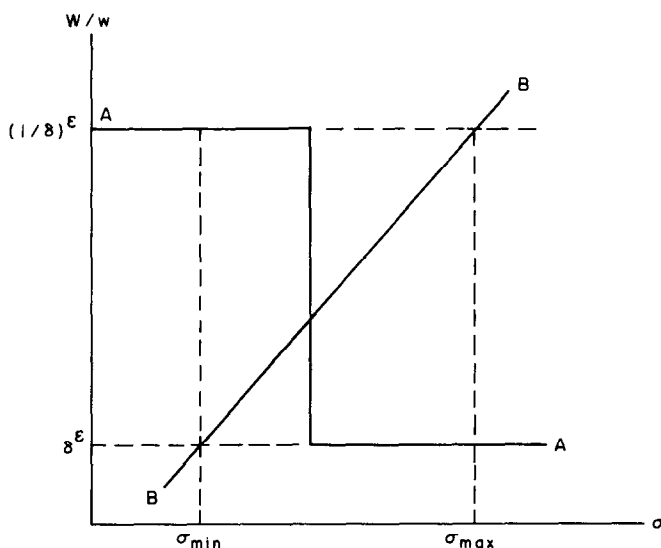


Fig. 3. Long run specialization.

Some goods are now produced in the home country, some in the foreign country. For those in the first group, we have  $L_i(t) = sL(t)/\sigma(t)n$ ,  $l_i(t) = 0$ . For those in the second group,  $L_i(t) = 0$ ,  $l_i(t) = sl(t)/(1 - \sigma)n$ . It is immediately apparent that for the first group, productivity will rise faster in the home country, while for the second group it will rise faster in the foreign country. This means that the part of  $AA$  to the left of  $\bar{\sigma}$  will rise, that part to the right of  $\bar{\sigma}$  will fall. In the long run  $AA$  will come to have the 'step' shape illustrated in fig. 3.

Like a river which digs its own bed deeper, a pattern of specialization, once established, will induce relative productivity changes which strengthen the forces preserving that pattern.

Clearly, history matters here even for the long run. In particular, whatever market share  $\bar{\sigma}$  the home country starts with will be preserved over time, and so therefore will be the relative wage rates associated with that share. Thus there is a whole range of possible steady state market shares. The boundaries of that range are shown as  $\sigma_{\min}$  and  $\sigma_{\max}$  in fig. 3. These are defined by the relative wage rates at which a country will be competitive in a sector even if it has no production experience of its own and must rely entirely on international diffusion of knowledge. Obviously the range of possible outcomes is narrower, the larger is  $\delta$  – that is, the more international are the learning effects.

We have now laid out a simple model where comparative advantage is 'created' over time by the dynamics of learning, rather than arising from

underlying national characteristics. In the remainder of this paper I will perform a series of thought experiments on this model. What we will see is that a model of this kind can be used to formalize a variety of heterodox arguments about international competition.

#### 4. The narrow moving band

The economic success of Japan has been attributed by many to the industrial policies of the Japanese government, and in particular to the use of infant industry protection as a way of gradually broadening the Japanese industrial base. In an effective diatribe, Givens (1982) has described the intervention of the Japanese government as a 'narrow moving band' which slices off one industry after another, protecting an industry until it is strong enough to eliminate its U.S. competitors, then moving on to the next target.

The economic reasoning underlying this view of Japanese policy is not completely clear, but our model seems to have the necessary features. It is certainly possible in this model – within limits – for temporary protection to permanently shift comparative advantage.

Suppose that there is some good  $i$  in which the foreign country originally has a comparative advantage. Then the labor allocation will be  $L_i=0$ ,  $l_i=s/\sigma n$ . Now suppose that the home country closes its market for good  $i$  to imports. The effect will be to turn  $i$  into a non-traded good, with each country satisfying its own demand,

$$L_i = sL/n, \quad l_i = sl/n.$$

Clearly, the effect of this market closure will be to accelerate the pace of productivity change in this sector in the home relative to the foreign country. If the protection is continued long enough, this change in relative productivity growth may be enough to give the home country a cost advantage in  $i$ . At this point the protection becomes irrelevant, and trade policy has achieved a permanent shift in comparative advantage. We can imagine a government protecting a series of sectors in succession, and thus steadily increasing its market share – a process illustrated in fig. 4.

There is, however, a limit to this process. As a country acquires more industries, its relative wage rate will rise. This means that the next sector will require higher relative productivity and thus a longer period of protection to become established. In the limit, protectionist policies can at most lead to a relative productivity advantage of  $\alpha(L/l)$  and thus cannot push the relative wage above  $W/w = \alpha(L/l)$ .

Without pursuing the story too much further, this analysis suggests that the use of temporary protection to engineer permanent shifts in comparative advantage is likely to work best when one is a country with a large labor



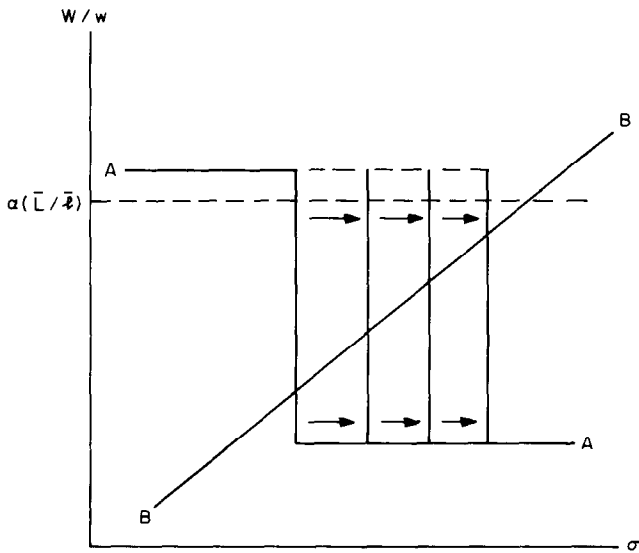


Fig. 4. The narrow moving band.

force but low wages. Small countries will find that the domestic market is not large enough for protection to yield much in the way of accelerated productivity growth; high-wage countries will find that the extra productivity is not enough to provide a cost advantage.

### 5. The Dutch disease

When a country discovers tradeable natural resources, such as oil, it normally experiences real appreciation of its exchange rate and thus a crowding out of its other tradeable sectors. This phenomenon first drew attention in the case of the Netherlands, where natural gas discoveries clearly hurt the competitiveness of Dutch manufacturing, but the experience is familiar from a number of examples.<sup>3</sup> The interesting question is why it should be regarded as a problem. In conventional trade models, countries should simply specialize in whatever is their comparative advantage. If an oil discovery shifts this comparative advantage, so be it. In practice, however, there is widespread concern that the contraction of a country's manufacturing sector which follows natural resource discoveries is a bad thing. The worry seems to be that when the natural resources run out, the lost manufacturing sectors will not come back.

<sup>3</sup>A number of papers have been written on the Dutch disease. See, in particular, Corden and Neary (1982) and Van Wijnbergen (1984).

Our model does not allow a role for natural resources directly. However, the discussion of the Dutch disease usually treats income earned in the natural resource sector much as if it were a pure transfer payment from abroad. So I will approximate the discussion by considering the implications of a transfer payment from the foreign to the home country.

We need first to rewrite the balance of payments equilibrium condition to take account of the transfer. Following Dornbusch, Fischer and Samuelson (1977) the condition may be written

$$\sigma(t)s[l - T] = (1 - \sigma(t))s\{[W(t)/w(t)]L + T\},$$

where  $T$  is the transfer, measured in foreign wage units. This implies the relative wage equation

$$\frac{W(t)}{w(t)} = \frac{s(t)}{1 - \sigma(t)} \frac{l}{L} + \frac{1 - s}{s} \frac{T}{L}. \quad (11)$$

This now defines the  $BB$  schedule. As long as  $s < 1$  – that is, as long as there are non-traded goods – a transfer to the home country will shift the schedule up.

The effects of this transfer depend both on its size and on its duration. Let us suppose that we are initially in or near a steady state in which each country has been specialized for a long period. Then the schedule  $AA$  will have the shape shown in fig. 5: a step function. The effect of a small transfer is illustrated by the upward shift of  $BB$  to  $B'B'$ ; this will raise the home country's wage but without altering the pattern of specialization. A larger transfer, however, will raise the schedule to  $B''B''$ : the rise in the recipient's relative wages will be enough to offset its productivity advantage, so that some sectors move abroad.

The longer run implications now depend on how long the transfer payment lasts. The shift of production from home to foreign will mean declining relative home productivity in those industries over time. Thus  $AA$  will develop a middle step, which will deepen over time. The possibilities are illustrated in fig. 6. There a large transfer is assumed to shift  $BB$  up to  $B'B'$ , resulting in a shift of some industries from the home to foreign country. If the transfer does not last too long, when it ends and  $BB$  returns to its previous position the old pattern of specialization and relative wages will reassert itself. If the transfer lasts longer, however, some of the industries will not come back when it ends. For a transfer of sufficiently long duration, all of the industries which move abroad in the short run will remain abroad even when the transfer ends. In either of the latter cases the home country's market share and relative wage will turn out to have been permanently reduced by its temporary good fortune.

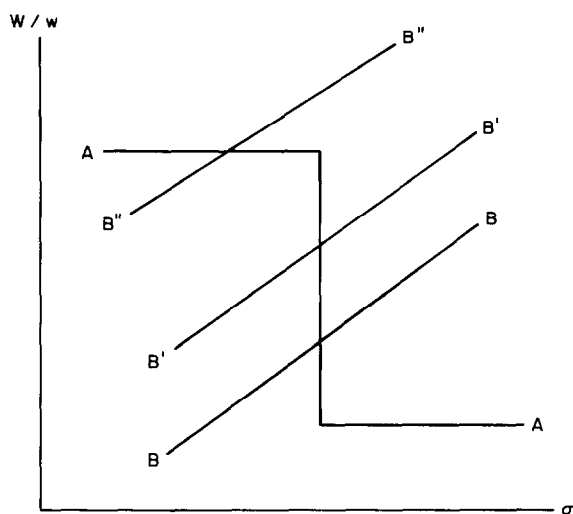


Fig. 5. Short run impacts of a transfer.

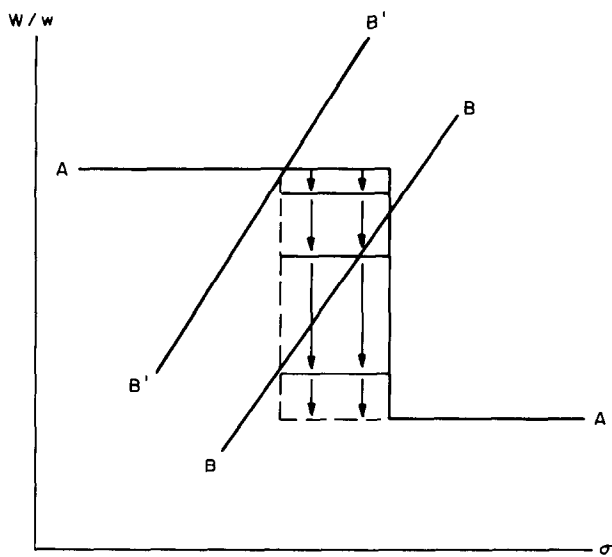


Fig. 6. Long run effects of a transfer.

## 6. The competitive consequences of Mrs. Thatcher

When countries pursue more contractionary monetary policies than their trading partners, one important channel through which the monetary contraction takes effect appears to be through real appreciation of the exchange rate and a resulting loss of competitiveness in traded goods production. This has been dramatically illustrated by the experience of the U.K. under Margaret Thatcher. When this happens, a major question becomes one of appropriate policy response. Given a consensus on the need for a contractionary monetary policy, say to control inflation, should the tradeable sector be required to bear as much of the burden as seems to be the case? Or should exchange market intervention, capital controls, or such trade policy instruments as tariffs and export subsidies be used to insulate the traded sectors from some of the consequences of a disinflationary transition?

The implication from conventional economic models is that traded sectors should contract along with the rest of the economy. If a certain amount of slack must be created in the economy, why should it occur only in non-traded sectors? Frankel (1983) has shown that in one simple model a floating exchange rate actually gets it exactly right, producing the optimal mix of output reduction between traded and non-traded sectors.

The counter-argument is not usually clearly expressed, but hinges on the belief that preserving competitiveness in tradeable sectors is somehow more important than maintaining output in non-traded sectors. While a model with dynamic economies of scale may not capture the whole of this belief, it does provide at least a possible way to make sense of a view that sees the international consequences of tight money as more serious and enduring than the purely domestic consequences.

To examine this issue, we need to modify our model to allow for monetary policy, and in particular for monetary policy with real effects. Once again Dornbusch, Fischer and Samuelson (1977) provide the simplest formulation. Let us assume, first, that nominal expenditure in each country is proportional to that country's money supply (both measured in units of local currency),

$$E(t) = M(t)V, \quad e(t) = m(t)v. \quad (12)$$

Let us define  $R(t)$  as the exchange rate, defined as the price of foreign currency in terms of home currency. Then the balance of payments equilibrium condition may be written as

$$\sigma(t)R(t)e(t) = [1 - \sigma(t)]E(t). \quad (13)$$

For changes in monetary policy to have a real effect, there must be

nominal rigidities somewhere. The simplest assumption is simply to let wage rates be exogenously fixed in local currency,

$$W(t) = \bar{W}, \quad w(t) = \bar{w}. \quad (14)$$

Combining (13) and (14), we can write an equation for relative wages measured in a common currency,

$$\frac{\bar{W}}{R(t)\bar{w}} = \frac{\sigma(t)}{1 - \sigma(t)} \frac{e(t)}{E(t)}. \quad (15)$$

This will define a *BB* schedule, just as in previous sections. The *AA* schedule continues to be defined as before.

Consider, now, the effects of a temporary reduction in the home money supply. A decline in *M* will reduce *E*, shifting *BB* up. As in the last section, if the shock is not large enough there will be no effect on the pattern of specialization. For a sufficiently large reduction in the money supply, however, market clearing will require that some industries move from the home to the foreign country.

At this point the analysis becomes entirely parallel to the analysis in the previous section. If the tight monetary policy is sustained for long enough, when it ends, specialization will remain in its new pattern instead of returning to its previous pattern. As a result the temporary rise in relative wages produced by the monetary contraction will be followed by a permanent reduction in relative wages.

This is a highly simplified model, but it does seem to capture the essentials of an argument that it is dangerous to let tight money be reflected in a very strong currency.

## 7. Conclusions and implications

The purpose of this paper has been to suggest that heterodox views about a variety of issues in international economics can be tied together by a single theme: the argument that dynamic economies of scale play a crucial role in international specialization. The three examples given might at first glance seem quite disparate – the use of infant industry protection to expand market share, the problems resulting from natural resource discoveries, and the long run effects of monetary policy. Yet we were able to show that alarmist concerns in each case can be given their most plausible grounding by a model in which dynamic economies of scale play a crucial role.

This is, however, an exploratory paper, and by no means intended to give blanket approval to any proposal for protection. There are at least three major reasons to be cautious about the results. Each of these reasons also provides a program for future research.

The first problem with the analysis is the assumption that dynamic scale economies are wholly external to firms. There are certainly both external and internal dynamic scale economies in reality. We have some rough idea how important the internal economies are (varying greatly across sectors); how important the external economies are is highly disputable. A major question is the extent to which the results would go through with imperfectly competitive firms and internal economies. We know from recent work that predatory trade and industrial policies, like those of section 4, are possible in a world of imperfectly competitive firms [see Brander and Spencer (1985) and Eaton and Grossman (1986)]. But it also seems to be the case that in some models the sort of multiple equilibria we have stressed here vanish when economies of scale are wholly internal to firms [see Helpman and Krugman (1985, chs. 3 and 4)]. The point is that a wage differential between countries with no fundamental differences in their technological capacity may offer a profit opportunity if the differential is not due to wholly external effects.

Second, the model here is clearly too stark in its assumption that dynamic scale economies are the only source of specialization and trade. Allowing for other forces – particularly differences in factor endowments – would surely soften the results. In particular, the complete arbitrariness of the pattern of specialization would be modified, particularly if factor prices shift over time. To return to the geological metaphor of section 3, a river may dig its own bed, reinforcing the results of past history; but eventually the larger forces of tectonics will bury that history. Britain's early pre-eminence in cotton spinning may have been self-reinforcing for the first half of the nineteenth century, but it was eventually overridden by the rising gap between wages in Britain and those in poorer countries.

Finally, while this paper has addressed policy issues, it has not contained any explicit welfare analysis. We have seen, for example, that in the model presented here a step-by-step policy of infant industry protection can succeed in making a country competitive in an enlarged range of industries. We have not, however, shown that this is necessarily a desirable policy. Formal welfare analysis is bound to be hard in the kind of world envisaged in this paper, a world of imperfect markets and dynamic effects over time. Nonetheless, we should be careful about making policy prescriptions without such analysis.

This paper, then, is an exploration rather than a definitive work. It raises more questions than it answers.

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