INSTITUTE OF DEVELOPMENT STUDIES

WORKING PAPER

· 1 ·

February 1994

Skill, Land and Trade: a Simple Analytical Framework

ADRIAN WOOD

Preliminary material and interim research results circulated to stimulate discussion and critical comment

ISBN 1 85864 036 9

Draft: comments welcome. February 1994

SKILL, LAND AND TRADE: A SIMPLE ANALYTICAL FRAMEWORK

Adrian Wood

Institute of Development Studies, University of Sussex
Brighton BN1 9RE, England
Phone 0273 678280 Fax 0273 691647
Email A.J.B.Wood@Sussex.ac.uk

CONTENTS

1. A crucial gap 2

2. Skill categories 3

3. Comparative advantage: manufactures versus primary products 6

4. Comparative advantage: within manufacturing 12

5. Trade policy 15

6. Defence of some assumptions 17

7. Simple empirical tests 20

8. Conclusions 25

Summary. This paper proposes a minimal model of the relationship between human resources and foreign trade in developing countries, aimed at making it easier for economists working in these two fields to communicate with one another. The model combines familiar ingredients in a framework which is rigorous but not technically difficult, and simple but not unrealistic. The model is subjected to some preliminary tests, using readily available data, and various extensions and possible further research are outlined.

Acknowledgements. The author is most grateful for financial support from the UK Overseas Development Administration (through ESCOR Research Scheme R5037 and the IDS Research Programme), for research assistance from Kersti Berge, and for comments on earlier versions from participants in seminars at IDS and at the Universities of Cambridge, Manchester, Oxford and Paris.

1. A CRUCIAL GAP

The revival of interest in human resources in the 1990s (sparked partly by UNDP 1990 and World Bank 1990) has displaced foreign trade from the central position it occupied in the development debates of the 1980s. This shift, however, leaves unanswered many important questions about the relationship between human resources and trade.

From the foreign trade angle, the questions concern the human resource requirements for success in international markets. For example, to what extent did East Asian success in exporting labour-intensive manufactures depend on an initially highly literate labour force? What results can be expected from the adoption of export-oriented policies in countries where few girls go to school? Could Korea have moved up-market in manufactures without massive investment in higher education? Have recent advances in technology raised the educational requirements for competitive exports of labour-intensive goods?

From the human resource angle, the questions concern the role of foreign trade opportunities and policies in raising the returns to past investment in people, in decisions about the allocation of educational resources, and in accelerating skill formation. To what extent could under-utilisation of educated labour in some countries be reduced by different trade policies? Would the low quality of some of this education be an obstacle? How much do manufactured exports boost the demand for the unskilled labour of the poor? Should educational priorities be different in countries with large primary exports based on abundant natural resources?

Though such questions are often asked, economists are not well placed to answer them, largely because the human resource and foreign trade strands of development thinking have evolved separately. There are exceptions: various economists have brought skills and human capital into explanations of trade, some focussed on developing countries (for example, Balassa 1979, 1986 and Krueger 1983). Recent work on the theory of growth also combines human resources and trade (for example, Grossman and Helpman 1991 and Romer 1992). In general, however, human resources and trade have remained apart - studied by two different groups of development economists, each paying little attention to the other's work.

Partly as cause and partly as consequence of this separation, there is no simple and generally accepted analytical framework in which to set about answering empirical questions and debating policy issues that span the two fields. This is a crucial gap. Experience in other fields suggests that shared concepts, definitions, and causal linkages are needed for progress, both intellectual and practical.

The object of this paper is to suggest such a common framework - based on familiar ingredients, balanced between the concerns of human resource and trade specialists, and easily understandable by economists in both fields, as well as by others with a broader interest in development. To attain a common model of reasonable simplicity, of course, requires some things to be given up on both sides - and entails the risk of pleasing nobody - but market research among colleagues suggests that the particular compromises and simplifications proposed here might be widely accepted. It should be emphasised, too, that the model outlined below is minimal, and capable of being elaborated and extended in a variety of directions.

Section 2 defines and discusses the three skill categories into which the labour force is divided. Section 3 presents one half of the model, which relates the division of exports between manufactures and primary products to the balance between human and natural resources. The other half of the model, in section 4, relates the composition of manufactured exports to the skill structure of the labour force. Section 5 outlines the role of trade policy in the model, while section 6 defends some of its assumptions, and section 7 reports on some simple empirical tests.

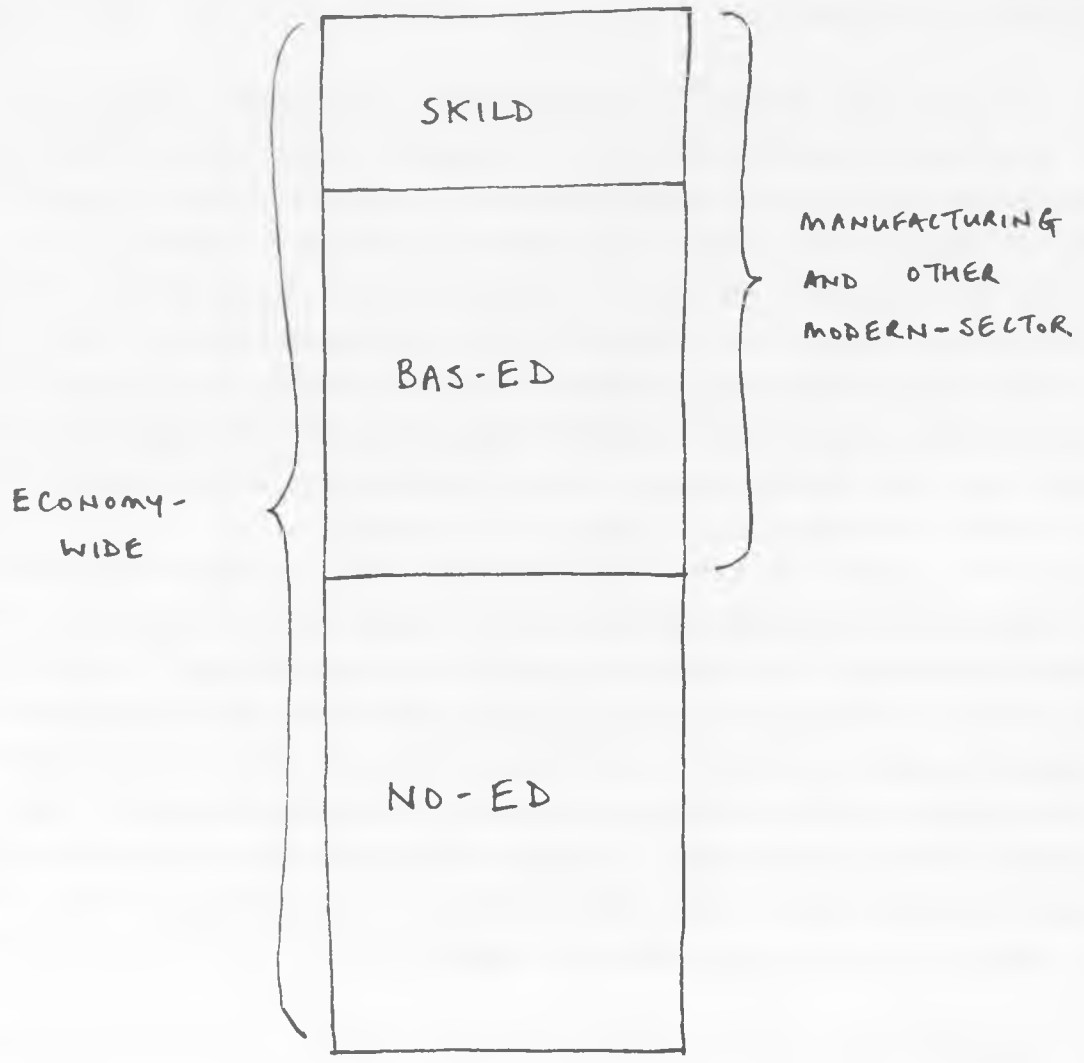
2. SKILL CATEGORIES

To model the relationship between human resources and trade in developing countries, it seems essential to divide the labour force into a minimum of three skill categories (illustrated in Figure 1).

1) NO-ED. These are workers with no (or almost no) schooling. In some developing countries (as in all developed countries) there are now few NO-EDs, but the average adult illiteracy rate in low-income countries is 40%,

Figure 1

MINIMUM BREAKDOWN OF THE LABOUR FORCE



and in lower-middle-income countries 26%, with much higher proportions in some countries (World Bank 1993, Indicators Table 1).

2) BAS-ED. These are workers with a basic general education - complete primary or lower secondary - but no more. (The label of this category is thus pronounced *base*-ed, by the way, not *bass*-ed.)

3) SKILD. This category includes all workers with substantial post-basic education and training - professional and technical workers with advanced qualifications, experienced managers, and manual craftsmen (who have been through an apprenticeship or other extended training). The label SKILD is used, rather than the normal word "skilled", as a reminder of the internal heterogeneity of this category.[1]

Merits of the categorisation

This three-way split captures some of the main concerns of those who work on human resources and development. As the emphasis on primary schooling in the literature makes clear (Colclough and Lewin 1993, Psacharopoulos 1993), the distinction between illiterate (NO-ED) and literate people is crucial. This is because of the beneficial effects which basic education has been shown to have on a wide range of indicators of well-being, both economic and social. However, human resource specialists also emphasise the importance of more advanced skills, and have argued for decades about how post-basic education and training should be provided and managed (e.g. Dougherty 1991, Godfrey 1991).

In analysing trade, too, these three categories are more useful than the usual two-way (skilled and unskilled) division of the labour force. This is because NO-EDs are of little use in modern manufacturing. The problem is partly their lack of literacy and numeracy, and partly absence of the habits of disciplined working in groups to a set timetable that prolonged schooling inculcates. But whatever the precise reasons, there is strong evidence that it is BAS-ED, not NO-ED, people who are needed as unskilled workers in manufacturing for export in developing countries.[2] To suggest,

---

1. For more information on the definition and measurement of SKILD labour, see Wood (1994a, table 4.9 and sect. A1.5).

2. See for example the survey in Lim (1980).

as trade specialists sometimes do, that a high illiteracy rate indicates "abundant unskilled labour", and hence a comparative advantage in labour-intensive manufacturing, is cruelly misleading.

For the purposes of our model, it is thus realistic as well as convenient to assume that NO-EDs are simply unemployable in manufacturing. In other words, the labour force of the manufacturing sector is assumed to consist of only two (SKILD and BAS-ED) of the three skill categories. NO-EDs are assumed to work mainly in agriculture (although in practice they are also engaged in traditional handicrafts, transport, construction and commerce). However, the agricultural labour force need not consist solely of NO-EDs: many studies have shown that literacy raises the productivity of farmers. SKILD and BAS-ED people are also employed in modern service activities.

Another convenient feature of this categorisation is that the process of raising the average skill level of a country's labour force - perhaps the most important ingredient of economic advance - can be treated simply as changing the relative numbers of people in the three groups. For example, successful development in East Asia appears to have involved a two-phase approach, with educational effort initially concentrated on reducing the share of NO-EDs to an inconsequentially low level, followed by a shift of emphasis to raising the proportion of SKILD workers.

However, a rise in the *average* level of skill in the labour force can be associated with more than one pattern of change in the *relative sizes* of different skill categories. In a backward country, for example, expansion of tertiary education would raise the SKILD/BAS-ED ratio and lower the BAS-ED/NO-ED ratio, while expansion of primary education would do the opposite. Nor, alas, is the average direction of movement always upwards - primary school enrollment rates fell in many developing countries in the 1980s.

Limits of the categorisation

This simple three-way division of the labour force thus encapsulates some essential features of reality. However, it is also important to be aware of its shortcomings. One of these is the need to draw somewhat arbitrary lines - regarding the number of years of schooling needed to be a BAS-ED worker, and the types and amount of post-basic education that qualify one

as a SKILD worker. Nor need the same lines be best for all purposes: for example, even among labour-intensive manufacturing activities, more years of schooling are preferred by employers for workers assembling electronic equipment than for workers making garments.[3] The average number of years of schooling possessed by BAS-ED workers also varies among countries.

Another shortcoming of this categorisation is that it neglects variations in educational quality (Behrman and Birdsall 1983). In some developing countries, for instance, workers who are said to have primary education or to be literate do not reach the BAS-ED standard. The attainment levels of upper-secondary school graduates also vary from country to country (e.g. IEA 1973). Finally, the mix and quality of the education and training of the many sorts of workers included in the SKILD category differ widely among countries and over time. In reality, then, the average skill level of a country's workforce can be raised not only by increasing the relative numbers of BAS-ED and SKILD workers, but also by improving the quality of skills within these two groups.

3. COMPARATIVE ADVANTAGE: MANUFACTURES VERSUS PRIMARY PRODUCTS

Human resources affect two fundamental aspects of a country's trade: (a) whether it is mainly an exporter of primary products or of manufactures, and (b) what sorts of manufactures it exports. The first aspect will be analysed in this section, the second aspect in the next section. In both sections, a simple model of the determination of comparative advantage is proposed - postponing until later a discussion of the ways in which trade policy may cause actual outcomes to diverge from comparative advantage.

Both models are based on the two-factor Heckscher-Ohlin theory of trade described in every economics textbook - although the choice of factors is somewhat unconventional. An important advantage of this framework in the present context is its familiarity to all economists - trade specialists and human resource specialists alike. However, most economists will also be aware of various criticisms of the relevance of Heckscher-Ohlin theory, against which the present models will be defended in section 6 below.

---

3. See Lim (1980), especially on Singapore.

Distinction between manufactures and primary products

In practice, it is hard to decide exactly where to draw the line between manufactures and primary products. However, the real-life distinction is sufficiently clear in most people's minds, and sufficiently well agreed by trade statisticians, that it is possible to proceed directly to comparing these two categories from a theoretical point of view.

What distinguishes one good from another in any Heckscher-Ohlin model is differences in the mixture of inputs required to produce them, or, to be more precise, in the *proportions* in which different *factors* are required, with a factor being defined as an input that is internationally immobile. Clearly, the production of both manufactures and primary commodities uses several sorts of inputs. Manufacturing requires SKILD and BAS-ED labour, capital, land (for factories), and raw materials. Primary production uses all three types of labour, capital, and land (or other natural resources).

Most raw materials are internationally traded, with low transport costs, and thus are not factors of production. This is because they are equally available to all countries, and thus cannot determine the pattern of any particular country's trade in manufactures (some exceptions are discussed later). Much the same is true of capital, whose influence on the pattern of trade appear to be rather small because of its international mobility, and will thus simply be excluded from the present model (this assumption too is defended and qualified in section 6 below).

The essential distinction, in the context of international trade, between manufactures and primary products can thus be boiled down to a difference in the proportions in which these two sorts of goods use only two broadly defined factors: skill and land (or human resources and natural resources). Both goods use both factors, but the ratio of skill (which includes BAS-ED as well as SKILD workers) to land is consistently greater in manufacturing than in primary production.

The reasons for this difference in factor proportions are largely obvious. One is that manufacturing is much more compact than agriculture - carried out on comparatively small sites and in cities, whereas agriculture needs large tracts of land. Another reason is that NO-ED labour is unemployable

in manufacturing, but can be employed in agriculture - and is so employed, in large numbers, in many developing countries. Neither of these reasons applies directly to mineral extraction, which can be carried out on small sites, and sometimes requires a highly skilled labour force. However, the *relative* cost structure of mining resembles that of farming, with a much higher ratio of rent (for land or other natural resource use) to skilled wages than in manufacturing.

This reduction to only two factors, it should be emphasised, presupposes (like most other trade models) that different sorts of natural resources can be aggregated into a single factor called land. This reduction also assumes that the three categories of labour (SKILD, BAS-ED and NO-ED) can be aggregated into a single indicator of skill - such as the total number of person-years of schooling. The sheer number of workers - or amount of labour in the usual sense - disappears from sight, because it is subsumed in the skill indicator. In other words, what distinguishes manufacturing from primary production is a higher ratio of *average skill per worker* to *land per worker*, with the absolute number of workers cancelling out.

Determinants of comparative advantage

What determines a country's comparative advantage as between manufactures and primary products in this model - as most readers will have realised by now - is its relative endowments of skill and land. The logic is standard Heckscher-Ohlin. In the absence of trade (and of offsetting differences in consumer preferences), the relative price of these two factors would depend mainly on their relative supplies. Compared to skilled labour, land would thus be cheap in a country with a high ratio of natural resources to human resources, and expensive in a country where human resources were abundant relative to natural resources.

Because of the differing proportions in which the two factors are used in manufacturing and primary production, these variations among countries in relative factor prices would cause variations in the (autarky) relative prices of these two sorts of goods. In a country with few skilled workers but a lot of natural resources, manufactures would be expensive, relative to primary products. Conversely, manufactures would be cheap, as compared with primary products, in a country with plenty of skilled workers but few

natural resources. Given the chance to trade, the former sort of country would clearly tend to export primary products and to import manufactures, and the latter sort of country to do the opposite.

What matters for trade is the *relative* supply of land and skill in each country (as compared with other countries). So a country could have many skilled workers, but still be mainly an exporter of primary products if it had an even greater endowment of natural resources (for example, oil reserves). But a country with rich natural resources would be mainly an exporter of manufactures if it were even better endowed with human resources - the United States, for example. Conversely, a country whose natural resources were meagre might nonetheless be mainly an exporter of primary products, because its supply of skilled labour was even more meagre - Ethiopia, for instance.

As these examples suggest, *absolute* supplies of land and skill are also important - but for a country's income level, rather than for its pattern of trade. This is illustrated in Figure 2, which permits each country to be positioned on two dimensions - its amount of land per worker, and its average level of skill per worker (which depends on the shares of BAS-ED and SKILD workers in its labour force). Countries which lie close to the origin are poor, since they have small supplies of both natural and human resources. Countries which lie further from the origin have higher per capita incomes, since they have more of at least one of these resources, and the richest countries are those in the top right corner, which have large supplies of both resources.

By contrast, a country's pattern of trade depends not on its distance from the origin, but on whether it lies above or below some ray from the origin. Countries above the ray tend to be net exporters of manufactures, because they have high ratios of human resources to natural resources, while those below the ray tend to be net exporters of primary products. The slope of the ray reflects the relative supply of human and natural resources in the world as a whole. Thus the greater the global abundance of skill relative to land, the steeper the ray - because a higher ratio of skill to land is then needed for any particular country to have a comparative advantage in manufacturing.

Figure 2

MANUFACTURED VERSUS PRIMARY EXPORTS

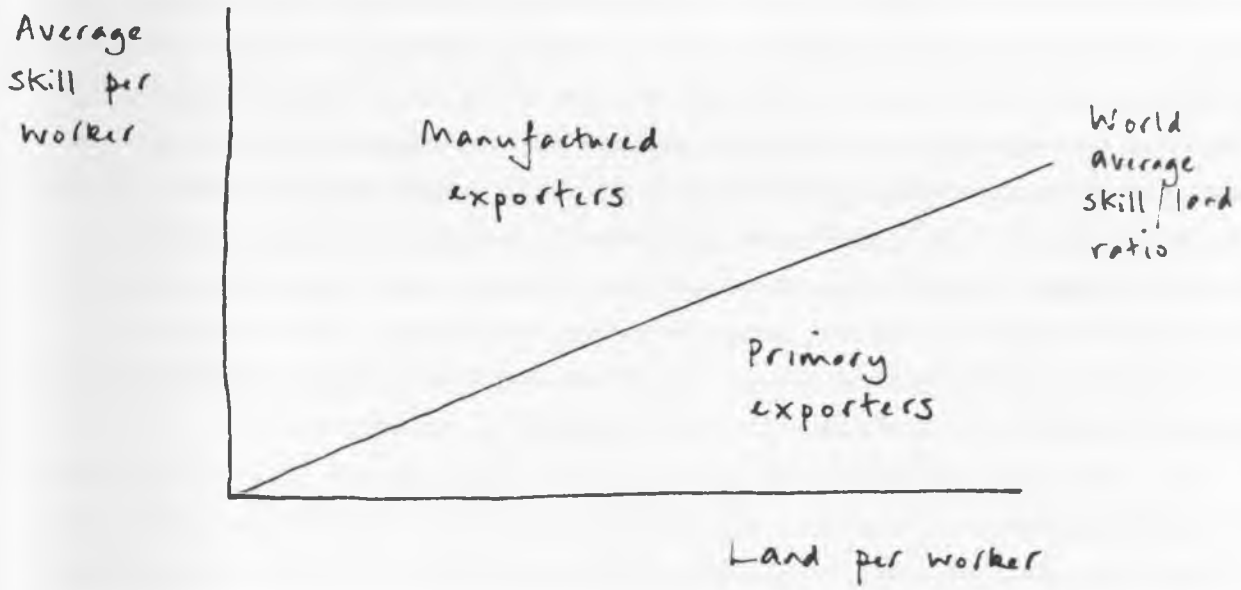
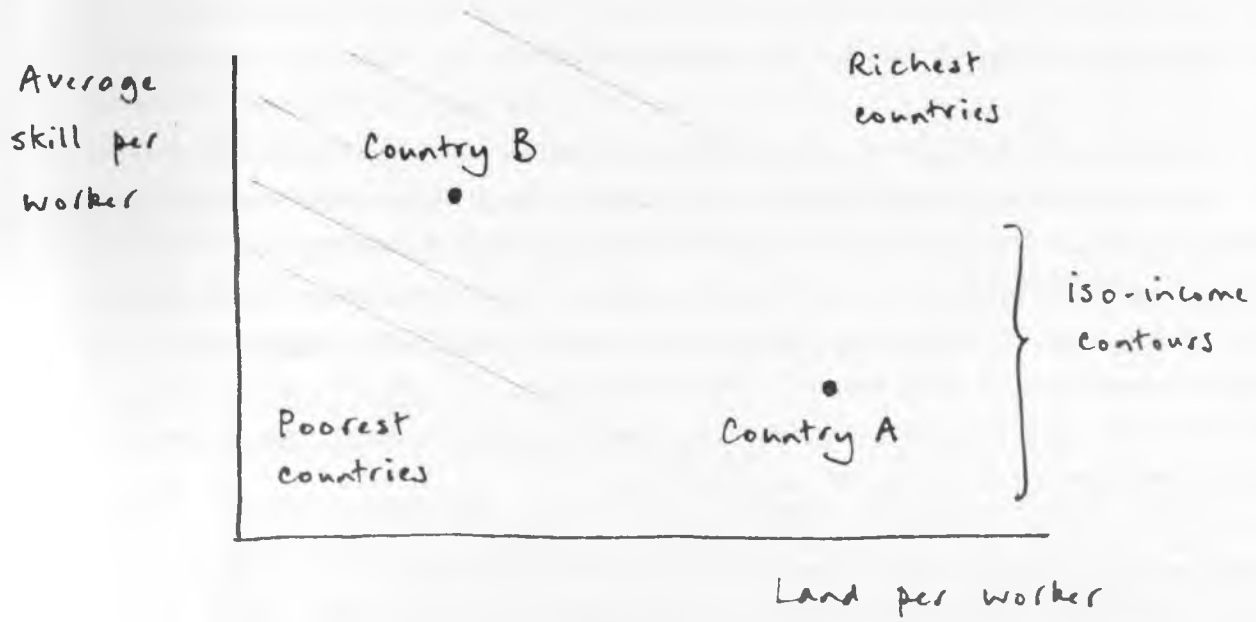


Figure 3

TERMS OF TRADE AND RELATIVE INCOMES



The relative world *demand* for manufactures and primary products (and thus indirectly for skill and land) does not affect the slope of this ray, but it does affect the relative world prices of the two goods and thus of the two factors - and hence the relative income levels of different countries. For example, the lower the global demand for primary products, relative to manufactures, the poorer will countries with low skill/land ratios tend to be, relative to countries with high skill/land ratios. This is shown in Figure 3, by adding iso-income contours to Figure 2 (which requires the strong assumption that all countries make equally productive use of their resources). These contours are parallel lines, whose slope depends on the relative world prices of primary products and manufactures. Thus if the price of primary products were lower, the lines would be flatter, which would make country A in the figure poorer relative to country B.

Paths of development

Although Figure 2 has thus far been discussed in terms of the positions of different countries at one moment of time, it can also be used to describe the dynamics of development. Progress in this diagram consists mainly of movement upwards - that is, raising the average skill level of a country's labour force, which makes the country richer, moving it further away from the origin. This gain is likely to be partly offset by drift to the left, as population growth reduces the amount of land per worker. Both sorts of movement, however, tend to have the same effect on a country's pattern of trade - raising the ratio of skill to land, and thus shifting the country away from primary exports and towards manufactures.

The development paths followed by different countries, as they raise the skill levels of their labour forces, will clearly vary according to their starting points in the land-per-worker dimension. Thus a country with more natural resources will tend to start with (and maintain) a higher level of income than a country with fewer natural resources. A country with more natural resources will also remain a net exporter of primary products for longer: that is, it will have to attain a higher level of skill per worker before it becomes an exporter of manufactures.

In considering the development path of a particular country, it has to be borne in mind that other countries are developing, too, and that change in

trade depends on a country's progress *relative* to that of other countries. The accumulation of skills in the rest of the world can be represented in Figure 2 as the ray from the origin getting steeper over time. To shift from exporting primary products to exporting manufactures, a country must thus not only raise the skill level of its labour force, but do so faster than other countries. In terms of the diagram, it must chase and overtake the ever-steepening ray from the origin. Success in this regard would also tend to raise the country's relative income per capita - to move it up the world income ranking. Any upward movement, however, even if slower than the ray, would tend to raise the *absolute* level of a country's income.

Processed primary products and services

The dividing line between manufactures and primary products has thus far been taken for granted. In the present model, the position of this line depends crucially on the international mobility of the raw materials used in an activity. Raw materials for manufacturing were assumed above to be highly mobile. However, some such materials are heavy or bulky, relative to the final product, and hence transport costs provide a strong economic incentive to process them close to the natural resources from which they are obtained. From the point of view of the present model, activities of this kind, being tied to natural resources, should be treated as primary production - although the line (based on transport costs) which separates them from manufactures is bound to be somewhat arbitrary.[4]

The definition of manufactures required by the present model is close to that which is actually used by trade statisticians - categories 5-8 of the Standard International Trade Classification (SITC), minus sub-category 68 (nonferrous metals), with primary products being categories 0-4 plus 68.[5] This definition, it should be noted, differs from that used in employment and production statistics, where manufactures are the much broader category 3 of the International Standard Industrial Classification (ISIC), and the

---

4. See the discussion of this point in Krueger et al (1981: 15).

5. These are the definitions used in, for example, UNCTAD and GATT data. The dividing line is not based on one consistent level of transport costs: thus some processed primary products belong in the manufactures category, and vice versa. But the practices of trade statisticians follow more or less the same logic as Heckscher-Ohlin theory.

definition of primary products is correspondingly narrower. The difference between the SITC and the ISIC definitions of manufactures consists mainly of food, beverages and tobacco, refined petroleum, leather, lumber, pulp and paper, and nonferrous metals - to which it is convenient to give the collective label of "processed primary products".[6]

Another advantage of the present narrow definition of manufactures is that it can be extended without difficulty to cover traded services, which are now an important (though ill-documented) component of world trade. This is because services, like narrow manufactures, use little land and are not tied to other natural resources. And as with manufactures, the other key determinant of comparative advantage in trade in services is availability of skilled labour. The term "manufactures" should thus be interpreted in the context of the present model as embracing also traded services.

4. COMPARATIVE ADVANTAGE: WITHIN MANUFACTURING

Any useful theory of human resources, trade and development must split up manufactures. There are large and obviously important differences between low-priced shirts and shoes, say, and high-priced chemicals and machinery. This section analyses these differences in the framework of another simple Heckscher-Ohlin model. (There is less need, in the context of this paper, to split up primary products, since the mix of items that countries export and import depends largely on the composition of their natural resources, and is much less influenced by their human resources.)

Skill hierarchy

The essential respect in which manufactures vary, in reality as well as in the present model, concerns their skill intensity. The crucial difference between shirts and chemicals from the point of view of international trade, in other words, is that the production of chemicals requires a more highly skilled labour force than the production of shirts.

In the present model, the skill intensity of particular manufactured goods is measured by the ratio of SKILD to BAS-ED workers needed to produce them

---

6. See Berthet-Bondet et al (1988) and Wood (1991, table 1).

(at any given SKILD/BAS-ED wage ratio). This convenient formulation takes advantage of the earlier assumption that NO-ED workers are unemployable in manufacturing. The simplest specification would be to have only two sorts of manufactures - skill-intensive (or "sophisticated" or "high-tech"), and labour-intensive (or "simple" or "standard"). In the real world, however, manufactures are spread out along a continuum or hierarchy of SKILD/BAS-ED ratios, which can be divided into as many discrete segments as desired.

A country's comparative advantage within manufacturing is thus determined by its relative supplies of SKILD and BAS-ED labour, the logic again being standard Heckscher-Ohlin. Suppose, to begin with, that there are only two sorts of manufactures, and only two groups of countries in the world - the North, with a high ratio of SKILD to BAS-ED workers, and the South, with a low ratio. SKILD labour thus tends to be relatively cheaper in the North than in the South, enabling the North to produce the skill-intensive good relatively more cheaply than in the South. Given opportunities for trade, the North will thus tend to export the skill-intensive good and to import the labour-intensive good, while the South will do the opposite.

This initial version of the model can easily be extended, with more than two manufactured goods, or more than two country groups - distinguished by their SKILD/BAS-ED supply ratios. Figure 4, for example, has three goods (of high, medium and low skill intensity) and three groups of countries - splitting the South between a Middle group and a Low group. Each country group specialises in one of the goods (or, more generally, in one segment of the skill intensity continuum of goods, with minor overlaps at the edges).[7] Thus, for example, the Middle group exports goods of medium skill intensity to both other groups, while importing more skill-intensive goods from the North and less skill-intensive goods from the Low group.

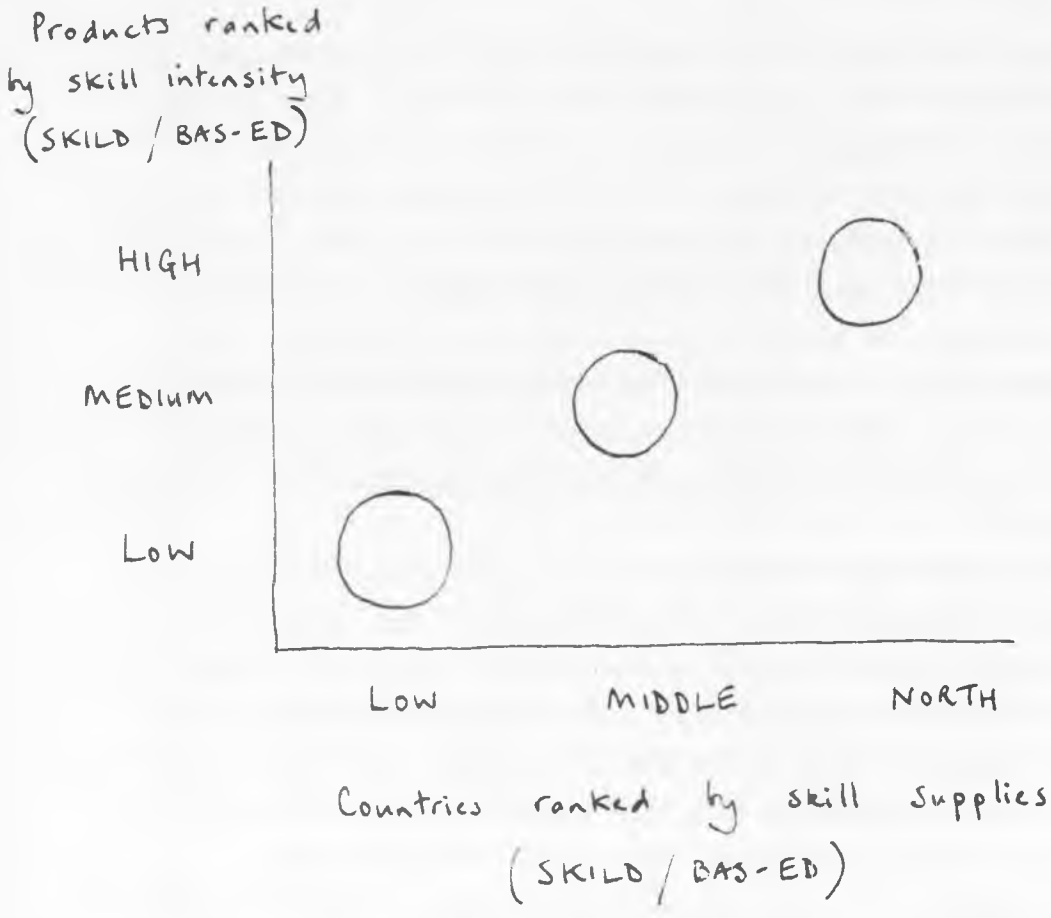
Development dynamics

As with the model in the previous section, this account of comparative advantage within manufacturing can also be used to analyse movements through time. Consider, for example, a country with a rising ratio of SKILD to BAS-ED labour, due to expansion of tertiary education. As this

7. For a fuller discussion of this sort of model, with some variations in the numbers of countries and commodities, see Wood (1994a, ch. 9).

Figure 4

COMPARATIVE ADVANTAGE WITHIN MANUFACTURING



supply ratio rises, the wages of SKILD workers tend to fall, relative to BAS-ED workers, which tends to shift the country's comparative advantage towards more skill-intensive manufactures (unless the SKILD/BAS-ED labour ratios of its trading partners are rising even faster). In Figure 4, such a country would move up the skill hierarchy, away from the origin.

How does this aspect of development dynamics relate to that discussed in the previous section? Or, to put the question in a more general way, what is the relationship between the two sub-models of the present framework?

Within limits, the two sub-models are independent of one another. Thus, for instance, reducing the share of NO-EDs could raise the average skill level of a country's labour force, and so tend to shift its comparative advantage away from primary products, without altering its ratio of SKILD to BAS-ED labour and hence its comparative advantage within manufacturing. Conversely, it would be possible for a country, by shifting resources from primary to tertiary education, to increase its SKILD/BAS-ED labour supply ratio without raising the average skill level of its labour force (since the shares of both SKILD and NO-ED workers would be enlarged).

However, the independence of these two dimensions clearly depends on the existence of a substantial number of NO-ED workers, and is thus mainly of relevance to countries at a low level of development. Where the share of NO-EDs is small - let us say zero for simplicity - the two dimensions are locked together. The only way to increase the average skill level of the labour force is to raise the ratio of SKILD to BAS-ED workers (so long as the assumption of a given level of skill in each category is maintained), and any change in the SKILD/BAS-ED ratio necessarily implies a change in the average skill level of the labour force.

In practice, therefore, and especially in more advanced countries, it is often important to consider both sub-models simultaneously. For example, to move from the bottom to the top of the ladder of development, a country would have to transform its labour force from one that consisted mainly of NO-EDs to one that consisted mainly of SKILD workers. This would cause it to advance in both dimensions - from primary exports to manufactures, and from labour-intensive to skill-intensive manufacturing.

Even if the origin and destination of this development journey are given, though, there are many possible paths in between, which the two sub-models can be used to disentangle. One determinant of the path taken is clearly educational policy, and in particular the relative priority given to basic and post-basic education in the early stages of development. Another is the extent of a country's natural resources. For instance, a country with a lot of land per worker would tend to start to export manufactures later, but at a higher level of skill intensity - since by that stage it might have achieved quite a high ratio of SKILD to BAS-ED labour.

Various other issues could be analysed within this framework. One is the evolution of income inequality in the course of development, which depends on the way in which the relative wages and relative numbers in the three skill groups change, and on changes in the relative scarcity of skill and land (as well as on the pattern of ownership of land). Another issue is trends in the global terms of trade, not only between primary products and manufactures, but also among manufactures of varying skill intensity (see for example Wood 1994a, ch. 9).

5. TRADE POLICY

A further issue which demands analysis within the present framework is the impact of trade policy. A proper examination of this issue lies beyond the scope of this paper, but the terrain may be briefly surveyed.

Static effects

Trade policy can cause a country's actual pattern of trade to diverge from its comparative advantage - the pattern implied by its relative supplies of skilled labour and land. To the extent that this is the case, the two sub-models are bound to be less accurate as descriptions of reality. However, they may still be reasonably accurate for most countries - and in any event remain useful for predicting the consequences of changes in trade policy.

Consider, for instance, the classic case of a country which protects all its manufacturing activities. The effects - and thus the consequences of liberalising the trade regime - will vary, depending on where the country is located in the skill/land and SKILD/BAS-ED labour dimensions. If its

comparative advantage lay in primary exports, this protection would alter the composition of domestic production (in favour of manufacturing), and reduce the overall level of its trade, but would probably not much affect the *composition* of its trade (its exports would still consist mainly of primary products and its imports mainly of manufactures).

By contrast, if the country's comparative advantage lay in manufactures, protection would have more of an effect on the composition of its trade, and might cause its actual exports to consist mainly of primary products (as well as being smaller in total than with a more open trade regime). There would also be an effect on the composition of production within its manufacturing sector, with less specialisation in a particular segment of the hierarchy of skill intensity. Thus for example a poor country would make more skill-intensive goods and fewer labour-intensive goods than if its trade regime were more open, and vice versa in a rich country.

Dynamic effects

Up to this point, it has been assumed that the skills of the labour force are exogenous - and in particular that the relative numbers of workers in the three skill categories are not influenced by a country's trade pattern or policies. One obvious reason why this is unlikely to be strictly true is that the relative supply of labour to each category must depend to some extent on its relative wage, which in turn must be affected by the pattern of trade. For example, liberalisation of trade policy in a country with a comparative advantage in manufacturing would boost the demand for educated relative to NO-ED labour, which would encourage more parents to send their children to school. However, this sort of supply elasticity tends merely to strengthen a country's existing comparative advantage (as was noted by Ohlin 1933, 1967: 81-2), leaving the outcome qualitatively unaltered.

A potentially more fundamental issue is the effect of trade on the supply of SKILD labour. Research - and common sense - shows that the acquisition of economically useful skills beyond the level of basic schooling requires not only advanced formal education or training, but also experience or on-the-job training. Thus, for example, expansion of tertiary education is a necessary but not sufficient condition for a country to raise its ratio of SKILD to BAS-ED workers (and move up the skill intensity hierarchy). The

tertiary graduates must also get relevant experience - and in this regard trade policies exert an important, though complex, influence.

On the one hand, trade provides many opportunities to acquire practical knowledge and experience - so that trade barriers tend to reduce learning by restricting opportunities to work with imported materials and equipment, or to make and market certain goods on world markets. On the other hand, however, trade restrictions can provide opportunities to learn which would not exist with a more open trade regime. The infant industry argument for protection is all about skill acquisition. Moreover, the countries which have been most successful at catching up in skills - France, Germany and the US in the nineteenth century, Japan, Korea and Taiwan more recently - do not appear to have practiced free trade.

6. DEFENCE OF SOME ASSUMPTIONS

All models are simplifications of a complex reality, which must be judged not on the literal accuracy of their assumptions, but on their usefulness for organising thought and research. However, some of the assumptions of the present model are likely to strike some readers as so unrealistic that they demand some defence here. (For a fuller discussion, see Wood 1994a, sections 2.2, 2.3, 3.2 and 3.5.)

Heckscher-Ohlin theory

Although Heckscher-Ohlin theory is known to all economists, and taught to all students, the assumptions on which it is based are widely regarded as "incredible" (Leamer 1984: 45). Partly for this reason, research on trade has come to focus increasingly on other sorts of theory (Helpman 1989).

The most often-challenged of the Heckscher-Ohlin assumptions is that all countries have access to the same technology. This is not strictly true, but can be defended as an initial approximation, provided that technology is defined as *knowledge embodied in material objects* - especially capital and intermediate goods. Some such goods are available only in particular countries (for example because patent-holders refuse to license them), but the great majority are internationally traded, and so equally available in all countries. What varies much more widely among countries is *knowledge*

embodied in people - or skill - on which the capacity to make economic use of advanced technology often depends. The present model thus captures the deepest meaning of the common proposition that developing countries are "technologically backward", namely that they have few skilled workers.

Another unloved assumption of Heckscher-Ohlin theory is constant returns to scale, which new trade (and new growth) theory has replaced with a strong emphasis on increasing returns. Scale economies are undoubtedly important in explaining trade in specific varieties of manufactured goods, but have much less influence on the broad pattern of trade with which the present model is concerned. One notable exception to this generalisation is that SKILD workers seem to be more productive when they are clustered together - in countries where they are relatively numerous, and in skill-intensive activities.[8] As it happens, however, this exception reinforces (rather than contradicts) the Heckscher-Ohlin point that countries with abundant skilled labour have a comparative advantage in skill-intensive goods.

A third concern is that Heckscher-Ohlin theory implies that factor prices are equalised across countries, which is clearly untrue, particularly for wages. However, even in its strong modern form (as contrasted with the weaker form in which it was originally set out by Ohlin), the theory does not always imply factor price equalisation. In particular, when countries vary widely in their relative factor supplies, they tend to specialise in the production of particular goods (as is assumed for example in Figure 4 above), and thus trade causes factor prices to move only part of the way towards equality.[9]

Specialisation, it should be noted, is not sufficient to explain all the observed facts about international differences in wages. For example, it can explain why BAS-ED workers (and land) in developed countries are paid more than in developing countries, because they are scarcer, but not why this is also the case for SKILD workers (who in Heckscher-Ohlin theory,

---

8. See the discussion and references in Wood (1994a: 55, 137).

9. Non-equalisation of factor prices also eliminates the need to make the unrealistic assumption of identical homothetic preferences in all countries (Helpman 1984). Another common concern about Heckscher-Ohlin models is the possibility of factor intensity reversal: in practice, however, this does not appear to be a serious problem (Wood 1994a: 42, 112-12).

with access to the same technology, should earn absolutely less in developed countries). The higher earnings of SKILD workers in developed countries may be explained as a result partly of superior infrastructure, and partly of the economies of clustering mentioned above.

Exclusion of capital

To exclude capital from the present model may seem particularly odd, since almost all expositions and applications of Heckscher-Ohlin theory take one of the factors to be capital. However, the arguments for *including* capital in this sort of model are actually rather weak (Wood 1994a, sect. 2.2, and 1994b). Machines are internationally mobile, and buildings can be erected anywhere in a year or two, which makes it hard to argue that capital *goods* are a fundamental basis of comparative advantage. Nor is there much inter-country variation in real *interest rates*, partly because financial capital too is internationally mobile, which undermines the main theoretical basis for treating capital as a determinant of the pattern of trade.

The case for excluding capital is strengthened by the long history of odd results from empirical tests of Heckscher-Ohlin models that include capital as a factor of production (see e.g. Findlay and Kierzkowski 1983: 958-9 and Deardorff 1984a: 478-93). These results are often seen as casting doubt on the whole of Heckscher-Ohlin theory, but a more plausible interpretation is that their oddity arises from a basic mis-specification of the influence of capital (Gaisford 1993, Wood 1994b). In particular, most of these tests treat capital as if it were a non-reproducible and internationally immobile input, like land, which is clearly wrong.

There is one type of physical capital that *can* reasonably be treated like land, namely infrastructure, which is immobile and takes long periods of time to construct. There are thus large and persistent differences among countries (most notably between North and South) in the extent and quality of infrastructure. These differences affect the extent of trade, which is hampered by poor transport facilities, and also its commodity composition, for instance by giving the South a comparative disadvantage in goods whose production requires a reliable electricity supply. But the only available piece of empirical research (Clague 1991) suggests that this effect on the composition of trade is of second-order importance.

To "exclude capital" from the present model is not, of course, to deny the importance of capital as an input to production, or to neglect the role of physical investment in economic development. It implies only that capital is not a "factor of production" in the particular sense in which this term is used in Heckscher-Ohlin trade theory - for whose purposes it is usually better to think of capital as an intermediate input.

This treatment of capital, moreover, can be reconciled with the apparently contradictory approach of other well-known Heckscher-Ohlin models of trade and development - Krueger (1977), Deardorff (1984b), Leamer (1987) and the various works of Chenery and Syrquin (e.g. 1975). These models all regard development as a process of capital accumulation, which shifts a country's comparative advantage towards more capital-intensive exports. Their usual view of "capital" is *physical*, but their analytical insights remain intact if capital is interpreted instead as *human* - or, even more simply, if the word "capital" is replaced throughout by the word "skill".

7. SIMPLE EMPIRICAL TESTS

Proper statistical testing of the analytical framework outlined above lies outside the scope of this paper. However, it is worth briefly subjecting the model to some simple tests - simple both in the sense of not using the formal methodology for testing Heckscher-Ohlin theory (Wood 1994a, section 3.5.2), and in the sense of using readily available sources of data. The two tests - one for each sub-model - ask how well the pattern of trade is explained by the suggested determinants of comparative advantage.

Manufactured versus primary exports

The essence of this sub-model is that the ratio of a country's exports of manufactures (X_m) to its exports of primary products (X_p) is determined by its relative endowments of human resources (HR) and natural resources (NR). For many purposes, it is more convenient (as in Figures 2 and 3 above) to express this endowment ratio in terms of skill per worker (hr = HR/L) and land per worker (nr = NR/L), making these variables independent of country size. A simple and flexible specification of the relationship is then

$$(X_m/X_p) = A(HR/NR)^{\alpha} = A(hr/nr)^{\alpha} \qquad (1)$$

where A and α are parameters. Equation (1) can be estimated in (natural) logs - denoted by $\hat{}$ over the variable - as

$$(\hat{X_m}/\hat{X_p}) = a + b(\hat{hr}/\hat{nr}) + u, \text{ or equivalently} \qquad (2a)$$

$$(\hat{X_m}/\hat{X_p}) = a + c.\hat{hr} - d.\hat{nr} + u \qquad (2b)$$

where a should be $\hat{A}$; b, c and d should all be estimates of α; and u is the error term.

Equations (2a) and (2b) were estimated for the largest possible number of countries (114) with a population above one million - as in the Indicators tables of the *World Development Report* - in the most recent available year. The trade data, mainly for 1989, are from the UNCTAD *Handbook of Trade and Development Statistics* (1991, table 4.1), using the conventional division between primary exports (SITC 0-4 plus 68) and manufactured exports (SITC 5-8 minus 68).[10] Skill per worker is measured by the average number of years of schooling of the adult (over 25) population in 1985 (from Barro and Lee 1993, supplemented in a few cases from the UNDP *Human Development Report*). This measure may be interpreted as a weighted average of the labour force shares of SKILD, BAS-ED and NO-ED workers, with mean years of schooling in each category as the weights.[11]

Natural resources are measured simply by each country's total land area (divided by its adult population to obtain land per worker, nr). This is clearly not an ideal measure of NR, since it ignores all differences among countries in the composition and quality of their land, but at least it is

---

10. These are gross exports. Experiments with net exports, which in theory are preferable, gave similar results. Incidentally, the data on Taiwan for all variables are from the *Statistical Yearbook of the Republic of China*.

11. For example, if NO-ED, BAS-ED, and SKILD workers constituted 40%, 50% and 10% of the labour force, respectively, and averaged 0, 8 and 16 years of schooling, the weighted average would be (0.4x0 + 0.5x8 + 0.1x16) = 5.6 years for the labour force as a whole. A weakness of this interpretation is that the average number of years of schooling in each category varies among countries - see section 2 above.

an unbiassed measure.[12] This is because what each country has, per square kilometre of its surface area, in terms of soil fertility, water resources, minerals, and so on, can be regarded as the outcome of a random draw.

The estimated OLS regression of equation (2b) is

$$(\bar{X}_m/\bar{X}_p) = \underset{(0.46)}{0.88} + \underset{(0.14)}{0.81}\bar{hr} - \underset{(0.09)}{0.70}\bar{nr} \qquad R^2 = 0.57 \qquad (3)$$

with standard errors in parentheses. Three features of this result merit comment.

(a) The coefficients on both independent variables are significantly different from zero at better than the 1 percent level (on a two-tailed t-test). This confirms that the ratio of a country's primary exports to its manufactured exports is determined both by its natural resources and by the skill level of its labour force. (An alternative hypothesis would be that this trade ratio is determined solely by the extent of a country's natural resources relative to its population - land per worker - in which case the coefficient on the hr variable should have been insignificant.)

(b) The coefficients on the human and natural resource variables are not significantly different in size, which supports the argument of this paper that the manufactured/primary export ratio is governed simply by the *ratio* of HR to NR (or of hr to nr). In other words, it justifies the use of specifications (1) and (2a), which would be less appropriate if the true relationship were, for example, $X_m/X_p = A.hr^{\alpha}nr^{-\phi}$ (with unequal α and ϕ). Direct estimation of equation (2a) by OLS thus predictably yields

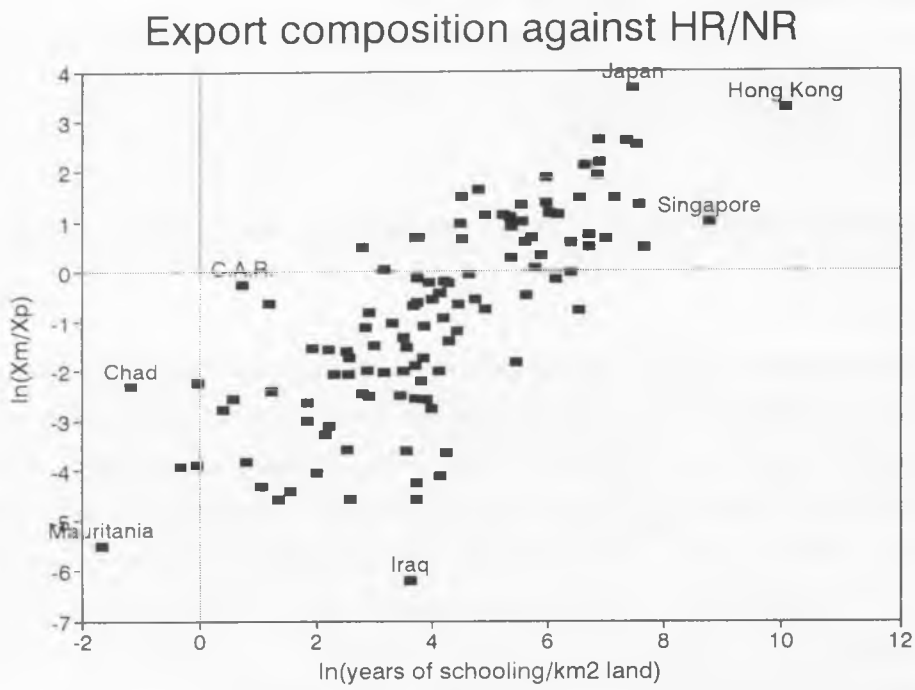
$$(\bar{X}_m/\bar{X}_p) = \underset{(0.21)}{1.14} + \underset{(0.06)}{0.73}(\bar{hr}/\bar{nr}) \qquad R^2 = 0.57 \qquad (4)$$

with, again, a highly significant coefficient on the independent variable, and virtually the same R^2. Equation (4) can conveniently be plotted as a scatter diagram, shown in Figure 5 (in which the units of the independent

---

12. The land area data are from the *World Development Report* (Indicators Table 1).

Figure 5


Export composition against HR/NR
Japan
Hong Kong
Singapore
C.A.R.
Chad
Mauritania
Iraq
ln(Xm/Xp)
ln(years of schooling/km2 land)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-2
0
2
4
6
8
10
12

variable have been scaled up so that hr/nr - unlogged - is simply years of schooling per square km).[13]

(c) The R^2 of 0.57 is surprisingly high, given the simplicity of the model (which omits, among other things, the influence of trade policy), and the obvious weaknesses of the measures of both human and natural resources. As the scatter diagram confirms, a substantial part of the variation in the manufactured/primary export ratio is *not* explained by the model, indicating the need for further work to improve the specification of the model and its variables. What seems more striking, though, is the proportion of variance which this extremely simple model *does* explain.

Composition of manufactured exports

The second sub-model postulates that the skill composition of a country's manufactured exports depends on its ratio of SKILD to BAS-ED labour. For example, assuming the same general relationship as in the other sub-model,

$$(X_{ms}/X_{mb}) = B(N_s/N_b)^{\beta}, \qquad (5)$$

where X_{ms} and X_{mb} are, respectively, skill-intensive and unskilled (or BAS-ED) labour-intensive manufactured exports, and N_s and N_b are the numbers of SKILD and BAS-ED workers.

The data again refer to a cross-section of countries, in the most recent available year. However, the number of countries in the sample is smaller (77), partly for lack of the necessary data, and partly because it seemed sensible to exclude countries where manufactures account for less than 10% of total exports.[14]

The only skill-related breakdown of manufactured exports easily available in standard statistical sources is that between SITC 5 + 7 (chemicals and

---

13. The only effect of this rescaling on the regression is to reduce the intercept. The figure shows that the data are heteroscedastic. However, the use of White's heteroscedasticity-consistent estimator made little difference to the results.

14. If all countries with data are included, raising the sample size to 95, the size and significance of the coefficients in equation (7) stay more or less the same, but the R^2 is reduced slightly (from 0.19 to 0.17).

machinery and equipment) and SITC 6 + 8 (everything else). The shares of skill-intensive items in SITC 5 and 7 are usually higher than in 6 and 8 (Leamer 1984, ch. 3; Wood 1994a, ch. 3). However, all four of these broad SITC categories contain goods of widely varying skill intensities, making this breakdown (again obtained from the 1991 UNCTAD *Handbook of Trade and Development Statistics*) far from satisfactory. Not least, the electronic assembly operations that now generate a large share of the manufactured exports of developing countries are in SITC 7, although they are clearly BAS-ED-intensive: a rough adjustment was thus made to move these exports into the X_{mb} category, using data from the *World Development Report*.[15]

SKILD and BAS-ED workers are distinguished simply by their number of years of schooling (for lack of data on skills acquired in other ways). More specifically, SKILD workers are defined as those with a complete secondary or tertiary education, and BAS-ED workers as those with more than zero but less than complete secondary schooling.[16] In most schooling systems, this dividing line (between lower and upper secondary or junior and senior high school) occurs at about 9 years of schooling.[17] The data, which refer to 1985, are from Barro and Lee (1993, table A.2).

Preliminary estimation experiments using the logarithmic transformation of equation (5) suggested that ß is approximately unity. They also generated an unreadably bunched scatter diagram. It thus seemed better to work with the unlogged form

---

15. Indicators Table 17 of the *WDR* contains data by country of origin on OECD imports of electrical machinery and electronics. For all developing countries (low- and middle-income, plus Hong Kong and Singapore), these imports (adjusted for the cif-fob margin) were subtracted from SITC 5 + 7 exports, and added to SITC 6 + 8. In Haiti and the Philippines the SITC 5 + 7 residuals were negative, and set to zero. The main effect of this adjustment on regression (7) is to raise its R^2 (from 0.15 to 0.19).

16. In principle, people with only a couple of years of primary schooling should be NO-EDs rather than BAS-EDs, but treating those with "incomplete primary school" in this way generates worse statistical results, probably because countries vary in the length of their primary cycles and in the typical degree of incompleteness.

17. An attempt was made to impose a uniform 9-year dividing line, based on information about the length of the primary and secondary school cycles in each country, but this could not be done accurately (partly because of the need to interpolate and partly because in some countries the length of the cycles changed), and using the resulting variable made the fit of equation (7) slightly worse.

$$(X_{ms}/X_{mb}) = a + b(N_s/N_b) + u \qquad (6)$$

where b is an estimate of B, and a should be zero. The data are plotted in Figure 6 as a scatter diagram, and the OLS regression is

$$(X_{ms}/X_{mb}) = \underset{(0.12)}{0.48} + \underset{(0.23)}{0.98}(N_s/N_b) \qquad R^2 = 0.19 \qquad (7)$$

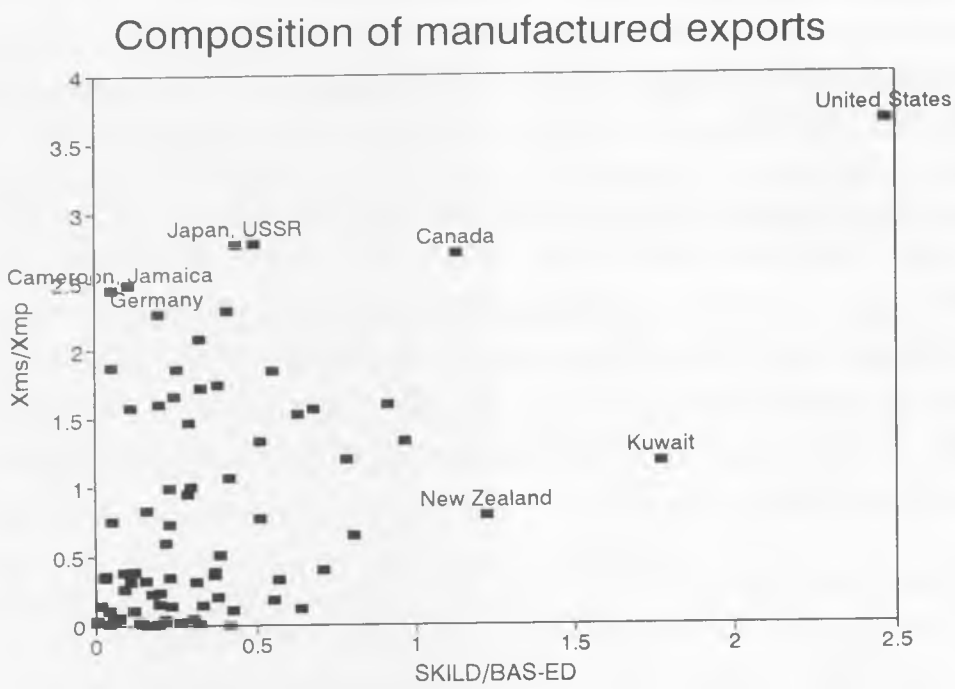
The coefficient on (N_s/N_b) is of the right sign and significant at better than the 1% level, and the constant term is not far (though significantly different) from zero. The fit of the regression is not particularly good, as would be expected from the scatter, which also reveals that the result depends heavily on one outlier: the USA. If this observation is excluded, the coefficient on (N_s/N_b) remains similar in size and significant at the 2% level, but R^2 is halved (to 0.08).

Clearly, this sub-model does not work so well as the previous one, though the results suggest that the theoretically postulated relationship exists. One obvious reason for the poor fit is the unsatisfactory proxies used to measure both the dependent and the independent variables, which imply, for example, that Cameroon has highly skill-intensive manufactured exports and that Germany has a low-skilled labour force. More refined studies show a stronger relationship between skill supplies and the skill composition of manufactured exports (Wood 1994a, ch. 3), but it is not easy to find better data for large samples of countries.

8. CONCLUSIONS

These statistical tests should be regarded as preliminary - intended only to show that the theoretical relationships in the present model correspond with some readily measurable features of reality. Nor, indeed, should the theoretical framework proposed here be judged simply by its performance in such tests: a more important criterion is its prospective usefulness as a starting point for further work on trade, skills and development. In this light, it is hoped that the model will appeal to both trade economists and human resource economists, and thus help to increase communication between these two groups of specialists, which has hitherto been rather limited.

Figure 6


Composition of manufactured exports
United States
Japan, USSR
Canada
Cameroon, Jamaica
Germany
Kuwait
New Zealand
Xms/Xmp
SKILD/BAS-ED
0
0.5
1
1.5
2
2.5
3
3.5
4

Another merit of the model, it may be suggested, is the ease with which it can be extended in a variety of directions. This paper has been concerned mainly to set out the basic framework in a non-technical way, but has also touched on many possible extensions, including modification of some of the assumptions and analysis of the impact of trade (and other) policies. The cross-country statistics in this paper likewise illustrate only one of the ways in which the model can be applied empirically: in practice, it may be of most use as a framework for case studies of particular countries.

REFERENCES

Balassa, Bela (1979). "The Changing Pattern of Comparative Advantage in Manufactured Goods", *Review of Economics and Statistics*, LXI/2: 259-79.

Balassa, Bela (1986). "Comparative Advantage in Manufactured Goods: A Reappraisal", *Review of Economics and Statistics*, LXVIII/2: 315-19.

Barro, Robert J and J-W. Lee (1993). "International Comparisons of Educational Attainment", *NBER Working Paper* 4349, National Bureau of Economic Research, Cambridge, Mass.

Behrman, J R and N Birdsall (1983). "The Quality of Schooling: Quantity Alone is Misleading", *American Economic Review*, 73/5: 928-946.

Berthet-Bondet, Claude, Derek Blades and Annie Pin (1988). "The OECD Compatible Trade and Production Data Base 1970-1985", *Working Paper* 60, Department of Economics and Statistics, OECD, Paris.

Chenery, Hollis and Moshe Syrquin (1975). *Patterns of Development 1950-1970*, Oxford University Press, Oxford.

Clague, C. K. (1991). "Factor Proportions, Relative Efficiency and Developing Countries' Trade", *Journal of Development Economics*, 35/2: 357-80.

Colclough, C. L. with K. Lewin (1993). *Educating All the Children: the Economic Challenge for the 1990s*, Oxford University Press, Oxford.

Deardorff, Alan V. (1984a). "Testing Trade Theories and Predicting Trade Flows", in R. W. Jones and P. B. Kenen (eds.), *Handbook of International Economics*, Vol. 1, North Holland, Amsterdam.

Deardorff, A. V. (1984b). "An Exposition and Exploration of Krueger's Trade Model", *Canadian Journal of Economics*, XVII/4: 731-46.

Dougherty, Christopher (1991). "Education and Skills Development: Planning Issues", in Asian Development Bank, *Technical and Vocational Education and Training*, Manila.

Findlay, Ronald and Henryk Kierzkowski (1983). "International Trade and Human Capital: a Simple General Equilibrium Model", *Journal of Political Economy*, 91/6: 957-78.

Gaisford, James D. (1993). "International Capital Mobility, the Factor Content of Trade and Leontief Paradoxes", unpublished paper, University of Calgary [place of publication to be inserted].

Godfrey, Martin (1991). *Education, Training and Employment: What Can Planners Do?*, UNDP and ARTEP, New Delhi.

Grossman, G. M. and E. Helpman (1991). *Innovation and Growth in the Global Economy*, MIT Press, Cambridge Mass. and London.

Helpman, Elhanan (1984). "The Factor Content of Foreign Trade", *Economic Journal*, 94 (March): 84-94.

Helpman, Elhanan (1989). "The Noncompetitive Theory of International Trade and Trade Policy", in *Proceedings of the World Bank Annual Conference on Development Economics*, Washington DC: 193-216.

IEA (1973). International Association for the Evaluation of Educational Achievement, *International Studies in Evaluation I, Science Education in 19 Countries: an Empirical Study*, Wiley, New York.

Krueger, A. O. (1977). "Growth, Distortions and Patterns of Trade Among Many Countries", *Princeton Studies in International Finance*, 40. Reprinted with minor revisions as Krueger (1983: ch. 4).

Krueger, A. O. (1983). *Trade and Employment in Developing Countries: 3 Synthesis and Conclusions*, University of Chicago Press, Chicago.

Krueger, A. O., H. B. Lary, T. Monson and N. Akrasanee (eds.) (1981). *Trade and Employment in Developing Countries: 1 Individual Studies*, University of Chicago Press, Chicago.

Leamer, E. E. (1984). *Sources of International Comparative Advantage: Theory and Evidence*, MIT Press, Cambridge, Mass.

Leamer, E. E. (1987). "Paths of Development in the Three-Factor, n-Good General Equilibrium Model", *Journal of Political Economy*, 95/5: 961-999.

Lim, Linda (1980). "Women in the Redeployment of Manufacturing Industry to Developing Countries", *Working Paper on Structural Change* 18, United Nations Industrial Development Organization, Vienna.

Ohlin, Bertil (1933, 1967). *Interregional and International Trade*, Harvard University Press, Cambridge, Mass. (1st edn 1933; page references are to the revised edition, 1967).

Psacharopoulos, George (1993). "Returns to Investment in Education: a Global Update", *Policy Research Working Paper* 1067, World Bank, Washington DC.

Romer, P. M. (1992). "Two Strategies for Economic Development: Using Ideas and Producing Ideas", *Proceedings of the World Bank Annual Conference on Development Economics 1992*, Washington DC.

UNDP (1990). United Nations Development Programme, *Human Development Report*, Oxford University Press, Oxford.

Wood, Adrian (1991). "What Do Developing-Country Manufactured Exports Consist Of?", *Development Policy Review*, 9/2: 177-97.

Wood, Adrian (1994a). *North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World*, Clarendon Press, Oxford.

Wood, Adrian (1994b, forthcoming). "Give Heckscher and Ohlin a Chance!", *Weltwirtschaftliches Archiv* [vol and page references to be inserted].

World Bank (various years). *World Development Report*, Oxford University Press for the World Bank, New York.

FOR FURTHER INFORMATION ON IDS PUBLICATIONS
AND A FREE CATALOGUE, CONTACT:

IDS PUBLICATIONS
INSTITUTE OF DEVELOPMENT STUDIES
AT THE UNIVERSITY OF SUSSEX
BRIGHTON BN1 9RE
ENGLAND
TEL. (0273) 606261

Charitable Company No. 877338 limited by guarantee and registered in England

ISSN 1353-6141