Chapter 6
Some Refinements

6.1 Introduction

Explicitly or implicitly, all theoretical models so far examined have a common set of assumptions: perfect competition, rigid supply of ubiquitous and internationally immobile productive factors, absence of intermediate goods, absence of transport costs, certainty, absence of illegal trade (such as smuggling), and so on.

These are undoubtedly assumptions which do not correspond to reality, so that it is legitimate to ask what happens when they are relaxed. In this chapter we shall be concerned with the introduction of those elements which can be dealt with from inside the traditional theory, of which they are in fact a refinement (the examination of the case of non-constant returns to scale is also a refinement, for which see Sect. 3.5). In Part III we shall examine the consequences of introducing non-competitive elements and other alternative explanations of international trade, which can be fitted only partially (if at all) into the framework of the traditional theory.

Although the various topics treated in this chapter may seem unrelated to one another, there is a common thread running through them, which is to show how far one can go while remaining in the context of the traditional account of trade in a competitive setting with constant returns to scale. This adaptability may be one of the reasons why the traditional theory is still alive and well after the advent of the new explanations of international trade (see Part III).

6.2 The Specific Factors Model

Factors of production have been so far assumed to be ubiquitous in all sectors. It is however possible that, alongside with these all-purpose factors, other factors exist which are *specific* to each sector. This means that they can only be used in the sector of pertinence and not elsewhere. For example, the (physical) capital

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required to produce computer microprocessors is quite different from that used to produce textiles, and they are not interchangeable in the short run. Long-run interchangeability is of course possible, as the (Marshallian) long run is, in fact, defined as a period of time sufficient to allow all factors to be in free intersectoral mobility. In the long run, capital can move from the textile to the microprocessor sector via depreciation without replacement in the former and new investment in the latter.

Thus the models so far examined can be considered as long-run models, while the specific factors model is more appropriate for the short run.

Although it maintains the basic two-sector setting, the specific factors model[1] is actually *a three-factor* model. In fact, besides the ubiquitous homogeneous factor (say, labour), two additional and different factors are needed to represent specificity. These may be, for example, capital and land, if we wish to consider manufacturing and agriculture as our two sectors. We remain in the traditional framework and assume that the specific factors are two different capital goods (say, K^A and K^B). Thus commodity A is produced using labour and K^A, while commodity B is produced using labour and K^B.

Apart from this, the model's setting is identical with the traditional one: perfect competition, production functions homogeneous of the first degree, etc.

As we have already seen in previous chapters, perfect competition implies the equilibrium condition *value of the marginal product of a factor = price of the factor*. Labour mobility implies that the wage rate is equalized between sectors. Hence we can write

$$\begin{aligned} p_A MPL_A &= p_L, \\ p_B MPL_B &= p_L, \end{aligned} \tag{6.1}$$

where MPL_A, MPL_B are the (physical) marginal products of labour in the two sectors, and p_L is the nominal wage rate. Letting $w = p_L/p_A$ denote the real wage rate in terms of commodity A, and $p = p_B/p_A$ the commodity price ratio, we have

$$\begin{aligned} MPL_A &= w, \\ pMPL_B &= w, \end{aligned} \tag{6.2}$$

hence

$$MPL_A = pMPL_B, \tag{6.3}$$

[1]This model was widely used prior to the predominance of Heckscher-Ohlin theory (see, for example, Haberler, 1936), which pushed it into the background: see Bhagwati et al (1998, Chap. 7). It was simultaneously and independently revived by Samuelson (1971), who called it the Ricardo-Viner model, and Jones (1971)

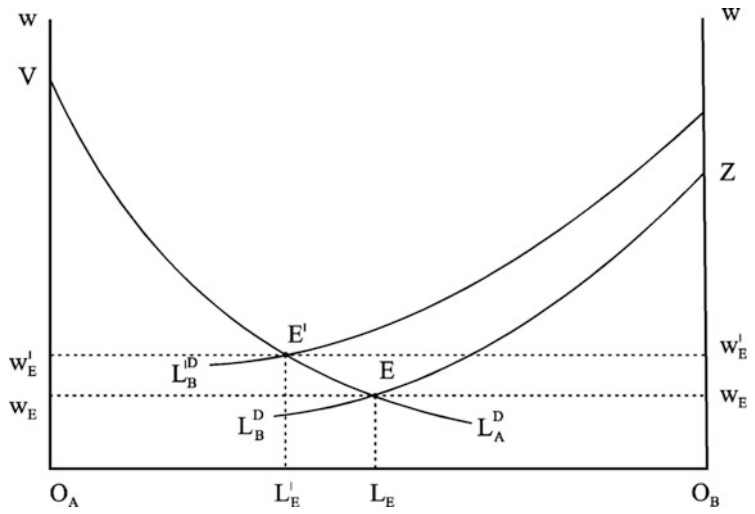

Fig. 6.1 The specific factors model

which determines the optimal allocation of labour between the two sectors and hence—since the two stocks of specific capital are also fully employed—the outputs of the two commodities for any given p.

Equation (6.3) can be given a simple graphic representation. In Fig. 6.1, the total amount of labour is measured by the segment $O_A O_B$. The quantity of labour used in sector A is measured from the origin O_A, while that used in sector B is measured from O_B. In the ordinate we show the real wage rate w. Curves L_A^D, L_B^D represent the demand-for-labour schedules in the two sectors, derived from Eqs. (6.2) for a given p. The equilibrium condition (6.3) obtains at point E. This determines the equilibrium real wage rate w_E and the optimal allocation of labour, which consists of $O_A L_E$ employed in sector A and $O_B L_E$ employed in sector B.

Since the area below a marginal product curve is total product, in sector A total labour income is the area $O_A w_E E L_E$, while total income of the specific capital K_A is the residual area $w_E V E$. Similarly in sector B labour receives $O_B w_E E L_E$ and the residual $w_E Z E$ goes to K^B.

Let us now determine the general equilibrium situation of the economy, which can be done through the general-equilibrium supply and demand curves (see Sect. 3.2). Let us note that the transformation curve cannot be derived from the two-dimensional box diagram as shown there, because the presence of three factors would require a three-dimensional diagram. It is however easy to show that the general-equilibrium supply curve is an increasing function of the appropriate relative price. Consider, for example, an increase in p. Given the second equation in (6.2), the L_B^D curve shifts upwards to position $L_B'^D$. This means that the amount of labour employed in sector B increases (from $O_B L_E$ to $O_B L'_E$), and hence the output of commodity B increases while that of commodity A decreases.

Let us assume that the general-equilibrium commodity price ratio is that corresponding to curve L_B^D, say p_1, and consider the introduction of international trade in a two-country framework. The condition for international trade to take place is that p_2, the closed-economy commodity price ratio in country 2, is different from p_1. Without loss of generality we can assume that $p_2 > p_1$, hence the post-trade price ratio p^* will be somewhere in between. Thus we can take E' as the post-trade equilibrium in country 1. In country 2 there will be a downward shift of the demand for labour in sector B, since $p^* < p_2$. This shows that there will be an increase in sector B's output in country 1 and in sector A's output in country 2.

What about the influence of trade on factor prices? A central result in traditional trade theory is factor price equalization (FPE, see Sect. 4.3). This is no longer true in the present context. Due to specific factors, marginal productivities are no longer equalized across countries. It remains true that, with constant returns to scale, marginal productivities only depend on the factor input ratio, but this ratio need no longer be equal across countries even with internationally identical production functions.

Take, for example, *MPL*. In the traditional $2 \times 2 \times 2$ model, MPL_{1A} depends on L_{1A}/K_{1A}, while MPL_{2A} depends on L_{2A}/K_{2A}. Since L_{1A}/K_{1A} and L_{2A}/K_{2A} turn out to be equal for the reasons explained in Chap. 4, it follows that $MPL_{1A} = MPL_{2A}$, etc.

In the present model, MPL_{1A} depends on $L_{1A}/\overline{K}_1^A$, while MPL_{2A} depends on $L_{2A}/\overline{K}_2^A$, where $\overline{K}_1^A, \overline{K}_2^A$ are the total amounts of the specific factor K^A existing in the two countries. There is no reason why these two ratios should be equalized.

That FPE does not hold should come as no surprise if we recall that even in the context of the traditional theory a model with more factors than commodities does not yield FPE (see Sect. 20.4).

The other basic results of the traditional $2 \times 2 \times 2$ model are the Rybczynski and Stolper-Samuelson theorems.

Let us begin with the Rybczynski theorem. We first note that it makes little sense to talk of factor intensity in the presence of specific and hence not comparable capital stocks. It is however possible to reformulate the theorem in the sense that an increase in a specific factor causes an increase in the output of the commodity in which it is employed and a decrease in the output of the other commodity. This can easily be shown in terms of Fig. 6.1. Take for example an increase in K^B. With constant returns to scale and decreasing marginal productivities, an increase in a factor must have a positive effect on the marginal productivity of the other factor (see Sect. 19.1.3). This means that for a given p the L_B^D curve shifts upwards, for example to position $L_B'^D$.

The new equilibrium point is E', where less labour is allocated to sector A (hence a lower output of A) and more to sector B (whose output increases both because more labour is employed there and because of the increase in its specific capital).

The outcome is however different when the ubiquitous factor is considered. An increase in labour (see Fig. 6.2) shifts the origin O_B to O'_B. Thedemand-for-labour

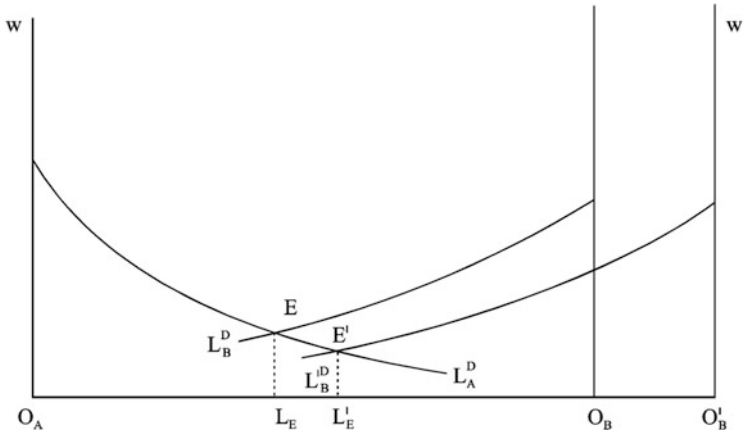

Fig. 6.2 The specific factors model and Rybczynski's theorem

schedule in sector B is now $L_B'^D$, which is the same as the curve L_B^D but referred to the new origin. The equilibrium point shifts from E to E', where more labour is employed in *both* sectors ($O_B'L_E' > O_BL_E$, and $O_AL_E' > O_AL_E$). Hence an increase in the ubiquitous factor brings about an increase in the output of *both* commodities.

Let us finally consider the Stolper-Samuelson theorem in its general formulation (see Sect. 5.3) according to which the increase in the relative price of a commodity raises the unit real reward of the factor used intensively in the production of that commodity. Again noting that it makes little sense to talk of factor intensity in the presence of specific and hence not comparable capital stocks, the Stolper-Samuelson theorem can also be reformulated in terms of specific factors. Let us then consider the reward of the specific factor used in the sector producing the commodity whose relative price increases.

For this purpose we can use Fig. 6.1, where we see that an increase in p (the relative price of commodity B) causes more labour to be used in sector B and less in sector A. The (specific) capital to labour ratio decreases in sector B and increases in sector A. Since the marginal productivity of capital (which is the real unit reward of capital) depends negatively on the capital to labour ratio, it follows that the marginal productivity of capital increases in sector B and decreases in sector A.

The effect on the ubiquitous factor is however ambiguous. The wage rate does, in fact, increase in terms of commodity A (from w_E to w_E'), but declines in terms of commodity B (since the marginal productivity of capital is higher there, the marginal productivity of labour is lower). Whether wage earners are better or worse off depends on the composition of their expenditure, a result that has been dubbed the *neoclassical ambiguity* in trade theory.

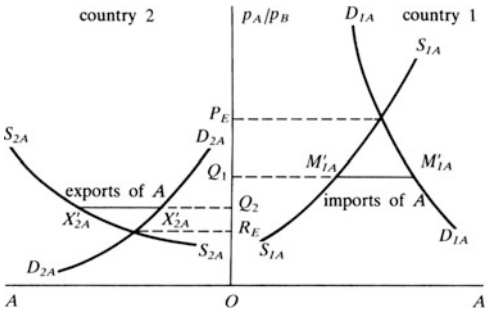

Fig. 6.3 The cost of transport: diagram 1

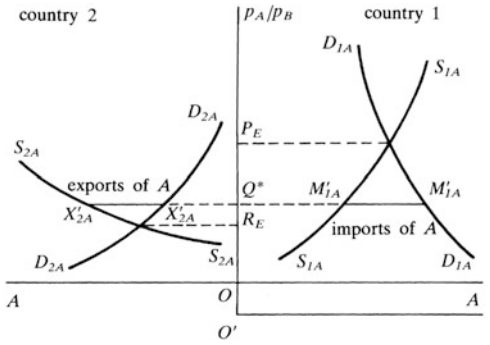

Fig. 6.4 The cost of transport: diagram 2

6.3 Transport Costs and International Trade

If we assume that the total cost of transport increases in proportion to the quantity of goods transported, i.e., that the cost of transport per unit of the commodity transported is constant, we can deal with the problem simply by taking up Fig. 3.6 again. The presence of constant unit cost of transport means that the price of a good in the importing country will be higher than the price of the same good in the exporting country by an amount equal to the given unit cost of transporting the commodity.

In Fig. 6.3 we have traced the same curves already analysed in Fig. 3.6. Note however that on the vertical axis we now measure p_A/p_B instead of p_B/p_A, so that the form and position of the curves has changed. Equilibrium is established when the relative price of A is OQ_2 in country 2 (the exporting country) and OQ_1 in country 1 (the importing country). The difference between OQ_2 and OQ_1, equal to segment Q_1Q_2, represents the given unit cost of transport, and segment $X'_{2A}X'_{2A}$ has the same length as segment $M'_{1A}M'_{1A}$.

An alternative way of showing the same phenomenon is described in Fig. 6.4 (the Cunynghame-Barone diagram: see Cunynghame, 1904, and Barone, 1908). This is derived from Fig. 6.3 simply by lowering the axis where the quantity of the importing market is measured (or, what amounts to the same thing, by raising the axis of the quantity of the exporting market) by an amount OO', corresponding

to the given unit transport cost ($OO' = Q_1Q_2$ in Fig. 6.3). The equilibrium prices in country 1 and country 2 can be read in this diagram as $O'Q^*$ and OQ^* respectively, because at these prices the excess demand for A in country 1 ($M'_{1A}M'_{1A}$) is exactly equal to the excess supply of A in country 2 ($X'_{2A}X'_{2A}$). It goes without saying that $O'Q^* = OQ_1$, and $OQ^* = OQ_2$, where OQ_1 and OQ_2 are the values referred to in Fig. 6.3.

In the treatment so far, we have limited ourselves to considering the cost of transport relative to good A. As one may well assume that there are also transport costs for good B, the diagrams used above are no longer valid, because in calculating the relative price p_A/p_B (or p_B/p_A according to the case) it is necessary to take into account the unit cost of transport both for A and B. The analysis of the general case can be more easily conducted in terms of offer curves if we simplify by assuming that the cost of transport is expressed in terms of the good transported, of which this cost constitutes a given proportion (the assumption made above, of transport costs proportional to the quantity of good transported is also maintained), let it be c_A for good A and c_B for good B. This means that only a proportion of the good exported is received as an import by the importing country, the difference being in fact consumed by transport. This method of calculating transport costs was introduced by von Thünen (1826, chap. 4) and Samuelson (1954). Von Thünen assumed that the cost of transporting grain largely consists of the grain consumed during the transportation by the horses pulling the carriage. Samuelson assumed that only a fraction of exports reaches the country of destination as imports, just as only a fraction of ice exported reaches its destination as unmelted ice. The Samuelson ice similitude was subsequently called in the literature the *iceberg* assumption.

Now, if we use k_A to indicate the proportion of A received by the importing country, then obviously the relationship $c_A + k_A = 1$ must be valid; similarly, $c_B + k_B = 1$. We now see how the offer curves are modified as a consequence of introducing transport costs in the manner described above. We must remember (Sect. 3.4) that OG_1 is the offer curve of country 1, which imports good A and exports good B, while OG_2 is the offer curve of country 2, which imports B and exports A. In order to examine the shifts in these curves, we must first establish whether we want to work with c.i.f. or f.o.b. curves. If we consider the cost of transport relative to good B, we can modify the offer curve of country 1 to indicate that this country offers a smaller amount of good B considered as c.i.f. (cost, insurance, and freight, that is, delivered at destination in country 2) in correspondence to any given amount of A it demands, because part of the original quantity of B is consumed by transport. Or else we can modify the offer curve of country 2 to denote that it demands a greater amount of good B considered as f.o.b. (free on board that is, excluding the cost of transport) in correspondence to any given amount of A supplied, because a part of B is consumed by transport. The same can be said for the cost of transport relative to good A (in the c.i.f. case, country 2's offer curve shifts, while in the case of f.o.b., it is the offer curve of country 1 which shifts).

In Fig. 6.5 we have considered the c.i.f. curves. Thus, in consequence of the transport costs of good B, OG_1 shifts to OG'_1: if we consider for example the

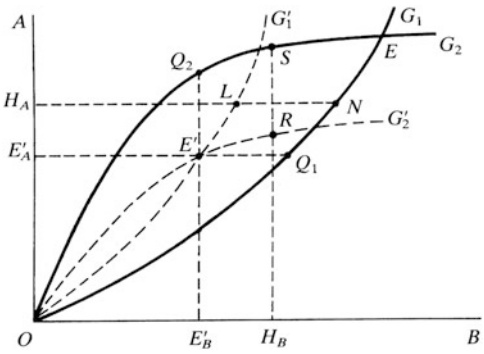

Fig. 6.5 The cost of transport and offer curves

given demand for imports OH_A, country 1 will be prepared to offer H_AL (rather than H_AN) of B c.i.f., LN representing the cost of transport: from what we said at the beginning, it will be $LN = c_B \cdot H_AN$ and $H_AL = k_B \cdot H_AN$. Given that c_B is assumed to be constant (and therefore also k_B), the shift of OG_1 towards the A axis will be equiproportional. Similarly, OG_2 will shift equiproportionally to OG_2' as a result of the cost of transport for good A (we have $RS = c_A \cdot H_BS$ and $H_BR = k_A \cdot H_BS$).

The new equilibrium is established at E', and the terms of trade with prices calculated c.i.f. are given by the slope of OE'. Country 1 exports $E_A'Q_1$ of good B, receiving in exchange $E_B'E' = OE_A'$ of good A (so that the domestic price ratio is given by the slope of OQ_1); segment $E'Q_1$ represents the cost of transport of good B, so that the quantity of that good effectively received by country 2 is $E_A'E' = OE_B'$.

Country 2 exports $E_B'Q_2$ of good A and receives in exchange $E_A'E' = OE_B'$ of good B (so that its domestic price ratio is given by the slope of OQ_2); segment $E'Q_2$ represents the cost of transport of good A, so that the quantity of that good effectively received by country 1 is $E_B'E' = OE_A'$.

The difference between the exports of one country and the imports of the other is made up of the quantity of the good exchanged that is consumed as transport cost.

This type of analysis could be extended to an examination of other problems (f.o.b. terms of trade, transport services supplied by only one of the two countries for both goods, and so on: see Mundell, 1957a), but we do not propose to pursue the matter further, partly because a more general analysis should eliminate the simple assumption that transport costs are translated in terms of consumption of the good transported. In effect for that type of analysis the problem would need reformulating in terms of at least four variables (that is, the two transport services in addition to the two goods), so that it would no longer be possible to make use of diagrams, but a complex mathematical treatment would be required (see Sect. 22.2).

We can however offer some general considerations as to the effects of the presence of transport costs. Apart from the obvious fact that (still assuming perfect competition) the price of any good traded will be higher in the importing country than in the country of origin, two other effects deserve mention.

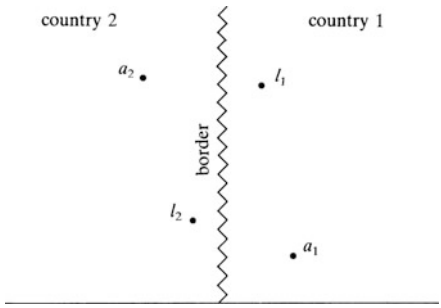

Fig. 6.6 The cost of transport as a determinant of international trade

The first is that *the presence of transport costs can impede the trading in goods which, in the absence of those costs, would be traded internationally*. If there is a gap between the prices of a certain good (expressed in a common unit of measurement) that ensure equilibrium between domestic demand and supply in each of the potential trading countries and if this gap is less than, or equal to the unit transport cost, there will be no international trade in that good. This can be easily be seen in terms of Figs. 6.3 or 6.4 (but the result is also valid in cases other than those shown in these figures): if the unit transport costs are equal to, or greater than, the gap between OR_E and OP_E, good A will not be traded. Transport costs, in other words, can prevent trading in a good that, in theory, should be tradable, just as a decrease in these costs can make a good tradable which had not been previously.

The second result is that *some international trade can be directly caused by the cost of transport* (without this having anything to do with technology, tastes, or factor endowments). Transport costs, then, become a *determinant* of international trade and can explain the apparently paradoxical fact that *a country is sometimes both importer and exporter of the same good*. Let us suppose that the two countries have a long common border and that both produce steel (in mills situated respectively at a_1 and a_2) which they subsequently transform into steel plate (in the mills situated at l_1 and l_2).

Technology, tastes and factor endowments are absolutely identical in the two countries. However, if we assume that, other things being equal, the cost of transport increases with distance, country 1 may find it cheaper to get its supply of steel from a_2, rather than a_1, because a_2 is nearer to l_1 (country 1 thus imports steel from country 2) and, in the same way, country 2 might find it cheaper to import steel from country 1 because a_1 is nearer to l_2 than is a_2 (Fig. 6.6).

Phenomena of this kind can be put in a general framework in the theory of location. Although location theory is beyond the scope of the present work, its relations with international trade and transport costs deserve a treatment, which we postpone to Chap. 16.

6.4 Intermediate Goods

As we have seen more than once, the traditional theory of international trade is based on a model in which two final goods (A and B) are produced employing two primary factors of production (K and L). In reality, production requires not only primary factors, but also intermediate goods. We have already come across intermediate goods in the empirical tests of the Heckscher-Ohlin theory (Sect. 4.6), and we shall meet them again in the theory of tariffs (Sect. 10.7) and in Sect. 6.4.1. One of the refinements of the traditional theory has been explicitly to consider these goods. Actually, the change in the price of a traded intermediate good influences relative factor and commodity priced (Djajić, 1983).

A first way of introducing intermediate goods (Vanek, 1963, Hamilton and Svensson, 1983) is to suppose that each existing product in the economy can be utilized as both an intermediate and a final good. Thus, in our simple model with two goods and two primary factors, the situation will be that good A is produced by using both K and L and certain quantities of itself and/or of good B, in the form of intermediate goods. The same can be said of good B. By subtracting the quantity of it used overall as an intermediate good in the economic system from the amount of good A produced, we have the net production of that good as a final good available to satisfy consumer demand.

Another way to tackle the problem (Batra & Casas, 1973) is to introduce pure intermediate goods, that is goods which are utilized exclusively as intermediate goods and are, therefore, physically different from final goods. Pure intermediate goods may or may not be traded internationally, but it is obviously of more interest when they are.

To deal with the case of intermediate goods which correspond physically to final goods, Samuelson (1965) suggested the expedient of considering the productive system as a "black box" with an input of primary factors of production and an output of the *net* quantity of final goods. The problem then is to define a net production function for each good, that is, a production function which has as its only inputs the total amount of primary factors, and as output the net quantity of each final good. By "total" amount of primary factors we mean the amount *directly* and *indirectly* necessary to produce a given net quantity of the final good. The indirect requirements of primary factors of production refer to the quantity of these primary factors required to produce the intermediate goods which enter into the production of the final good.

It is clear that if the expedient were feasible, one could argue in terms of net production functions; so that—if these have the same properties as traditional production functions, where intermediate goods are assumed absent—the theory of international trade given in the previous chapters would not require any modification.

It has in effect been demonstrated by Samuelson and others (see Sect. 22.3.1) that this is true (provided there are no joint products), so that the four core theorems (see Chap. 5) are still valid even in the presence of intermediate goods.

Those who support the second approach, however, object that in this way we lose sight of the fact that a large slice of international trade concerns those goods (semi-finished products, raw materials, etc.) which are used exclusively as inputs in the production of others goods and are thus *pure* intermediate goods. Traditional theory, further refined by the introduction of net production functions, cannot explain this phenomenon, and this represents a major weakness.

In order to examine the consequences of the second approach, it is necessary at the very least to introduce a third good, the pure intermediate one which is produced (by means of primary factors) exclusively to be used in the production of two final goods. In this case it is also possible to define derived production functions, which connect the production of final goods exclusively with the quantity of primary factors (directly or indirectly) required. So, the traditional theory, reformulated in terms of these new production functions, remains valid.

It is however clear that this method of solving the problem, if formally correct, is something of a piece of wizardry which leaves the initial problem unsolved, that is *how to explain international trade in intermediate goods*. Trade in intermediate goods cannot in fact be explained by reducing the model to a scheme of final goods/primary factors, from which intermediate goods have actually been eliminated! It is therefore necessary to work within the initial scheme with three goods. As the primary productive factors are always the two traditional ones (K and L), we must ask ourselves whether it is possible to classify the goods in order of factor intensity (measured as usual by the capital/labour ratio) and apply the traditional theory in its extended form to more than two goods. The answer is no, unless further qualifications and conditions are introduced and it is easy to understand why.

The traditional theory with two primary productive factors and three final goods is not applicable because the third good is not a final good but an intermediate one and, besides, in the definition of factor intensity, it is necessary to distinguish between *apparent* (or *net*) factor intensity and *total* (or *gross*) factor intensity. Apparent factor intensity is that obtained by considering the quantity of capital and labour directly required in the production of a given good. Total intensity is obtained, on the other hand, by considering the quantity of capital and labour *directly* and *indirectly* required in the production of that given good. The quantities of K and L indirectly required are those which enter into the production of the intermediate good. Total factor intensity, therefore, is obtained from the derived production function defined above. As regards the intermediate good, total and apparent factor intensities coincide, because the indirect requirements of K and L are zero, thanks to the simplifying assumption that the intermediate good itself is produced by means of primary factors only.

It is obvious that the classification of goods can be different according to whether apparent or total intensity is used, so that when the two classifications do not coincide problems arise which prevent the application of the traditional theory (see Sect. 22.3.2).

However, even when there is no discrepancy between the two classifications the structure of trade (that is which of the three goods are exported and which imported) is generally indeterminate, unless further restrictions are introduced.

Let us suppose, for example, following Batra and Casas (1973), that initially international trade in intermediate goods is forbidden. If we assume that there is no discrepancy between the two classifications, we can apply the Heckscher-Ohlin theorem and, having also assumed absence of complete specialization, the factor-price-equalization theorem will be valid (Sect. 4.3). Thus, the intermediate good (given the international identity of the production functions) will have the same price in the two countries. Consequently, once international equilibrium has been established, even if the prohibition of international trade in intermediate goods is eliminated, there will be no incentive for this trade.

However, we cannot exclude the possibility that this trade will take place in some direction,[2] without production and world demand for final goods being (initially) altered. But, as a result of the trade in the intermediate good, the transformation curves of the two countries shift—that of the country which is a net importer of the intermediate good outwards and that of the country which is a net exporter of this good inwards. Let us suppose that country 1 has a relatively plentiful supply of capital and that it is possible univocally to classify good A as the good with relatively high capital intensity. Let us also assume that country 1 exports the intermediate good: then, at the given prices, the shift of the transformation curves means that production of both A and B will decrease in country 1 and increase in country 2.

Consequently (remember that tastes, etc., are internationally identical), it is possible that in the end country 1 will import both good A and good B in exchange for the intermediate good, so that the Heckscher-Ohlin theory (according to which country 1 that has a relative abundance of capital ought to export good A) does not apply. It has been demonstrated by Batra and Casas (1973) that the condition for this theory to apply is that one of the three goods (whether a final or intermediate one) is a non-traded good and, in addition, that the apparent capital intensity of this good lies between the apparent intensities of the two traded goods.

The treatment of intermediate goods carried out in this section has important empirical implications. We have in fact seen in Sect. 4.6, that the studies of Leontief (and his followers) on the Heckscher-Ohlin theorem make use of total (direct and indirect) capital and labour requirements, that is, they take into account what we referred to above as total (or gross) factor intensity. When the intermediate good is not exclusively produced domestically but is (completely or in part) imported, then, to define the total factor intensity of final goods, it is necessary to take account not only of the requirements of capital and labour in producing intermediate goods of domestic origin, but also of the capital and labour requirements in producing goods for export, thanks to which the imported intermediate goods are obtained, by way of international trade (Riedel, 1976; see also Hazari, Sgro, & Suh, 1981, Pt. 2).

[2] Given the assumptions (internationally identical production functions, absence of transport costs, etc.), if the intermediate good has the same price in both countries, then, as we said, there will be no incentive to trade in it, in the sense that it will make no difference to producers of final goods in any country to use the domestically produced or the foreign intermediate good. But precisely because there is no difference, the possibility cannot be excluded that someone might use the nationally produced intermediate good and someone else the foreign produced one.

6.4.1 *Intermediate and Capital Goods in the Neoclassical Theory*

We know that the traditional theory of international trade in its basic version considers economic systems in which internationally immobile *primary* factors produce, without other inputs, final consumption goods, which are internationally mobile and traded. There is no room, in this version, for produced means of production (fixed and circulating capital). The stock of capital K, which appears in the version under examination, serves only to give it a (illusory) sense of realism: actually, many treatments eliminate the problem by avoiding all consideration of capital and introducing land (clearly a primary factor) as the other factor of production besides labour.

This version of the theory can be all too easily criticized, but it would *not* be correct to conclude from these deserved criticisms, without further analysis, that the whole neoclassical theory is invalid. We must at this point distinguish the problem of intermediate goods (circulating capital) from that of fixed capital goods.

As regards intermediate goods, these can be rigorously introduced into the traditional theory, as we have shown above. This part of the criticism then collapses.[3]

Much more difficult is the problem of fixed capital (henceforth, for brevity, we shall omit the adjective "fixed"), with regard to which two aspects must be distinguished: that of capital as produced means of production and that of capital as a collection of physically heterogeneous goods. If we assume that capital is a single physically homogeneous good (the terminology to indicate it is varied: meccano sets, treacle, jelly, etc.) which is used in conjunction with labour to produce both itself and consumption goods, no particular difficulty arises, and this aspect can be dealt with in the context of the traditional theory, as shown in Sects. 14.1 and 28.1.

The really serious difficulties arise when one must account for the fact that in reality no single physically homogeneous capital exists, but a collection of physically heterogeneous capital goods with varying proportions among themselves (if these proportions were constant, one could easily define a basket of capital goods in the fixed proportions, and consider it as a single homogeneous good).

This aspect will be examined in the next section; it is as well to inform the reader here that it also concerns the new theories of international trade (see Part IV), insofar as they also have to deal with heterogeneous fixed capital.

It is also important to point out that we have briefly dealt with this methodological debate in this chapter because neoricardian theories can be classified as "orthodox" in the sense that they also accept the basic assumptions of the traditional theory of international trade (as contrasted with the "new" theories), namely perfect

[3] Some problems might arise in time phased economies, i.e. in economies where production takes time. In this case a difference in the periods of production could give some trouble; see, however, Ethier (1979); see also Chacholiades (1985). A similar observation holds for the case of a homogeneous fixed capital good.

competition, product homogeneity, constant returns to scale (in the particularly simple form of a set of fixed technical coefficients).

6.4.1.1 The Methodological Debate Between Neoclassical and Neoricardian Theories

The problem mentioned at the end of the previous section is nothing but a reflection, on international trade theory, of the debate which has been going on for many decades regarding the theory of value and distribution. It is outside the scope of the present work to enter into this methodological debate, for which we refer the reader to the sources quoted in the References at the end of the chapter. Our task is briefly to examine the repercussions of this debate on the theory of international trade, hence our treatment will be no more than a very brief guide to the literature.

According to one line of thought (Parrinello, 1970; Steedman, 1979; Steedman Ed., 1979) the impossibility, in the presence of heterogeneous capital goods, of defining a measure of aggregate capital independently of distribution, mines the foundations of the neoclassical theory of international trade and in particular of the Heckscher-Ohlin theorem (it would become logically impossible, in fact, to determine factor intensities and factor endowments) and of the related theorems (factor-price equalization, etc.).

This line of thought therefore attempted to extend to international trade the analytical apparatus used to criticize the traditional (neoclassical) theory of capital and distribution in a closed economy. This apparatus, though set up in relation to the debate mentioned above, is related to the vision of the classical economists, in particular of David Ricardo, and this explains the adjective neoricardian in the title of this section and of the chapter. The main contributions in this direction are undoubtedly interesting, but in this line of thought it is not yet possible to find a complete model which can be considered as *the* neoricardian theory of international trade generally accepted by neoricardians (for a critical evaluation of Steedman (1979) and Steedman Ed. (1979), see Dixit (1981)).

According to a completely opposite line of thought (Ethier, 1979) it is perfectly possible to account for heterogeneous capital goods in the context of the traditional theory of international trade and reformulate its propositions in such a way that they remain valid. As we have seen in Chap. 5, the main propositions of the traditional theory are contained in four basic theorems: the Heckscher-Ohlin theorem, the factor-price equalization theorem, the Stolper-Samuelson theorem, and the Rybczynski theorem. Now, according to Ethier, the presence of heterogeneous capital goods does not vitiate the essence of these theorems, duly reformulated to account for such a presence. The numerous counterarguments of the neoricardian literature implicitly contain violations of the basic assumptions of the traditional model (such as, for example, factor-intensity reversals), so that their results can be fully dealt with in the context of the neoclassical theory: "The four basic theorems of the modern theory of international trade, formulated in a timeless context, are

insensitive to the nature of capital and remain fully valid in a time-phased world with a positive interest rate. The numerous counterarguments of recent years are simply old friends in disguise: phenomena that can be (and for the most part have been) fully analysed in timeless models" (Ethier, 1979, p. 236). Nothing new under the sun, then? The neoricardians, of course, do not agree, and criticize Ethier (see Metcalfe & Steedman, 1981), who, however, maintains his position (Ethier, 1981). For a general survey of the controversy between the neoricardian and the neoclassical theory of international trade see Smith (1984). See also Robinson (1954), Sraffa (1960), Samuelson (1962), Various Authors (1966), Spaventa (1968), Garegnani (1970), Harcourt (1972), Hahn (1982), Schefold (1985), Pasinetti (1977, 1981), Mainwaring (1984, 1988, 1991), Chacholiades (1985), and Parrinello (1988).

6.5 Elastic Factor Supply

In traditional theory the supply of factors is assumed completely rigid: in other words, all of the quantity of capital and labour existing in the economy is supplied, whatever the rewards might be. It is a convenient assumption introduced for the sake of simplicity; in effect, if it is removed, the analysis is much more complex. Let us assume that labour supply is elastic with respect to the real wage rate, while retaining the assumption of a rigid supply of capital. We know from micro-economic theory that the labour supply curve is not necessarily upward sloping through its entire range with respect to the real wage rate: even in normal cases it can at a certain point bend back (that is, with further increases in the real wage rate, the supply of labour decreases, for example, because workers opt for more leisure: this point is thoroughly dealt with in Laffer and Miles (1982), chap. 8). This is all that is necessary to create the problems mentioned above, which can be summed up as follows:

1. The supply (production) of goods is no longer necessarily an increasing function of the appropriate relative price. We have seen in Sect. 3.2.1 that the supply of good B increases with the increase in the relative price p_B/p_A, while the supply of good A decreases (an increase in p_B/p_A is equivalent to a decrease in p_A/p_B). In the case of variable labour supply, the supply of goods may have an abnormal behaviour, that is, be a decreasing function of the appropriate relative price.

   An intuitive explanation of this phenomenon follows. Let us consider the productive side of the neoclassical model, which must be modified to take account of the fact that the quantity of labour is determined endogenously, not exogenously, and let us see what the effects of an increase in p_B/p_A are. Let us assume that good B is relatively more labour-intensive: consequently, on the basis of the Stolper-Samuelson theorem (Sect. 5.3), the increase in p_B/p_A causes the real wage rate to increase. Now, if we find ourselves in the backward bending branch of the labour supply function, the increase in real wages will cause a

decrease in the supply itself. The decrease in labour supply determines, on the basis of Rybczynski's theorem (Sect. 5.4),[4] a decrease in the output of the labour-intensive good (in this case, good B) and an increase in the quantity produced of the other good (A). Note then that, with an increase in p_B/p_A, the supply of B decreases and the supply of A increases.

2. The offer curve can be anomalous, in the sense that there is a greater demand for imports when their price increases and vice versa. This is a possible consequence of the phenomenon described in the previous point (1). Remember (Sect. 3.4.1) that the offer curve is constructed starting from domestic excess supply and demand, so that the demand for imports coincides with the domestic excess demand for the importable good. Let us assume that A is the importable good: normally, the demand for A increases with the decrease in p_A/p_B (that is with the increase in p_B/p_A) and the supply of A decreases with the decrease in p_A/p_B, so that the excess demand for A (the demand for imports) increases with the decrease in its relative price. Let us assume that, for the reasons seen in point (1), the supply of A increases with the decrease in p_A/p_B. If this increase is greater than that of demand, the excess demand for A decreases with the decrease in its relative price and, conversely, it increases with the increase in p_A/p_B. This reasoning ignores possible effects of labour-supply variability on demand. These effects are due to the fact that this variability can produce anomalous effects on income and therefore on demand (for example, an increase in real wage rate that causes a reduction in labour supply can determine a reduction rather than an increase in workers' income). See Sect. 22.4.

   When the offer curves are anomalous, all the results of the pure theory of international trade based on the assumption that these curves are normal must be revised, whence the complications mentioned at the beginning (for example, equilibrium may be unstable).

6.6 Non-traded Goods

In the real world, each country produces goods that are not the object of international trade, that is, goods neither for export nor import. There are plenty of reasons why certain goods are not traded: prohibitive import duties (Sect. 10.3), embargoes (Sect. 10.6.4), prohibitive costs of transport (Sect. 6.3), etc.: all of which may justify the existence of non-traded goods.[5]

[4] Rybczynski's theorem has been discussed with reference to an increase in the quantity of factors, but it has symmetrical validity in the case of a decrease, as can easily be established from the box diagram if a shortening rather than a lengthening of the side representing the quantity of labour is considered.

[5] See, however, Padoan (1977) for an interesting criticism of the concept of non-tradable goods itself.

Alongside these cases, in which barriers to trade are due to obstacles which, if removed or reduced, might result in the goods concerned being traded, there are goods which in any case would not be traded, on account of differences of tastes or for reasons inherent in the nature of the goods (many services, for example, are intrinsically nontradable). According to some economists (for example, Kemp, 1969b, p. 134), in most industrialized nations the amount of non-traded goods represents more than half of the national product.

There thus seems to be a very real need to enrich and extend traditional analysis so as to include non-tradable goods. This means that it is necessary to introduce a third good into the standard two-good model, that is, in fact, the non-tradable good, which is produced by means of the same primary factors (K and L) used in the production of tradable goods.

It is often stated that, while prices of traded goods are determined on the international market (and so, in the case of a small country, are exogenously given), the prices of non-traded goods are determined exclusively by the conditions of domestic supply and demand. This is inexact for the simple reason that—assuming the right conditions occur for absence of factor-intensity reversals—the one-to-one correspondence between relative prices of goods and relative prices of factors (Sect. 4.1.1), together with the assumption of perfect competition and free internal mobility of factors, means that the relative price of the non traded good can be determined precisely, starting from the given terms of trade.

Let A, B, and N be three goods, of which the third is not traded, and let us consider the relative prices of goods B and N with respect to A. Given the terms of trade $p_B/p_A = p^*$, the relative price of the factors (p_L/p_K) used in sectors A and B is determined. This relative price, given the assumption of perfect competition and free domestic mobility of factors, is valid also for the N sector. Consequently, assuming that in the sector of the non-traded good the relation between the relative price of factors and the relative price of the good is also one-to-one, the relative price p_N/p_A is determined.

It is possible to give a simple diagram of this chain determination. Let us assume, for example, that good A has a capital intensity greater than both B and N, so that both the relation between p_B/p_A and p_L/p_K and that between p_N/p_A and p_L/p_K are increasing. The relation between p_B/p_A and p_L/p_K is taken from Fig. 4.5a; in the same way we can obtain the relation between p_N/p_A and p_L/p_K.

In the upper half of Fig. 6.7 we have shown the relation between p_B/p_A and p_L/p_K, while in the lower half we have given that between p_N/p_A and p_L/p_K turned upside down.

Given p^* (terms of trade), the relative price of the factors is determined at OF and so (lower half of Fig. 6.7) the relative price p_N/p_A is determined at OG. It can be seen from the diagram that at every value of p^* there corresponds one and only one value of p_N/p_A. This single-value correspondence will occur even if the relations between the relative price of goods and the relative price of factors are decreasing (either or both), provided that these relations are monotonic (absence of factor-intensity reversals).

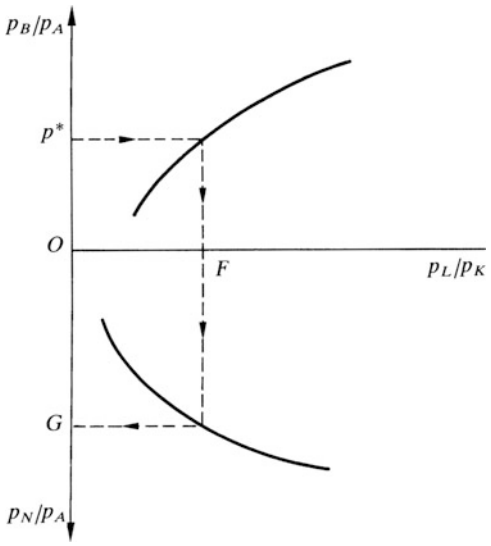

Fig. 6.7 Relative prices of traded and non-traded goods

But there is more to it than that: not only the relative price, but also the *absolute price* of the non-traded good is determined by the international market for traded goods if the factor-price-equalization theorem (see Sect. 4.3) holds. First note that, given p_L/p_K, the optimum factor combination for the production of good N is determined and (given the assumption of first-degree homogeneous production functions) independent of the scale; thus the technical coefficients K_N/S_N and L_N/S_N, where S_N is the quantity of good N produced, once given p_L/p_K, are constant. Now, as in perfectly competitive equilibrium the value of the product is equal to the sum of factor rewards, we have

$$p_N S_N = p_K K_N + p_L L_N, \tag{6.4}$$

from which, by dividing both sides by S_N, we get

$$p_N = p_K \frac{K_N}{S_N} + p_L \frac{L_N}{S_N}. \tag{6.5}$$

The technical coefficients are given, as shown above and, if the factor-price-equalization theorem is valid, p_L and p_K are also given at the level of the corresponding prices of factors in the rest of the world. It then follows from (6.5) that p_N is completely determined.

The statement that the price of non-traded goods are determined exclusively by domestic supply and demand conditions is therefore wrong if approached from the view-point of traditional theory enriched by the introduction of a third sector, which produces a non-traded good. One way to validate this statement—apart from the cases of factor-intensity reversals, etc.—is to drop the assumption of perfect

competition, and so admit that factors can have *different* (relative and absolute) prices in the various sectors, and/or that the price of the non-traded good should be fixed without respecting condition (6.5).[6] Another possibility is that there exist *specific* productive factors (see Sect. 6.2) in each sector.

At this point we must ask what is the relevance for international trade theory of the introduction of the non-traded goods sector, seeing that, on the basis of the argument so far, this sector is influenced by, but seems not to influence, the foreign sector? In effect, this impression is false, because the presence of sector N has a considerable influence on the offer curve (relative to goods A and B) of the country considered and thus also on the determination of the terms of trade (once the assumption of the small country is abandoned).

In fact, the presence of sector N can give the offer curve an anomalous behaviour, for example because the demand for imports increases (instead of decreasing) when the terms of trade worsen and decreases (instead of increasing) when the terms of trade improve.

Let us assume that A is the imported good, so that the demand for imports is given by the domestic excess demand for that good. If p_B/p_A increases (this represents an improvement, as p_A/p_B decreases) the excess demand for A in the two-good model increases for two reasons. On the one hand, with normal functions, the increase in p_B/p_A causes an increase in the demand for A. On the other, it causes an increase in the production of B and therefore a decrease in the production of A, which gives up resources to sector B. We shall now see what may happen in the three-good model.

As we have seen above, to every given p_B/p_A there corresponds a given p_N/p_A; let us now assume that when p_B/p_A increases p_N/p_A decreases.[7] The decrease in p_N/p_A, in a context of general equilibrium, also has effects on the demand for A, but to avoid further complications we shall assume that the effect of p_B/p_A prevails anyway, so that the demand for A increases when p_B/p_A increases. We now come to the production side: in a context of general equilibrium the supply of each good is also a function of all the relative prices, but, for simplicity's sake, we shall assume that following the decrease in p_N/p_A the supply of N decreases in any case. This makes resources available which flow into the other sectors, i.e., not only into sector B, but also into sector A (provided the decrease in p_A/p_B is less than the decrease in p_N/p_A, so that the production of A is more profitable than that of N). Thus an increase in the production of A is possible and, if this increase is greater than the increase in demand, the excess demand for this good (that is, the demand for imports) decreases.

In the same way, we can establish the possibility of an increase in the demand for imports when p_A/p_B increases.

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[6] It is clear that by doing this we move outside the context of the traditional theory: the problems that derive from abandoning the assumption of perfect competition will be dealt with in Part III.

[7] In terms of Fig. 6.7, this means for example that the relationship between p_N/p_A and p_L/p_K is monotonically decreasing rather than monotonically increasing.

The possibility of an abnormal behaviour of the offer curve opens up a whole series of problems which have been dealt with in earlier chapters: for example, international equilibrium can be unstable (Sect. 3.4.2), the Metzler and Lerner cases in the theory of tariffs can occur (Sect. 10.5.2), etc.

It is interesting to note in conclusion that the presence of a non-traded good has an influence on the offer curve in a way similar to what we saw in the case of variable supply of factors examined in Sect. 6.5. This will come as no surprise if we observe (Kemp, 1969b, p. 134) that the non-traded goods sector serves as a sort of reservoir which can release factors to the international sector, or absorb factors from it, in response to variations in prices. Finally, the validity of the four core theorems (see Chap. 5) in the presence of non-traded goods is examined in depth by Ethier (1972).

6.7 Natural Resources, "Dutch Disease", and De-industrialization

The phenomenon of the contraction of the traditional manufacturing sector, due to the rapid expansion of the extractive sector, was observed in various countries and was labelled de-industrialization or "Dutch disease". "Dutch" because it occurred in Holland among other countries, due to the rapid development of the natural gas extractive industry. The same phenomenon was observed in Australia (extraction of minerals), and Britain and Norway (following the extraction of oil from the North Sea).

To analyse this phenomenon on a proper theoretical basis, we must use a model with at least three goods (one exported, one imported and one non-traded good) and certain specific factors in the production of each good besides the traditional unspecific or general factors, which move freely from sector to sector. We can see at once that it is an extremely complex model, not to be dealt with by using traditional diagrams. Still, it is possible to make it less complex and more tractable, by the fairly simple use of an expedient introduced for other purposes by Salter (1959) and subsequently adapted by various economists (Snape, 1977; Corden & Neary, 1982; etc.), for the examination of the problem in hand.

This expedient consists in first assuming that we have to deal with a small country for which, therefore, the terms of trade are given. The relative price of the exported and imported goods is therefore exogenously given for the country in question, so that we can apply Hicks' theorem (1939, 1946) by which, if the relative prices of a given group of goods remain constant as the quantity of the goods themselves varies, the different goods in the group can be treated as a single whole, that is, as if they were a single good.

Thanks to this expedient,[8] we can get a two-sector model: the sectors of traded and non-traded goods. Thus, starting from the three goods A, B, and N[9] (see Sect. 6.6), we can argue in terms of two goods, say, C (all traded goods) and N (the non-traded one).

We now come to the productive factors. Following the specific factors model (see above, Sect. 6.2) we assume that each sector utilizes a specific factor (for example, a particular kind of capital) besides labour, which is the only general factor and moves freely from sector to sector. The price of N is therefore determined by domestic supply and demand, as the presence of specific factors prevents the application of the argument developed in Sect. 6.6.

Let us assume that there is a rapid expansion in the traded goods sector, for example, following a boom due to technical progress in the extraction of natural resources. We must distinguish two effects of the boom (Corden & Neary, 1982). The first is the *resource movement effect*: the boom in the extractive sector causes the marginal productivity of the general factor to grow and attracts it away from the other sectors (the basic model is always that of full employment of factors), with a series of adjustments in the rest of the economy. If the extractive sector uses relative little of the general factor, these adjustments will not be very appreciable, and the second effect will have the greater impact (as happened in Britain: see Corden & Neary, 1982).

The second is the *spending effect*: greater real income from the boom induces a greater expenditure on the various goods (none is assumed to be an inferior good). This in turn causes an increase in the price of N (without influencing the prices of A and B, as these are given by the international market) and a further chain of effects.

To analyse these effects we use the familiar diagram of the transformation curve; given our assumptions, we can argue in terms of goods C and N. In the initial situation, given the conditions of internal supply and demand, a certain price of N is determined with respect to C, for example that given by the slope of $P_h P_h$ in Fig. 6.8, and therefore equilibrium is found at point Q.[10] The boom in the extractive sector causes the transformation curve to shift to $T'T'$: note that, as nothing has happened in the N sector, the intercept with the N axis does not change in the new curve.[11]

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[8] It is self-evident that this expedient cannot be used for a country which enjoys monopolistic power, for example by way of a cartel. On cartels see Sect. 10.6.3; on the role of natural resources in trade models in general see Kemp and Long (1984).

[9] Each of the three goods A, B, and N can in turn be considered as a group inside which relative prices are constant. This explains why we can talk of "good N" and "non-traded goods" without making distinctions.

[10] Note that as N is a non-traded good, in equilibrium the production point and the consumption point coincide. In fact, point Q can also be determined by the tangency between the transformation curve and a social indifference curve, from which the relative price is determined, as is the common slope of the two curves at the point of tangency.

[11] The reader will note the analogy between Figs. 6.8 and 13.11 in Sect. 13.5.2. In effect, the extractive boom can be assimilated to the case when technical progress occurs in sector C.

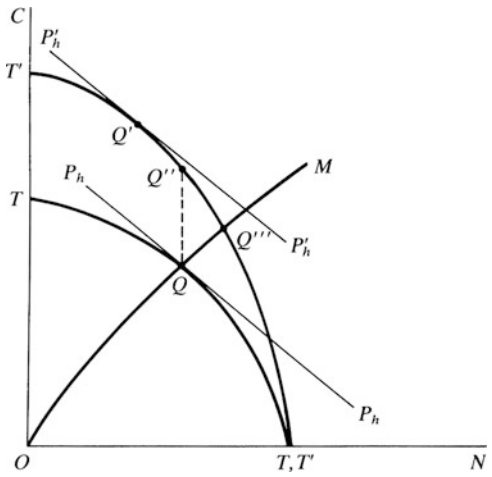

Fig. 6.8 Effects of an extractive boom on the commodity market

Assuming for the time being that the price of N is unchanged, the new point of equilibrium will be at Q', where $P'_h P'_h$, parallel to $P_h P_h$ is tangent to the new transformation curve. The initial effect of the *movement of resources* is represented by the shift of the production point from Q to Q', with a reduction in the production of non-traded commodities. If we wish to examine the further repercussions by abstracting from the spending effect, we assume that the income elasticity of the demand for N will be zero, so that the income-consumption curve is a vertical line which passes through Q and Q'', to denote the invariability of the demand for good N. By comparing Q'' with Q' it can be seen that there is excess demand for N which brings about an increase in the relative price of that commodity. In the graph, the slope of $P'_h P'_h$ with respect to the N axis increases, so that point Q' moves towards Q''; but without reaching it: with the increase of p_N / p_C, in fact, the demand for N decreases so that equilibrium will be found at an intermediate point between Q' and Q''.

The effect of the resource movement is therefore to reduce the production of good N, though to a lesser degree than the initial reduction.

Let us now consider the *spending effect* and, so as to abstract from the resource movement effect, let us assume that the transformation curve shifts in such a way that, at the given initial relative price, the tangency between $T'T'$ and $P'_h P'_h$ occurs exactly at Q''. Assuming that N is not an inferior good, the demand for it at the given initial relative price increases as a consequence of the increase in income, moving along an income-consumption curve such as OM, which intersects $T'T'$ at Q'''. If we compare Q''' with Q'', we note that there is excess demand for N, which will lead to an increase in the relative price of that commodity, so that point Q'' moves towards Q''', without however actually reaching it, because the increase in p_N / p_C causes the demand to decrease. The point of equilibrium will be between Q'' and Q'''.

The spending effect acts therefore to increase the output of N. The total effect will be given by the sum of the resource movement effect and the spending effect;

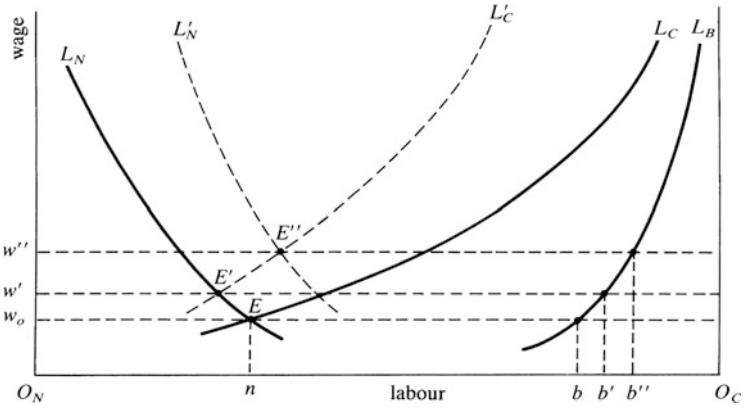

Fig. 6.9 Effects of an extractive boom on the labour market

because one is negative and the other positive the balance can in general have any sign and so the production of N can either increase or decrease. In any case, the production of C increases but for our purposes it is necessary to determine the variations in the outputs of the two traded goods, namely that of natural resources and that of manufactured goods; without any loss of generality, we can say that they are, respectively, commodities A and B.

For this purpose, it is sufficient to look at the *labour market*. In fact (see Sect. 6.2), since we have assumed that labour is the only mobile factor, while the others are specific factors, fully employed in each sector, to find out whether the production in one sector increases or decreases it is sufficient to find out whether employment increases or decreases in that sector. Let us therefore consider Fig. 6.9, where the segment $O_N O_C$ represents the total quantity of labour in existence. The quantity of labour used in sector N is measured from the origin O_N, while that used in sector C is measured from O_C. In the ordinate we show the wage rate (expressed in terms of good B). Curves L_N, L_B, L_C, represent the various functions of demand for labour in the initial situation. The demand for labour is a decreasing function of the wage rate on the basis of the well-known relationship $p_i MPL_i = p_L$ where MPL_i indicates the marginal productivity of labour in sector $i = A, B, N$; p_L is the wage rate and p_i is the price of commodity i. As we have expressed wages in terms of B, in order to draw the curves in Fig. 6.9 it is necessary also to know p_A and p_N. Now, p_A, like p_B, is given by the international market, while p_N is determined by Fig. 6.8. We have therefore all the elements necessary to construct Fig. 6.9. Note that the labour-demand curve shifts upwards both when the marginal productivity of labour increases (due to technical progress) and when the price of the commodity increases.

Let L_B be labour demand in the manufacturing sector; if we add the demand for labour in sector A (not shown in the diagram, so as to simplify) to L_B, we obtain the total demand for labour in the sector of traded goods, L_C. The L_N curve represents instead the demand for labour in the sector of nontraded goods.

Given the assumptions of full employment and mobility of labour (which imply an equal wage rate in all sectors), the wage rate will be w_0 and employment will be $O_N n$ in the sector of non-traded goods and $O_C n$ in the sector of traded goods, of which $O_C b$ in the production of manufactures and bn in the extractive sector.

The boom in sector A is the equivalent of an increase in the productivity of labour in that sector so that, at unchanged prices of the goods (which is the equivalent of considering the movement from Q to Q' in Fig. 6.8), the demand curve L_A shifts (at each given wage there is a greater demand for labour) and the total demand curve in the sector of traded goods shifts from L_C to L'_C. The new equilibrium point in the labour market is E', to which a wage rate w' corresponds; it can also be seen that employment has decreased both in sector N and in sector B, while it has obviously increased in sector A. However, point E' is only a temporary equilibrium point for, as we have seen above, in the final equilibrium situation the price of non-traded goods increases relative to those of traded goods and thus the labour demand curve in sector N shifts towards the right, for example to L'_N, and the wage rate further increases to w''. Employment in sector B decreases further (point b''). In the diagram we have assumed that E'' is to the right of E, so that employment (hence production) in sector N increases, but point E'' could also be to the left of E, so that employment (and thus production) in sector N might also decrease, as we already knew. The important result that we obtain is that in *any case* employment (and so output) in sector B decreases (*de-industrialization*): in fact, as point E'' will in any case be on L'_C to the right of E', point b'' will always be to the right of b'.

It goes without saying that, as the output of C has increased, the output of A—given that the output of B has decreased—must have increased.

We shall now see what happens to factor rewards. The wage rate expressed in terms of manufactured goods increases, but it is uncertain what happens to the real wage rate, if by "real" wage rate we mean workers' purchasing power, that is the nominal wage rate divided by a general price index. As the price of traded goods is a given constant, while the relative price of non-traded goods has increased, the purchasing power of wages in terms of non-traded goods might also have decreased. In fact, if we indicate the nominal wage rate by p_L and since $p_L/p_N = (p_L/p_B)(p_B/p_N)$, the increase in p_L/p_B can be more than compensated for by the decrease in p_B/p_N (if p_N/p_B increases it is obvious that p_B/p_N decreases); it follows from this that p_L/p_N can decrease. We thus have

(i) p_L/p_B increases;
(ii) p_L/p_A increases (as p_B/p_A is given by the terms of trade, if p_L/p_B increases p_L/p_A also increases);
(iii) p_L/p_N can either increase or decrease.[12]

[12]Given that $MPL_N = p_L/p_N$ and that MPL_N is a decreasing function of employment in sector N, it follows that p_L/p_N increases (decreases) if employment and therefore production of sector N decreases (increases).

When p_L/p_N increases, the real wage is bound to increase, but if p_L/p_N decreases, the real wage rate can either decrease or increase, according to the greater or smaller share of non-traded goods in workers' consumption.

As far as the rewards for other factors—the specific factors—are concerned, the only certainty is that the reward (in terms of good B) of the specific capital of sector B decreases. In fact, as employment in this sector decreases, the marginal productivity of specific capital of the sector itself decreases.[13]

In sector N, on the other hand, we do not know whether employment increases or decreases, so that the marginal productivity of specific capital in this sector can either increase or decrease. Also in sector A the reward of the specific factor can move in either direction, insofar as it is necessary to consider, besides the effects of employment, also the effects of technical progress on the marginal productivities of the factors. It is therefore possible (even if this involves not very plausible values of the parameters) for the benefits of the extractive boom to spread to other factors, to the point where there is a decrease in the reward of the specific factor used in the extractive sector.

We can then conclude that a boom in the extractive sector will have the following effects:

1. Production and employment in the extractive sector increase while production and employment in the traditional manufacturing sector decrease (*de-industrialization*); production in the non-traded goods sector, on the other hand, may either increase or decrease;
2. The price of non-traded goods increases. As the price of traded goods is given by the international market, the general price level in the country concerned increases[14];
3. The direction in which the real rewards of the various factors (labour and specific factors) move is usually indeterminate a priori.

It is important to stress the fact that these results have been obtained assuming a *single* general factor that is mobile between sectors, while the others are immobile specific factors. This assumption can be relaxed, for example, by introducing the mobility of capital between the two sectors of traded goods (while the sector of non-traded goods continues to use a specific factor in addition to labour) or even that capital and labour are common factors to all sectors and are freely mobile between these. By modifying the assumptions the results change, and it is no longer certain whether de-industrialization will come about: for a detailed examination of the various possible cases, see Corden and Neary (1982); see also

[13]We recall from the properties of first-degree homogeneous functions—see Sect. 19.1.3—that the marginal productivity of a factor is an increasing function of the quantity of the *other* factor. Thus the marginal productivity of capital decreases (increases) if the quantity of labour employed decreases (increases).

[14]This is inflation of the type contemplated by the so-called Scandinavian model of inflation. See, for example, Lindbeck (1979).

Bruno and Sachs (1982), Long (1983), van Wijnbergen (1984), Corden (1984a), and Findlay (1995, pp. 172–73).

6.8 International Factor Mobility and Trade in Factors

The international immobility of productive factors is, as we know, one of the concepts around which the traditional theory of international trade revolves. In effect, it would be possible to argue that, in a situation of free and perfect international mobility, of both goods and factors, the need for a theory of international trade disappears, as the whole world would become a single integrated system.

In reality there is never perfect international mobility either of goods or factors, but the assumption of absolute immobility of factors is undoubtedly inexact, so that it is important to analyse the consequences of introducing international mobility of factors into traditional theory.

Before going on, however, a few terminological caveats are in order.

Firstly, although 'international factor mobility' and 'trade in factors of production' are often used synonymously, we prefer to keep them distinct for the following reasons.

International factor mobility remains rooted in the traditional model, in the sense that we are always in the context in which final goods are produced by means of *primary* factors. The only difference from the traditional model is that the assumption of international factor immobility is dropped: factors can freely move at both the national and international level. If, say, capital moves from country 1 to country 2, and labour from country 2 to country 1, we may say for short that country 1 has 'exported' capital and 'imported' labour, but we must keep in mind that these primary factors are not 'traded' in the sense in which commodities are traded.

In fact, as we know from previous chapters, commodity trade depends on the conditions of demand and supply, where supply implies *production* in an essential way. The $2 \times 2 \times 2$ simple general equilibrium model that forms the basis of the traditional theory of international trade is not a pure exchange model, but a model with production and exchange. Primary factors of production, by definition, are not produced. This is why we prefer not to speak of factor trade when we are in the presence of the mere international mobility of primary factors. Both capital and labour can be considered under this heading, land being immobile by its very nature.

Trade in factors, on the other hand, implies that we are dealing with factors which are themselves *produced* means of production and, in addition to being internationally mobile, can be traded as any other good. This practically restricts the picture to (physical) capital in its various forms, both fixed and intermediate.

Our distinction is neither semantic nor whimsical, as it has important consequences. Suffice it to point out that, in the case of mere factor mobility, when

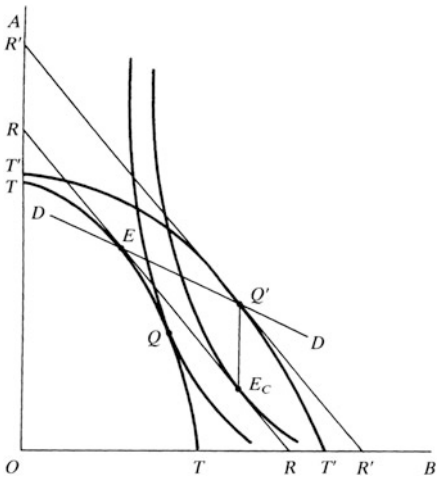

Fig. 6.10 International factor mobility

factor prices are equalized through factor movements, factors *stop moving*. On the contrary, in the case of trade in factors, when the prices of traded factors are equalized through free trade, these factors (in their quality of traded goods) *continue to move* as any other traded commodity.

This is why these apparently equivalent topics are treated in separate sections.

6.8.1 Factor Mobility, and the Theorems of International Trade

Let us assume that productive factors can shift from one country to another as a result of income differentials: each factor thus will tend to move to that country where the reward is highest.[15]

The point of departure in our analysis is therefore the existence of different rewards for the same factor in different countries and that, note, is the same as saying that *the conditions of the factor-price-equalization theorem* (Sect. 4.3) *are not satisfied*. As we know, there are various reasons why factor price equalization may not occur: one of these is the presence of obstacles to international trade which prevent the equality of prices of goods in the various countries. We shall therefore assume that a duty is levied and, to simplify the analysis, that the country which levies the duty is a small one, so that the terms of trade on the international market

[15]Naturally, this does not mean that factors may not shift for other reasons (unemployment in the country of origin; the political or social situation in the country of origin; the possibility of more fully realizing one's own potential, rewards apart—the so-called brain drain—etc.), but only that these reasons cannot be considered by the traditional theory, based on the assumption of full employment, etc.

are unchanged. Proceeding step by step, we begin—see Fig. 6.10—from an initial situation of international free trade and immobility of factors.

The situation in Fig. 6.10 gives rise to the terms of trade represented by the slope of RR,[16] to the production point E and the consumption point E_C, so that the country imports commodity B and exports commodity A. Working within the Heckscher-Ohlin model, we assume that this result is due to the fact that the country concerned is relatively abundant in labour and that A is the labour-intensive good. Given the absence of complete specialization and taking the other conditions to be fulfilled, the factor price equalization theorem is valid (Sect. 4.3), so that the real reward (marginal productivity) of each factor is equal at home and abroad.

If at this point all obstacles to international mobility of factors are removed, the factors will not shift, because there are no income differentials. But by introducing a duty the situation changes. Following Mundell (1957b and 1968, Chap. 6) we assume that the duty is prohibitive (we shall see later that the conclusions do not change even when the duty is not prohibitive) and that free international mobility applies only to capital.

The introduction of a prohibitive tariff on B shifts the production point, to coincide with the consumption point, at Q. As the domestic relative price of B has increased, it follows from the Stolper-Samuelson theorem (Sect. 5.3) that the real reward (marginal productivity) of the factor used relatively intensively in the production of B, i.e., capital, increases. Given free international mobility of capital, this will flow from the rest of the world towards the country concerned and will continue to do so until the income differential has disappeared: as the prices of goods and factors remain unchanged in the rest of the world, this means that, in the country concerned, the reward of capital (and, therefore, labour, given the assumption of first-degree homogeneity and international identity of the production functions) must return to its original pre-tariff level.

In the final equilibrium situation, therefore, the income of national factors must be the same as the initial national income and, furthermore, the domestic relative price of goods must be the same as the initial pre-tariff one: in fact, given the assumption of absence of factor intensity reversals, there exists a one-to-one relationship between the relative price of goods and the relative price of factors (Sect. 4.1.1). This means that in the final equilibrium situation the income of national factors coincides with the original isoincome line, RR.

Let us now point out the following important implication of free international factor mobility. When the marginal productivities of factors and therefore also their incomes are equalized, both the relative and the absolute prices of commodities must be equalized, given the assumption of international identity of the production functions. This confirms what was said in Sect. 4.3, note 2, that free international mobility of factors constitutes a perfect substitute for free international mobility of

[16] We must also remember that the position of RR represents the level of national income, measured by the intersection with the vertical axis (in terms of A) or by the intersection with the horizontal axis (in terms of B).

commodities and leads to the equalization of the prices of the commodities, despite the fact that these are immobile (see, however, Svensson, 1984 and Markusen & Svensson, 1985, for an examination of whether goods trade and factor mobility are necessarily substitutes or may be complements in particular cases). It is, as it were, a "*commodity price equalization theorem*", dual to the factor price equalization theorem.

It is important at this stage to note what happens to income earned by the foreign owners of the capital which flowed in from abroad: for simplicity's sake, we shall assume that it is entirely repatriated to the country of origin, so that income spent in the country we are concerned with always coincides with income received by national factors. This income is clearly less than the value of the product, because a part of the latter is handed over to the foreign capitalists.

The increased production is naturally made possible by the use of a greater quantity of capital which has flowed in from abroad, therefore the transformation curve shifts upwards and to the right (see $T'T'$). When there is an increase in capital, Rybczynski's theorem can be applied (see Sect. 5.4) on the basis of which—with the same factor prices—there is an increase in the domestic production of the commodity which is relatively intensive in its use of the increasing factor (that is commodity B) and a decrease in the production of the other (that is to say, commodity A). This means that Rybczynski's line (see Sect. 14.2) has a negative slope, that is point Q' at which $R'R'$, parallel to RR, is tangent to $T'T'$, must be further down to the right with respect to point E.

We must now demonstrate that the situation represented by Q' (as a production point) and E_C (consumption point) is indeed that of final equilibrium. That the final consumption point is E_C derives from the fact already discussed, that the income of national factors coincides with the initial isoincome line RR and from the assumption that all the income accruing to foreign capital is repatriated, so that the income spent at home must be that accruing to national factors. Consequently, the final consumption point must be identical with the initial one. That the final production point is Q' derives from the fact already discussed that the difference between the value of the product and the income paid to national factors constitutes the reward of foreign capitalists. It is therefore necessary for the country to produce at a point (which must lie along Rybczynski's line) such that, when the foreign capitalists' reward has been deducted, it is able to consume at E_C without trade (given the existence of the prohibitive tariff). Since the difference between the value of the product and the income paid to the national factors can be measured by the vertical distance between $R'R'$ and RR, it becomes clear that by producing at Q', which lies vertically above E_C, and by paying $Q'E_C$ to the foreign capitalists, the country can consume at E_C. At any other point along the DD line, to the right or to the left of Q', the structure of production would not be such as to permit the country to consume at E_C without trade (after the foreign capitalists have been rewarded).

At this point the tariff becomes irrelevant! When the prices of factors and commodities have been equalized between the country in question and the rest of the world, and when the production-consumption situation, given by Q' and E_C, has

been stabilized, even if the tariff is eliminated, there is not the slightest incentive to move commodities, so that there will be no international trade, nor any incentive to cause an outflow of the foreign capital.

As we said above, these results do not change even if the initial tariff is not prohibitive: however small the tariff may be, it always leads to the disappearance of trade. Going back to the initial situation, we assume that the tariff introduced is not prohibitive, so that trade goes on. The increased domestic reward of capital causes more to flow in from abroad. Since we have assumed that the country considered, let's call it country 1, is relatively labour abundant, in the initial situation we find $(L/K)_1 > (L/K)_2$. The inflow of K from the rest of the world (country 2) to country 1 leads to a continuous decrease in $(L/K)_1$ and increase in $(L/K)_2$ to the point where the two ratios become equal: once the difference between the relative factor endowments has been eliminated international trade will cease. Another way of getting the same result is to observe that, with the inflow of capital into country 1, the production of the importable good B (which is relatively capital intensive) will grow and the production of the exportable commodity A will be reduced to the point where the structure of production will coincide with the structure of demand (cessation of international trade). One consequence of the outflow of capital is that in country 2 the output of the exportable commodity B (which is relatively capital intensive) is reduced[17] and the production of the importable commodity A increases. Thus in country 2 (the large country compared to the small country 1), the price ratio p_B/p_A increases, once the trade flows have ceased (but not the outflows of capital, because the difference in reward persists) and therefore the marginal productivity of capital (Stolper-Samuelson theorem) increases in country 2 and decreases in country 1, until they are equalized. At this point capital movements also cease.

Among the other causes of international factor movements due to different rewards, we must list complete specialization, factor intensity reversals, etc. The principal conclusions of the analysis are as follows (Kemp, 1964, chap. 9; for further analysis see Sect. 22.7):

1. The removal of impediments to international factor movements gives rise to an improvement in the world productive efficiency;
2. The terms of trade can move in any direction or else remain the same;
3. If at least one of the trading countries levies a duty, then the final equilibrium will be characterized by the absence of trade;
4. If, on the other hand, there is free trade, the final equilibrium will be characterized by an increase in specialization in the various countries compared to the initial situation and at least one country will be entirely specialized.

[17]It should be remembered that Rybczynski's theorem is valid for both increases and decreases of a factor: the production of a commodity with a relatively intense use of a factor varies in the same direction as the quantity of this factor.

A related issue is whether the four core theorems of the traditional theory (the Heckscher-Ohlin, factor-price-equalization, Rybczynski, and Stolper-Samuelson theorems) remain valid under the assumption of factor mobility. The answer is yes, provided that the number of goods and mobile factors is at least as large as the total number of factors (Ethier & Svensson, 1986; Wong, 1995, chap. 4; see also the Appendix to the present section).

On international factor movements in general see Jones (1967), Hill and Méndez (1983), Various Authors (1983), Jones and Dei (1983), Ruffin (1984), Norman and Venables (1995), and Wong (1995).

Further light on the question can be thrown by using the specific factors model treated in Sect. 6.2 (see Neary, 1995; Wong, 1995, chap. 4, sect. 4.10). For clarity of exposition we shall separately treat the movements of capital and the movements of labour.

6.8.2 International Movements of Labour (Migration)

To examine the effects of an inflow of labour in the specific factors model, it is expedient to use Fig. 6.2.

As we have seen in Sect. 6.2, an increase in labour, which is the ubiquitous factor, shifts the origin O_B to O'_B. The demand-for-labour schedule in sector B is now L'^D_B, which is the same as the curve L^D_B but referred to the new origin. The equilibrium point shifts from E to E', where the wage is lower. We also note that more labour is employed in *both* sectors ($O'_B L'_E > O_B L_E$, and $O_A L'_E > O_A L_E$), hence an increase in the ubiquitous factor brings about an increase in the output of *both* commodities. Since both industries have more workers but fixed amounts of the respective specific factor, the wage in both industries declines because of the diminishing marginal productivity of labour.

Thus the specific factors model predicts that an inflow of labour will lower the wage in the country where the workers are migrating to. It also predicts that the output of both industries will increase. What about the returns ("rentals") of the specific factors? We begin by observing that the (specific) capital to labour ratio *decreases* in both industries because more labour is employed in each of them. Since the production functions have been assumed to be homogeneous of the first degree, it follows that the marginal productivity of capital is a decreasing function of the capital/labour ratio. Hence a *decrease* in this ratio will cause an *increase* in the marginal productivity of capital.

In conclusion, the owners of (specific) capital will benefit from the reduction in wages due to immigration. Thus we should not be surprised that owners of capital normally support more open borders, that provide them with foreign workers with a consequent reduction in wages.

It should be noted that the above results are valid in the short run (actually, the specific factors model is a short-run model). The long run effects can be analysed in the context of Rybczynski's theorem (see Sect. 5.4). Further analysis of migration is contained in Hazari and Sgro (2001).

As regards the actual migration flows all over the world, see International Organization for Migration (IOM).

6.8.3 *International Movements of Capital*

The theory of international capital movements focuses on the movement and renting of physical capital, and can be treated much in the same way as we have done for international labour movements. Take for example an inflow of capital specific to sector B (K^B increases), and consider Fig. 6.1.

With constant returns to scale and decreasing marginal productivities, an increase in a factor must have a positive effect on the marginal productivity of the *other* factor (see Sect. 19.1.3), ceteris paribus. This means that for a given p the L_B^D curve shifts upwards, for example to position $L_B'^D$.

As we have seen in Sect. 6.2, the new equilibrium point is E', where less labour is allocated to sector A (hence a lower output of A) and more to sector B (whose output increases both because more labour is employed there and because of the increase in its specific capital).

What about factor rewards? As is obvious from the diagram, the wage rate increases from w_E to w'_E. Consider now sector A. As we have just shown, the amount of labour employed in that sector decreases, which implies a decrease in the marginal productivity of the other factor, namely in the rental of the specific capital K^A.

As regards sector B, we are in the presence of two opposite effects. On the one hand, the marginal productivity of K^B increases because of the increase in the amount of labour employed in sector B. On the other, the marginal productivity of K^B decreases because of the increase in the amount of K^B due to the capital inflow. However, since product prices are assumed fixed, the increase in the wage must be offset by a *decrease* in the rental on capital in both industries,[18] hence the rental of the specific capital K^B also falls.

[18]This follows from the fact that the proportional change in the price of each good is a weighted average of the proportional changes in factor prices in each sector, the weights being the share of each factor in the value of output of that sector. With fixed prices of goods, if a factor price increases, then the price of the other factor must decrease. More formally, consider Eq. 22.6 derived in Appendix 22.1, that we reproduce here for the reader's convenience:

$$\begin{aligned} \theta_{K^A A} p^*_{K^A} + \theta_{LA} p^*_L &= p^*_A, \\ \theta_{K^B B} p^*_{K^B} + \theta_{LB} p^*_L &= p^*_B, \end{aligned}$$

where the $\theta's$ denote the factor shares in each sector, and the asterisks denote relative changes. With fixed prices of goods, $p^*_A = p^*_B = 0$, so that, given $p^*_L > 0$, both $p^*_{K^A}$ and $p^*_{K^B}$ must be negative.

6.8.4 Foreign Direct Investment and Multinational Corporations

We must now point out that this theory does not cover the phenomenon of multinational corporations (MNC) that carry out foreign direct investment (FDI). Nowadays FDI is absolutely predominant, so that a new theory is called for.

The firm that carries out foreign direct investment is usually a big corporation that operates in a market with high product differentiation. For such a firm, foreign direct investment is often an alternative to exporting its product(s), because the ownership of plants abroad facilitates the penetration in foreign markets. Multinational corporations, also called multinational enterprises (MNE) are firms that undertake foreign direct investment, namely investment by which the firm (called the parent company) acquires a substantial participation in the equity of a foreign firm, or sets up a foreign subsidiary (the controlled foreign firm and the subsidiary are both called affiliates of the parent company).

Direct investment is defined *horizontal* when the foreign affiliate produces goods and/or services similar to those that the parent company produces for its domestic market. It is defined *vertical* when it refers to a geographic *fragmentation* of the productive process in stages. This term identifies the segmentation of a previously integrated productive process in two or more distinct stages, called fragments (or segments) of the productive process, localized in plants situated in different countries. Vertical MNC produce intermediate goods in a country and export them in another country where they are used to produce final goods. In such a case, since the intermediate goods remain within the same firm but cross the border, there is *intrafirm* international trade. According to UNCTAD, a significant percentage[19] of international trade is intrafirm, and the greater part of FDI is horizontal. It is also possible that mixed horizontal-vertical FDI takes place.

There are several reasons for the proliferation of MNC First, the progress in production techniques has made it possible to fragment the production process in distinct segments that can be located in different places. Second, the progress in transport technologies has made less and less expensive the transfers of goods (both intermediate and final) between distant locations. Third, the progress in the service links has facilitated the coordination among the various stages of the productive process. The service links are activities like transport, insurance, telecommunications, quality control, coordination management, that make possible the interaction among the foreign affiliates, and between the foreign affiliates and the parent company. Finally, the improvement in the knowledge of the culture and of the legal and institutional system of other countries has made it easier to set up economic activities (in particular production activities) beyond the national boundaries.

[19]Percentages are subject to change over time. Updated values can be found in UNCTAD's World Investment Report.

6.8.4.1 Types and Determinants of FDI

The starting point of the theory of MNC is the observation that firms which operate in a foreign country bear higher costs than the domestic firms of the foreign country. Therefore, for a firm to become multinational, there must be benefits that offset such higher costs. These benefits are summarized in the classification OLI (acronym of *O*wnership *L*ocation *I*nternalization) due to Dunning (1977, in Ohlin et al.; see also Markusen, 2002), still useful to understand the incentives for a firm to internationalize.

(a) *Ownership* advantages. These advantages are specific to a given firm and consist of the competitive advantage that the firm has over its competitors regardless of its location. Multinational corporations usually own a particular type of capital called *knowledge capital*. It consists of human capital (managers, engineers, financial experts, etc.), patents, know-how, reputation, trademarks, etc. The main characteristics of knowledge capital are:

1. It can easily be transferred to foreign affiliates at a low cost. For example, managers, engineers and other skilled workers can visit the foreign affiliates or communicate with them from the parent company through fax, phone, e-mail, teleconferencing, etc.
2. It can be used repeatedly and in different places without depreciating: chemical formulae, blueprints, reputation etc. are very costly to produce but, once created, they can serve the foreign affiliates without losing value or productivity. This means that knowledge capital possesses some of the characteristics of public goods (essentially the non-rivalry in consumption), so that it can be considered as a public input for the firms that owns it.

(b) *Location* advantages. These advantages are specific to a given country or region, and are due to competitiveness in factor prices or to proximity to markets. With production facilities localized near final consumers, multinational enterprises cut transport costs. Furthermore, MNE can decide to localize stages of the production process which are relatively intensive in a certain factor, in a country where this factor is cheaper than in the parent company's country. This advantage is related with the principle of comparative advantage due to different relative factor endowments (see Chap. 4). For example, unskilled labour is normally cheaper in developing countries than in industrialized countries. Therefore, a MNE whose parent company is located in an industrialized country will find it profitable to move the production stages intensive in unskilled labour in a developing country, while keeping the production stages intensive in skilled labour in the parent company's country.

Finally, location advantages may derive from the possibility of avoiding trade barriers, such as import duties levied by the foreign country. Vertical multinationals may find it optimal to export intermediate inputs and knowledge capital to a foreign affiliate for the assembly, and from there to export the final product to the parent company's country.

(c) *Internalization* advantages. Ownership and location advantages could in principle be also reaped through agreements (such as licences) with foreign firms. However, the same characteristic of knowledge capital that makes it easily transferable also makes it easily dissipated. For example, licencees may absorb the knowledge capital and then defect and set up a business on their own, or they can ruin the trademark's reputation in order to satisfy their greed for gain. Therefore multinational enterprises prefer to transfer know-how etc. internally, to maintain the value of knowledge capital and prevent its dissipation.

6.8.4.2 Effects of FDI

In Sect. 6.8.4 we have examined the effects of a movement of (physical) capital in the context of the specific factors model. However, we have warned that this view does not cover the phenomenon of MNC that carry out FDI. Better to understand this statement, it is enough to consider the fact that a direct investment does *not* necessarily mean an increase in the physical capital stock of the host country. If, for example, the multinational corporation x of country 1 buys the majority of the equities of corporation y in country 2 (previously owned by country 2's residents) the only thing that has happened is an inflow of *financial capital* (the payment for the equities) into country 2, whose stock of physical capital is *exactly the same* as before. It goes without saying that insofar as the multinational x subsequently transfers entrepreneurship, known-how, etc., to y, there will be "real" effects on country 2, but this is a different story. It has indeed been observed that direct investment is strongly industry-specific: in other words, it is not so much a flow of capital from country 1 to country 2 but rather a flow of capital from industry α of country 1 to industry α of country 2.

Here we give a brief treatment of the effects of FDI on the home country and on the host country.

Effects on the home country Exports of the home country may either increase or decrease. They will decrease to the extent that the domestic firm which becomes multinational shifts abroad the production of a commodity that it produced domestically for export. But exports may also increase if the internationalization of the domestic firm is a success and so enables this firm to sell abroad more of the goods whose production has been kept at home.

The effects on domestic employment may also act in two opposite directions. In general, as treated under point b (location advantages) above, a MNE whose parent company is located in an industrialized country will tend to shift the production stages intensive in unskilled labour toward developing countries. Hence there will be a rearrangement of the labour force in the home country against unskilled labour and in favour of skilled labour (employees in the administrative, financial, marketing, R&D sectors, etc.).

Besides, the fact that some enterprises become multinational will have effects on the enterprises that remain domestic. These effects may be both positive and

negative. They will be positive to the extent that the internationalization of some enterprises generates externalities on the productivity and the competitiveness of the whole economic system. The MNE, having access to technologies present in the host countries, may "import" them in the domestic country and spread them throughout the domestic productive system. In addition, domestic enterprises may benefit from the situation if they are domestic suppliers of the MNE. In fact, these suppliers see an increase in their business with positive effects on domestic employment. However, it is very likely that the MNE will replace some domestic suppliers with suppliers located in the countries where the MNE has delocalized some stages of the productive process. In this case the domestic enterprises will have to reduce their business with negative effects on domestic employment.

A further effect on the home country is that on the sectorial composition of its productive system. As we have already said, in the case of vertical FDI the various segments of the productive process are shifted to foreign countries where the factor of which these segments make intensive use is cheaper, there will be a sectorial recomposition of the domestic productive system according to the logic of comparative advantage.

Finally, the tax revenue of the domestic country might be negatively affected by the internationalization of domestic firms. In fact, the MNE will shift some of its productive activities to countries where taxation is lower: thus the foreign affiliates' profits will be taxed a first time in the host country and a second time in the domestic country of the parent company but only insofar as they are repatriated and only if the tax rate in the domestic country is higher than that in the host country. In this last case the tax rate will be an average of the rates of the two countries. Hence the tax revenue in the domestic country falls.

Effects on the host country The effects of FDI on the host country are, in the first place, those on its entrepreneurial system and on employment. Among the positive effects we must recall that MNE transfer into the host country technology and managerial skill often not available locally. However, this transfer sometimes does not occur because of the presence of a dual market, one in which MNE operate and the other in which local enterprises operate. The former is characterized by the access to advanced technologies, know-how, contractual power, network of international relations, etc. None of this is available to the latter.

A second category of effects are those called pro-competitive. In general, MNE are considered more efficient than the local enterprises of the host country. Therefore, the operation of MNE in the local market of the host country may stimulate the competitiveness of the local entrepreneurial system. But this positive effect cannot be taken for granted. In fact, it may happen that the entry of much more efficient firms in a preexisting market causes difficulties to the local firms, which are unable to cope with the higher competition and have to leave the market (a *crowding-out* effect).

Then there are the effects on the host country's employment, which are the other side of the coin of the effects seen above on the home country. If the country of destination of FDI is, as it often happens, a developing country, there will be an

increase in the demand for unskilled labour. It should however be noted that workers which are unskilled from the point of view of the MNE might be considered skilled from the point of view of the developing country, in the sense that the MNE might in any case request a process of training to perform tasks for which the local workers are not prepared. The effects on employment are ambiguous. Usually there will be a decrease in the employment in the local enterprises (due to the crowding out effect mentioned above) and an increase in the employment in the plants of the MNE.

In addition to the effects on the level of employment, there may be effects on its volatility. MNE are generally considered as footloose enterprises, in the sense that, when the international situation makes it profitable, they can leave the host country since they have no long-run interests there. This implies that the employment generated by MNE in the host country may change in relation to the changes in the international economic situation. The effects on the level of wages are also ambiguous.

Finally, other effects on the host country are:

(i) The exploitation of the local economy, for example when the outflow of repatriated profits is greater than the inflow of FDI;
(ii) The possible decrease in its sovereignty, when the affiliate follows the directives of the parent company rather than those of the local government;
(iii) The possible checkmating of its economic policies (for example a restrictive monetary policy can be nullified by the subsidiary which has recourse to the financial market of the country of residence of the parent company).

6.8.5 Offshoring

The term offshoring refers to the decision by a firm to realize one or more stages of the production process abroad. Such stages may involve physical production of goods (typically intermediate inputs) or instead concern only immaterial services which can conveniently been carried out at distance (such as call centers, accounting services, etc.). A firm may relinquish the ownership of offshored activities (*foreign outsourcing*) or retain ownership (in this latter case we are in the presence of FDI by a multinational enterprise).

We shall return to offshoring in Chap. 17 where we shall study the effect of offshoring on wage inequality. Here we study a simplified version of the model proposed in Grossman and Rossi-Hansberg (2008) which extends the Heckscher-Ohlin set up by including the possibility of offshoring. The model highlights a fundamental trade off: offshoring is attractive for firms because it allows hiring some factors more cheaply abroad than at home but carries higher supervision and coordination costs since the different stages of the production process take place far from each other.

In the present context K and L denote, respectively, skilled labour and unskilled labour instead of capital and labour. Each factor of production performs one and

only one type of task. Tasks performed by skilled labour are denoted K-tasks while tasks performed by unskilled labour are denoted L-tasks. Production of each good requires performing each of the L-tasks and each of the K-tasks once. Let N_L and N_K be the number of L-tasks and K-tasks, and let t index tasks and assume $N_L = N_K \equiv N$. Let a_{fi} denote the input of factor f needed to perform a typical f-task in industry i of country 1; where $f = K, L$ and $i = A, B$. Goods have identical technology in terms of task inputs because they all require performing each task once. Nevertheless, goods differ in factor intensity because the parameters a_{fi} differ between goods. This assumption parallels that of different factor intensities between goods typical of the Heckscher-Ohlin model. Factor markets are assumed to be perfectly competitive and factors may freely move between industries though they are immobile between countries. In the present context, offshoring is assumed to be possible for L-tasks only. Let w_1 and w_2 denote the price of unskilled labour in countries 1 and 2, respectively. To make things simple, assume that there is a technology disadvantage of country 2 relative to country 1 represented by the parameter $\chi > 1$. Any task, when performed by firms of country 2 requires a factor input which is χ times the factor input used by firms of country 1. Therefore, any equilibrium of incomplete specialization will be such that $w_1 > w_2$ and such that offshoring, if at all, takes place from country 1 to country 2. Goods markets are perfectly competitive, trade in goods is free; thus goods prices are identical between countries. Factors price equalization does not take place given the technological difference represented by χ.

When a firm offshores a task it uses the technology available to it in its own country. Nevertheless, performing a task abroad comes at an additional costs. Such cost has a generic component which applies to all tasks and a component which differ across tasks. Specifically, when an L-task is performed in country 2 by a firm of country 1 it requires $a_{Li}\beta\delta_t$ units of L. It is assumed that $\beta\delta_t > 1$ for all t so that performing a task abroad requires larger labour input than performing it at home. The parameter β is a shifter that applies to all tasks. It could represent, for instance, the additional cost of communication when passing from face-to-face to remote communication. In this interpretation, a decline in β would represent an improvement in remote communication technology. The parameter δ_t is a parameter specific to task t. It may represent the cost of remote communication related to each specific task over and above the cost β. Tasks are ordered in such a way that $\delta_{t''} > \delta_{t'}$ for any $t'' > t'$. The fact that $\beta\delta_t > 1$ runs against offshoring but lower wages of unskilled labour in country 2 run in favour of it. In equilibrium the following no-arbitrage condition must hold:

$$\underbrace{w_1}_{\text{Unit labour cost in 1}} = \overbrace{\beta\delta_t \quad \underbrace{w_2}_{\text{Unit labour cost in 2}}}^{\text{Overall unit cost of labour in country 2 for firms of country 1}} \tag{6.6}$$

Given wages, Eq. (6.6) determines the task t^* such that the cost of performing the task at home is the same as performing it abroad; that is, it determines the number

of offshored tasks.[20] Note that if parameters δ_t were the same for all tasks than either all tasks or none would be offshored. Instead, the fact that parameters δ_t increase with t gives rise to the possibility that some but not all tasks are offshored. Equation (6.6) also shows two quite intuitive relationships. First, the larger the wage difference between countries the larger the number of offshored tasks, ceteris paribus. Second, ceteris paribus, the number of offshored tasks increases as the shift parameter declines.

Consider an initial equilibrium in which both countries produce both goods and in which there is some offshoring. Then consider an improvement in remote communication technology, represented in the model by a fall in β. The first consequence of such fall in β is that the number of offshored tasks increases as we have seen by inspection of Eq. (6.6). This, in turn reduces the marginal cost in both industries. It is interesting to note that the decline in marginal cost due to offshoring is equivalent to an increase in productivity of unskilled labour in country 1. To see this it is convenient to spell out the marginal cost of production in country 1, denoted mc_i^1, which is

$$mc_i^1 = \underbrace{w_1 a_{Li}\left(N - t^*\right)}_{\text{Cost of home } L\text{-tasks}} + \underbrace{w_2 a_{Li}\beta \sum_{t=1}^{t^*} \delta_t}_{\text{Cost of offshored } L\text{-tasks}} + \underbrace{r_1 a_{Ki} N}_{\text{Cost of } K\text{-tasks}} \tag{6.7}$$

The first addendum on the right hand side of (6.7) is the contribution of L-tasks performed at home to the marginal cost; there are $(N - t^*)$ L-tasks performed at home, each of them requires a_{Li} units of L whose unit price is w_1. The second addendum is the contribution to marginal cost of L-tasks performed abroad each of which costs $w_2 a_{Li}\beta\delta_t$. The third addendum is the contribution to marginal cost of K-tasks, where r_1 is the price of skilled labor in 1. From Eq. (6.6) we obtain $w_2 = w_1/\beta\delta_t$ which substituted into Eq. (6.7) yields

$$mc_i^1 = w_1 a_{Li}\left(N - t^* + \frac{1}{\delta_{t^*}}\sum_{t=1}^{t^*}\delta_t\right) + r_1 a_{Ki} \tag{6.8}$$

The term in parenthesis declines as t increases, which makes the marginal cost fall as t increases. Inspection of Eq. (6.8) reveals the channel through which offshoring affects the economy. Since the term in parenthesis multiplies the input coefficients a_{Li}, we can interpret offshoring as a gain in productivity of unskilled labour, it is as if unskilled labour had become more productive in country 1. It is

[20] As an example take $w_1 = 1.8$, $w_2 = 1$, $\beta = 1.5$, $t = 1 \ldots 10$, and $\delta_t = \{1.1,\ 1.2,\ 1.3,\ \ldots,\ 2\}$. Then Eq. (6.6) gives the equilibrium value for δ_t equal to 1.2, to which it corresponds $t^* = 2$. This means that two L-tasks are performed abroad and the remaining eight L-tasks are performed at home. Or, 20 % of L-tasks are offshored.

intuitive then that as a result of a decline in β the world supply of the labour intensive good will increase and that its relative price will decline. In this model, offshoring is equivalent to an increase in productivity of the home factor concerned by the offshoring activity. As per the effects on factors prices they will move according to the usual Stolper-Samuelson mechanism; the fall in the relative price of the L-intensive good runs against the relative price of unskilled labour. The real wage of skilled labour unambiguously increases and the real wage of unskilled labour may increase or decrease depending on whether the "productivity" effects dominates the adverse effect of changes in goods prices. Thus, it is possible that all factors gain from offshoring. Note that this is different from the result of liberalization of trade in goods where the relatively abundant factor gains and the relatively scarce factor loses. The reason is that the scarce factor experience the equivalent of an increase in productivity.

6.8.6 Factor Trade

Capital as a produced and traded means of production has been considered in Sect. 6.4 (as intermediate capital, together with standard immobile primary fixed capital), and will be considered in Sect. 14.1 (as fixed capital). We refer the reader to these sections, where international trade in such capital goods is analysed.

6.9 International Trade under Uncertainty

An implicit assumption in the models of international trade so far examined is that each economic agent should have precise knowledge of all the relevant data as well as the outcome of every action initiated by him. If we look at the neoclassical model treated in Chap. 3, for example, this amounts to the assumption that once the equilibrium price has been determined, production and trade occur immediately and simultaneously or, alternatively, that they take place in the future with certain outcome. In reality all economic activity is permeated by uncertainty and this is particularly true in international trade, where agents often have to make decisions without knowing the precise value of specific and crucial variables, as, for example, the terms of trade. In this regard, one only needs to remember the instability of international prices of raw materials and the consequent problems that it may create for the producing countries, which are often underdeveloped and base their development policy on forecasts as to the income from the export of these raw materials.

It must also be remembered that in the real world many production processes take a certain amount of time, in the course of which stochastic factors beyond the control of economic agents may intervene, in such a way as to alter the expected results radically. The classic example comes from agriculture, where once a certain

quantity of inputs have been used, the quantity of produce obtained depends on the weather conditions during the period of production. But problems of uncertainty may exist even on the side of consumption and on that of factor endowments. As far as factor endowments are concerned, adventitious and uncontrollable events may alter them (for example, a flood can put land out of use) and, in the same way, in the field of consumption, demand should be seen as probabilistic (in the above example, a consequence of the flood will be that landowners' income will decrease and so will their consumption of commodities, etc.).

Uncertainty can thus fall indiscriminately on any of the three basic determinants of international trade: technology, factor endowments, and demand. One might well ask whether the results of the international trade models examined in previous chapters hold true even when uncertainty of one sort or another is introduced or—if they are no longer true—whether it is possible to replace them by different, but determinate results. At the present state of the art, there is no satisfactory answer to the question except by making extremely restrictive assumptions. For example, let us consider the Ricardian model treated in Chap. 2. As we know, one of the findings of that model, once the necessary and sufficient conditions for international trade have been met, is that it is to the advantage of each of the two countries to specialize in one of the two goods, and precisely in the one in which the country has a relatively greater advantage (or a relatively lesser disadvantage).

We now introduce uncertainty, but only insofar as it affects production. This means that—using the same symbols as in Sect. 2.2—the quantity of commodity x produced with the employment of a given amount of labour is uncertain and the same applies for the quantity of commodity y. We assume that this state of affairs can be represented formally by introducing a stochastic variable ε (with mean one) in multiplicative form: in other words, as far as x is concerned, we shall have

$$x = \left(\frac{1}{a_1} L_1\right) \varepsilon. \tag{6.9}$$

We now introduce a further simplifying assumption, namely that uncertainty in the production of y can be represented by means of the same stochastic variable, so that

$$y = \left(\frac{1}{b_1} L_1\right) \varepsilon. \tag{6.10}$$

In this extremely simplified case it is obvious that it will be worthwhile for country 1 to specialize in the production of the commodity in which it has a comparative advantage (in our case commodity x). In fact, independently of the value assumed by the stochastic variable, the *ratio* between the quantities depends exclusively on the comparative cost (which is certain), as can be seen from the fact that, by calculating the ratio y/x, the variable ε (which appears in multiplicative form both at the numerator and the denominator), will cancel itself out, so that we shall again have Eq. 2.1 in Sect. 2.2. In other words, the stochastic variable has an influence only on the absolute level of the quantities produced and leaves their ratio unchanged.

The type of uncertainty mentioned is defined in the literature as *scalar uncertainty* and can be applied to any theory of international trade without altering the results. As Dumas (1980) observes, the only difference between a traditional production function

$$Y = F(K, L), \tag{6.11}$$

and a production function affected by scalar uncertainty lies in the introduction of a multiplicative stochastic variable, which causes the quantity of output also to be stochastic:

$$Y_s = \varepsilon_s F(K, L). \tag{6.12}$$

In the last formula the subscript s refers to "states of nature" (supposedly of finite number, say S) to which the various values of the stochastic variable ε correspond.

When technology is affected only by scalar uncertainty, the ratios between the quantities of a given commodity produced in different states of nature will be independent of the input combination, as can readily be seen from the fact that

$$Y_i / Y_j = \varepsilon_i F(K, L) / \varepsilon_j F(K, L) = \varepsilon_i / \varepsilon_j, \tag{6.13}$$

where i and j indicate any two states of nature.

In the case of scalar uncertainty it can be shown (see Sect. 22.8) that all the theorems of the traditional theory remain valid.

Unfortunately, as soon as the assumption of scalar uncertainty is dropped to move to more general cases (so-called *generalized uncertainty*), the situation becomes very complicated and it is not easy to demonstrate the truth of the traditional theorems (see Sect. 22.8). For a general analysis of the traditional trade model under uncertainty see Hoff (1994), see also Casprini (1979), Kemp (1976), Helpman and Razin (1978), Pomery (1979).

6.10 Illegal International Trade and the Economic Theory of Smuggling

The presence of smuggling implies a situation in which there are restrictions to trade (tariffs, quotas, etc.). It is in fact obvious that where there is free trade for all commodities there will be no scope for smuggling.

The traditional opinion was that smuggling, apart from any ethical judgement, improves economic welfare because it constitutes a (total or partial) avoidance of tariffs (or quantitative restrictions, etc.) and amounts to the (total or partial) removal of these obstacles to free trade. This action, like any other removal of restrictions to trade, increases welfare.

This opinion is, however, mistaken for two reasons. First of all, because one must consider that the thesis, according to which the removal of an obstacle to free trade definitely improves social welfare, implicitly assumes, as it does, that this removal in itself is free of costs: this is not the case with smuggling, which obviously involves costs additional to legal trade. In the second place, the basic thesis shows itself to be invalid in the light of the theory of second best (see Sect. 11.6), because in a real situation in which several violations of Pareto-optimum conditions are present, the elimination of any one of these violations may have any effect (positive or negative) on welfare. It is thus necessary to go beyond a generic statement of the above kind and construct appropriate models in which smuggling activity is explicitly incorporated in the traditional theory together with the activities of legal trade. These models have given results which for the time being are not clearly defined. This comes from the fact that the different ways in which smuggling is formally introduced will produce different results.

Like any kind of economic productive activity in the broad sense, smuggling requires the use of resources which involve costs for anyone who undertakes it. The root problem therefore is how to formalize this activity.

A first possible way was introduced by Bhagwati and Hansen (1973; but, as the authors recognize, the basic idea was already contained in an article by Cesare Beccaria in 1764, which was the first attempt to analytically examine smuggling. See also Bhagwati Ed., 1974). They assume that smuggling is an activity which "uses" one (or both) commodities—we are in fact in the context of the standard two-commodity model—and does not utilize productive factors, which means that the real costs of smuggling consist exclusively in the loss of part of the smuggled goods (through confiscation, etc.). Note incidentally that this assumption is similar to the one adopted in the traditional treatment of transport costs (Sect. 6.3). In this way it is possible to remain within the bounds of the two-commodity and two-factor model.

To analyse the effects of smuggling within this framework, it is expedient to take Fig. 10.3 from Sect. 10.5.1 (see that section for the diagram's construction details) and introduce a representation of smuggling into it (Fig. 6.11).

The price charged by smugglers will be intermediate between the international price and the domestic price inclusive of duty. It will be higher than the international price on account of the real costs of smuggling,[21] but it will be lower than the legal domestic price (the international price plus duty) because otherwise consumers would not buy smuggled commodities. We also assume, for simplicity, that the price charged by smugglers is independent of the level of smuggling, so that the illegal domestic price is constant.

It is therefore possible to represent the illegal domestic relative price as the slope, say, of the line $P_S P_S$, which, as we have said, is intermediate between that of RR

[21] One should, *de rigueur*, add the smuggler's profits to the real costs of smuggling (these profits disappear if one assumes that there is a situation of perfect competition between the smugglers themselves), in which case, to avoid problems of the assessment of the welfare associated with those profits, one may assume that the smugglers are non-residents.

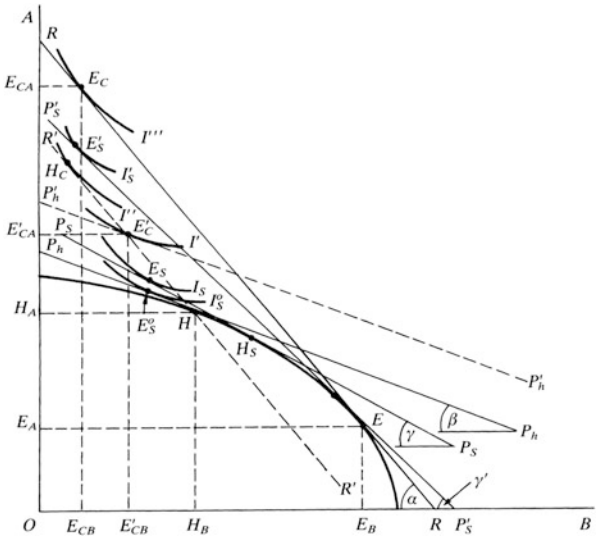

Fig. 6.11 Smuggling and social welfare

and $P_h P_h$ as $\tan\beta < \tan\gamma < \tan\alpha$.[22] As the public can now trade in the two commodities at the relative price $\tan\gamma$, the production point will be H_S and the consumption point E_S, to which there corresponds an indifference curve I_S lower than I'. Smuggling has thus caused a reduction in welfare. But it is quite possible–still on the condition that the illegal domestic relative price is intermediate between the legal one and the international relative price–that the said illegal domestic relative price is $\tan\gamma'$, in which case the consumption point will be E'_S, with welfare, represented by I'_S, *greater* than I'. It is clear that the nearer the illegal domestic relative price is to the legal one (i.e., the greater are the costs of smuggling)[23] the more probable it becomes that smuggling will bring about a reduction in welfare. In effect it is possible to state that in the purely hypothetical case in which the relative price of smuggling is equal to the legal domestic relative price, there would surely

[22] We must remember that A is the imported commodity, so that the tariff and the smuggling, which imply a greater domestic price for A than its international price, cause the relative domestic price p_B/p_A to be lower than the international price. Note that, while in the case of a tariff international trade takes place at the given international terms of trade and consumers react to signals received from the domestic relative price (see Sect. 10.5.1), in the case of smuggling, international trade also gives rise to the same domestic relative price, given the assumption that part of the commodities, after being traded on the international market, is lost through smuggling.

[23] And the greater are the smugglers' profits, see footnote 21.

be a reduction in welfare, as one can see from the fact that when $P_S P_S$ coincides with $P_h P_h$ the consumption point is E_S^0 which is on I_S^0 lower than I'.[24]

In the model we have given, smuggling and legal trade cannot coexist. In fact, when the illegal domestic relative price is more favourable to consumers than the legal price, everyone will turn to the smugglers and, on the assumption that these will not modify their price, legal trade will disappear. In reality this does not happen, and the co-existence of legal and illegal trade can be introduced into the model under examination in various ways, for example, by assuming that the price charged by the smugglers is increasing with the increase in the amount of smuggling on account of increasing costs. In the case of co-existence, it has been shown (Bhagwati & Hansen, 1973) that smuggling necessarily causes a reduction in welfare.

The analysis has been carried out so far without any account taken of the purposes for which the tariff was introduced (that is, by limiting the argument to a discussion of the de facto situation, in which the tariff is present as a historical accident). But it may also be assumed that the tariff was introduced for very precise ends, for example to protect a national industry from outside competition (see Sect. 11.2) and to obtain a given level of domestic production of the commodity in question. It can be seen then that a tariff in the absence of smuggling—while still suboptimal—is better than a tariff in the presence of smuggling (Bhagwati & Hansen, 1973). In that case, smuggling causes a reduction in welfare, as can be seen intuitively from the fact that its presence prevents (totally or in part) the achievement of the objective of production.

A second way in which smuggling can be analysed (Sheikh, 1974) is to assume that smuggling—in addition to the costs due to the risk of confiscation, etc., of the commodities smuggled—also implies the use of the same primary factors of production (capital and labour) employed in legal activities. This use is in any case indirect, in the sense that there is a third commodity produced with these factors, which is then utilized exclusively to make the smuggling possible (one can imagine for example a specific activity of transport used for smuggling: then, besides commodities A and B, we shall have commodity C).

With this way of introducing smuggling, the results obtained by Bhagwati and Hansen are no longer valid. In particular, it is no longer true that there are some cases in which smuggling necessarily reduces welfare (the case of the co-existence of legal trade and smuggling and that of a tariff introduced for a production objective), because it can be seen that also in these cases smuggling can both worsen and improve welfare. The difference in results is due to the fact that, as we are now dealing with a two-factor and three-commodity model (see above), the activity of smuggling modifies the form of the transformation curve, so that the quantities

[24]This is on the assumption that all trade is carried out by way of smuggling. If, on the other hand, legal trade and smuggling co-exist, the consumption point will be intermediate between E_S^0 and E_C' and therefore, in this case also, welfare will certainly be less than that represented by I'. The assumption of equality between the relative price of smuggling and the legal relative price is nevertheless purely hypothetical.

obtainable of the two commodities A and B are no longer definable independently of the total amount of smuggling (and therefore of the third commodity, C).

On the other hand, the fact that, by modifying the initial assumptions, we obtain a different result should come as no surprise: as usual in economic theory, by changing the structure of the model, the results may change, and the problem we are examining is no exception to that rule.

So far we have dealt with smuggling in the narrow sense, but in reality there are many other forms of illegal transactions in international trade, which might be defined as "quasi-smuggling". For example, over- and under-invoicing in the course of otherwise legal commercial transactions.

This means not only that legal and illegal trade exist side by side, but that quasi-smuggling is practised by the operators of legal trade themselves. In some countries, for example Indonesia, a great deal of the smuggling that goes on (which, unlike that analysed above, is *export smuggling*), is in fact practised by the legal exporters themselves. Legal export activity therefore provides a cover for illegal export activities: in economic terms, legal trade may be considered as an input into the smuggling activity. This idea has been formalized in some studies (see, for example, Pitt, 1981) from which it has emerged, yet again, that smuggling can both reduce and increase welfare.

It seems therefore necessary to conclude that, in general, smuggling can have either positive or negative effects on social welfare. For a general survey see Bhagwati (1981); see also Martin and Panagariya (1984), Norton (1988), and Fausti (1992).

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