Give Heckscher and Ohlin a Chance!

By

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I. Introduction

The ascent of new trade theory has been propelled partly by a widespread perception that old trade theory, particularly of the Heckscher-Ohlin type, is grossly inaccurate as a description of how the world actually works. A recent article by Bowen et al. [1987], which found almost no empirical support for H-O theory, is seen by many as the final nail in a coffin whose construction was started long ago by Leontief [1953].

This paper will argue that these criticisms have been greatly exaggerated, and that H-O theory provides an accurate and illuminating description of a large part of the global pattern of trade. Most empirical tests, it will be suggested, have mis-specified the theory by treating capital as similar to land, when in fact capital is internationally mobile, and thus does not generally influence the pattern of trade. The poor results of most tests, therefore, cannot be accepted as evidence that H-O theory is misleading.

Moreover, when H-O theory is correctly specified – excluding capital – it often seems to perform rather well. To illustrate this, the paper examines trade in manufactures between the North (developed countries) and the South (developing countries), two regions with very different factor endowments – and thus a highly appropriate domain for H-O theory. This is not the only domain in which H-O theory seems relevant – trade in primary products, for example, is a much larger one [Wood, 1993] – but it is a good one in which to discuss the role of capital.

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Section II discusses the theoretical framework. Section III considers the empirical difficulties of disentangling the effects of skill on trade from those of capital. Section IV reviews some factor content of trade studies, in the South and in the North, while Section V re-examines some well-known cross-country regression studies. Section VI sums up the conclusions.

II. A Model Without Capital

The hypothesis to be tested is that the broad pattern of North-South trade in manufactures (and in principle also in services) can be explained, to a first approximation, by a H-O model in which the factors of production are simply skilled and unskilled labour. More exactly, the hypothesis is that the North, because of its larger supply of skilled (relative to unskilled) labour, exports skill-intensive manufactures to the South, in exchange for imports of (unskilled-)labour-intensive manufactures.

The underlying model is developed in Wood [1994, ch. 2]. Its distinctive feature is not the inclusion of skill, whose influence on trade has been noted in many H-O studies,[1] but the exclusion of capital, a feature which it shares with a mere handful of earlier skill-only H-O models: Keesing [1965; 1966], Findlay and Kierzkowski [1983], and Minford [1989].[2] This exclusion is especially notable because capital is generally portrayed as one of the fundamental bases of North-South trade in manufactures. The North is said to be well-endowed with capital, and hence an exporter of capital-intensive manufactures to the South, which, because it is poorly endowed with capital, is said to have a comparative advantage in labour-intensive (meaning non-capital-intensive) manufactures.

Mobility of Capital

The exclusion of capital in this context thus calls for some rather strong justification, of which the most obvious and empirically plausible is that capital is internationally mobile. Machines are traded, and

[1] Starting with that of Ohlin [1933] himself. For a survey of empirical work, see Deardorff [1984, pp. 482–490, 496–497]. Skill also features in many studies more specifically of North-South trade in manufactures, including Balassa [1979 a; 1979 b], Krueger [1983], Schumacher [1989] and Evans [1989].

[2] Findlay and Kierzkowski give physical capital a role in the production of human capital.

finance flows freely around the world, which makes capital clearly different from other factors such as land and most sorts of labour. This is not quite the end of the story on capital and its mobility, as will be explained below, but it is convenient and apparently rather realistic to assume initially that capital is fully mobile between the North and the South.

This assumption permits us to draw on the theoretical framework of Ethier and Svensson [1986], who develop a H-O model with both immobile and mobile factors. Their general model has been ingeniously applied to the specific case of mobile capital by Gaisford [1993]: this particular application may be labelled the Ethier-Svensson-Gaisford (ESG) model. Its most important conclusion in the present context is that the pattern of trade in goods is determined by endowments only of *immobile* factors – which in the ESG model are land and labour. This result is intuitively appealing, and the formal proof by Ethier and Svensson provides a rigorous basis for the assumption, in this paper, that North-South trade in manufactures is governed only by supplies of skilled and unskilled labour.[3]

Endowments of capital, though they do not affect the pattern of trade in goods, still play an active role in the ESG model as a determinant of the pattern of foreign investment (and associated trade imbalances). Consider, for example, a country with a relatively large endowment of capital. Such a country will still export capital, *either* indirectly, embodied in goods, *or* directly, by running a trade surplus and investing abroad. The choice is determined by the capital-intensity of the goods in which its immobile factors give it a comparative advantage. Thus if the country has a high labour-land ratio, making it an exporter of clothing, which happens to be the more capital-intensive good, then it exports capital indirectly. But if it has a low labour-land ratio, making it an exporter of (less-capital-intensive) food, then it exports capital directly.

A Closer Look at Capital

Though the ESG conclusion that trade in goods is determined by endowments of immobile factors is well-founded in fact and logic, there is more room for doubt about the specific way in which ESG treat mobile capital, which is not well-grounded in formal capital theory. Indeed, Gaisford does not even offer an explicit *definition* of

[3] Land is omitted for reasons explained in Wood [1994, section 2.1.4].

what he means by capital, which thus has to be inferred from the internal logic and exposition of his model.

The definition of capital in this context cannot be *capital goods*. Some capital goods are traded (machines), but there is no necessary reason for net exports or imports of machines to be connected with trade surpluses or deficits, in the manner of the ESG model. Nor indeed is there much reason to regard machines as a factor of production: it is more natural to think of them as traded intermediate goods. Other capital goods (buildings) are nontraded, but the ESG model cannot refer to them, either, since they are immobile.

The definition of capital must therefore be *finance*, which appears to fit comfortably into the ESG framework, especially since net flows of finance between countries are reflected in trade imbalances. However, finance is not an ordinary input to production, like (say) coal or labour. Its role is to bridge over the gaps between net cash outflows and net cash inflows in different periods of time. This characteristic provides the basis for capital theory, which in its purest form treats capital simply as "dated labour", distinguished from current labour by having been used, and paid for, in earlier periods.

Interest Rates and Trade

The absence of any explicit treatment of inter-temporal relationships in the ESG model may thus cause concern about its analysis of the effects of mobile capital. The present – independently formulated – model adopts a different approach, which takes off from a large body of earlier work on trade theory and capital theory [e.g. Steedman, 1979; Pasinetti, 1981; Smith, 1984; Bliss, 1989; Evans, 1989]. The implications of this earlier work are elaborated in Wood [1994, section 2.2], but may be summarised as follows.

In capital theory in general, the interest rate has a central role, since it determines the price of dated labour relative to current labour. The interest rate also turns out to be the crucial determinant of the pattern of trade in capital-intensive and less-capital-intensive goods. A country has a comparative advantage in capital-intensive goods if and only if its (autarky real) interest rate is below the world average – and vice versa. This point, interestingly, was recognised by Ohlin [1933; 1967, p. 55].

A corollary of this conclusion is that if autarky real interest rates were equal in all countries, then no country would have a comparative advantage or disadvantage in capital-intensive goods. And it is on this

theoretical basis that capital is excluded from the present model, in conjunction with an empirical assumption, namely that interest rates do not differ much, on average, between the North and the South. For if this is the case, as has been noted by many economists [e.g. Pasinetti, 1981, p. 195; Bliss, 1989, p. 1206], and will be documented below, capital cannot exert a determining influence on the pattern of North-South trade.[4]

To make the model convincing, of course, it is necessary also to provide a theoretical reason *why* interest rates are similar among countries, and in particular to establish that this is not simply caused by the factor price equalising effects of trade. The most obvious explanation is international mobility of financial capital, which has vastly increased in recent decades with the lowering of many barriers to international financial transactions. The actual extent of capital mobility continues to be disputed [Feldstein and Horioka, 1980; Sinn, 1992], but most people agree that it is sufficient to impose a tight limit on differences in national interest rates.[5]

It may be helpful at this point to sum up the similarities and differences between the present model and the ESG model. What the two models have in common is: (a) that capital does not affect the pattern of trade in goods, and (b) that the lack of influence of capital is due to its international mobility. The main difference between the two models is the exact way in which they handle capital: the ESG model uses flows of finance, while the present model uses interest rates. It would be tempting to conclude that the one is simply the dual of the other, but the simple dualities between prices and quantities that exist in most contexts cannot be relied on in the case of capital [Pasinetti, 1981, pp. 192–194]. The difference between the two models thus needs further investigation, perhaps in an inter-temporal optimisation framework.

For this paper, however, all that matters are the points on which the two models *agree*, which are also the points at which they diverge drastically from almost all other H-O models. Other models, that is, treat capital as an internationally immobile factor, differences in

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[4] Many economists accept that there is little North-South difference in the real rate of interest, but still argue that the North has a comparative advantage in capital-intensive goods, because the average real wage, and hence the *wage-rental ratio*, is higher than in the South. This argument is seductive, but incorrect, as is explained in Wood [1994, section 2.2.4].

[5] Other possible reasons for international similarity of interest rates are mentioned in Wood [1994, p. 37].

national endowments of which influence the pattern of international trade. To put it even more simply, other H-O models treat capital as if it were like land, which it manifestly is not (except possibly for infrastructure [Wood, 1994, pp. 35–36]), whereas the ESG model and the present model imply that capital should be excluded from empirical explanations of the pattern of trade.[6]

Technology and Skill

The assumptions of all H-O models, including these two, are of course open to various well-known criticisms, which will not be rehearsed here [but see Wood, 1994, pp. 41–42]. The assumptions are surely not strictly true: the issue is simply whether or not they are sufficiently accurate to make H-O theory a helpful description of (at least part of) reality, which is a matter for empirical investigation, as in the latter part of this paper. However, it seems important to address one criticism which is often aimed specifically at the application of H-O theory to North-South trade, which concerns the assumption that all countries have access to the same technology.

This assumption is often portrayed as absurd in the North-South context, but it can be defended, provided that technology is defined as *knowledge embodied in material objects* – especially capital and intermediate goods. Since most such goods are internationally traded, this definition makes it reasonable to assume that the same technology is usually available in all countries – although there are important exceptions.[7] This definition of technology would be grossly misleading in a model which treated labour as homogeneous and unskilled. The present model, however, focuses on inter-country variations in *knowledge embodied in people* – or skill – and thus captures the deepest meaning of the South's "technological backwardness", namely the lower skill level of its labour force.

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[6] The criticism implied by the ESG and the present model of the treatment of capital in most H-O models should be distinguished from that of earlier authors [Pasinetti, 1981; Metcalfe and Steedman, 1981], which was couched in a capital-and-labour-only framework, and argued to refute the whole of H-O theory. The point of the present paper is entirely different, namely that H-O theory works well, so long as it is articulated with respect to inputs that are immobile factors of production, such as land, labour and skill.

[7] For a fuller discussion of this interpretation of technology, see Wood [1994, section 2.3].

III. Disentangling Skill and Capital

The general hypothesis advanced in the previous section is that H-O models are likely to work better in practice if capital is excluded than if it is included in the usual, wrong, way. The more specific hypothesis is that a skill-only H-O model can explain the commodity composition of North-South trade in manufactures. The rest of the paper tests this latter hypothesis against the results of earlier empirical studies.

As is widely recognised, a proper test of a H-O model must cover both the *factor content* of trade and the *factor endowments* of countries [Deardorff, 1984, pp. 478–493; Leamer, 1984, ch. 2]. More precisely, to establish that trade is based on differences in factor availability, it is necessary to show (a) that countries are net exporters of certain factors (by factor content of trade calculations), and (b) that these factors are comparatively abundant in these countries – bearing in mind that in this context a "factor" must be defined more specifically as an *immobile* factor.

Most studies of North-South trade (examined in Section IV) have done only the first of these two things, being simply factor content studies, whose results must be supplemented with other evidence on endowments. The cross-country regression studies (reviewed in Section V) generally include both ingredients. However, most of them neglect the mobility of capital, and are thus looking for a linkage between the capital content of trade flows and national endowments of capital which probably does not exist. Their results, too, require reinterpretation.

The reinterpretation of both sorts of studies is complicated by the fact that most of them treat *both* skill *and* capital as important influences on trade. Their results on these two dimensions thus have to be disentangled, in effect to salvage what can be learned about skill from the wreckage of what cannot be learned about capital. This process of disentangling, in turn, is complicated by the fact that factor content calculations show a strong association, across products, between skill intensity and capital intensity. This association, it will be suggested below, is partly the result of measurement error, but also reflects genuine complementarity between skill and capital.

Measuring Skill Intensity and Capital Intensity

Most North-South factor content of trade (FCT) studies have looked at one or other of the two regions, and compared the skill and

capital intensity of exports with that of imports (in contrast to the Heckscher-Ohlin-Vanek test, which calculates the factor content of *net* exports).[8] By using the capital-labour ratio as their measure of capital intensity, however, most of these studies have inadvertently created an accounting linkage between skill intensity and capital intensity.

To explain this point, it is first worth recalling how *skill* intensity is measured, and why. The natural way to compare the skill intensity of two goods is in terms of the skill composition of employment needed for their production. A more skill-intensive good is one that needs a higher ratio of skilled to unskilled workers. This is the natural measure for a H-O framework, because it ensures that a greater scarcity of skilled relative to unskilled labour – reflected in a higher ratio of skilled to unskilled wages – would increase the price of more skill-intensive goods relative to less skill-intensive goods. It is interchangeable with a number of other measures, such as the average amount of human capital per worker, and the average wage per worker (at least where it is reasonable to assume that wage differences among workers largely reflect skill differences).[9]

The general logic is thus that the measure of factor intensity should be consistent with the theoretically postulated relationship between relative factor prices and relative goods prices. This logic can then be deployed, with the assistance of some capital theory, to find the natural measure of *capital* intensity in a H-O model, which turns out to be the capital-output ratio rather than the capital-labour ratio [Wood, 1994, pp. 76–77]. This is a corollary of the capital-theoretic view that the relative price of capital (i.e. dated labour) and labour is the interest rate. For if this is so, then using the capital-output ratio to measure capital intensity ensures that a rise in the relative price of capital will consistently raise the relative prices of more capital-intensive goods, which is not guaranteed when the measure is the capital-labour ratio [Pasinetti, 1981, pp. 180–188].

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[8] This statement actually applies only to the subset of North-South FCT studies which have explicitly measured skill or capital content. A much larger number have been limited to one factor, labour (undifferentiated by level of skill), and are thus not helpful in discriminating between skill-only and skill-plus-capital interpretations of this trade [Wood, 1994, sections 3.3, 3.4.2, 3.5.1].

[9] This interchangeability does not extend to another "skill intensity" measure that is sometimes used in studies of trade, namely the ratio of skill input to the value of *output*, which can give wrong results, because skilled and unskilled labour are not the only inputs to production [Wood, 1994, p. 76].

For present purposes, the key point is that inter-sectoral differences in skill intensity tend to cause, and to be correlated with, inter-sectoral differences in capital-labour ratios, even if there are no differences in capital-output ratios. To see this, consider the accounting identity

$$c_i = k_i/v_i \,, \tag{1}$$

where c_i is sector i's capital-output ratio, k_i its capital-labour ratio, and v_i value added (or net output) per worker. This last variable can be written more fully, using another familiar accounting identity, as

$$v_i = w_i + r_i k_i \,, \tag{2}$$

where r_i is the sectoral rate of profit on capital, and w_i is the average wage. The latter depends on the skill composition of employment:

$$w_i = \sum_h w_{hi} n_{hi} \,, \tag{3}$$

where n_{hi} is the share of workers of skill category h in sector i's labour force, and w_{hi} is their wage. It is convenient here to assume that the w_{hi} are strictly equalised across sectors by labour market competition, so that variations in w_i among sectors purely reflect inter-sectoral differences in skill intensity.

Substituting (2) into (1), assuming for convenience that r is the same in all sectors, and simplifying, the identity becomes

$$c_i = 1/(w_i/k_i + r) \,. \tag{4}$$

If labour were homogeneous, w_i too would be the same in all sectors, and sectors with higher capital-output ratios would always have higher capital-labour ratios, and vice versa. However, when labour is heterogeneous and products differ in skill intensity, the bond between these two indicators of capital intensity is broken. For with variations in w_i across sectors, depending on the skill composition of their labour forces, it is possible for two sectors to have equal capital-output ratios, but unequal capital-labour ratios, or for one to have a higher c but a lower k, and so on.

Moreover, inter-sectoral variations in k_i, for a given c_i, are positively associated with variations in skill intensity. This can be verified by rearranging (4) as

$$k_i = w_i/(1/c_i - r) \tag{5}$$

and differentiating with respect to w_i. The derivative $1/(1/c_i - r)$ must be positive, because $r c_i$ is the share of profits in output, which must

be less than unity. Sectors with higher average wages (for whatever reason) tend to have higher capital-labour ratios – essentially because they tend to have fewer workers per (value) unit of output.

This general point has particular relevance to previous studies of North-South trade in manufactures which have inferred differences in the capital intensity of exports and imports from differences in capital-labour ratios when the use of capital-output ratios would have suggested no difference in capital intensity. In such cases, what the differences in capital-labour ratios show are differences in *skill* intensity – in the expected direction. In the North, the capital-labour ratio of exports exceeds that of import substitutes, implying (as shown in equation (5)) that the former are more skill-intensive, while in the South this relationship is reversed.

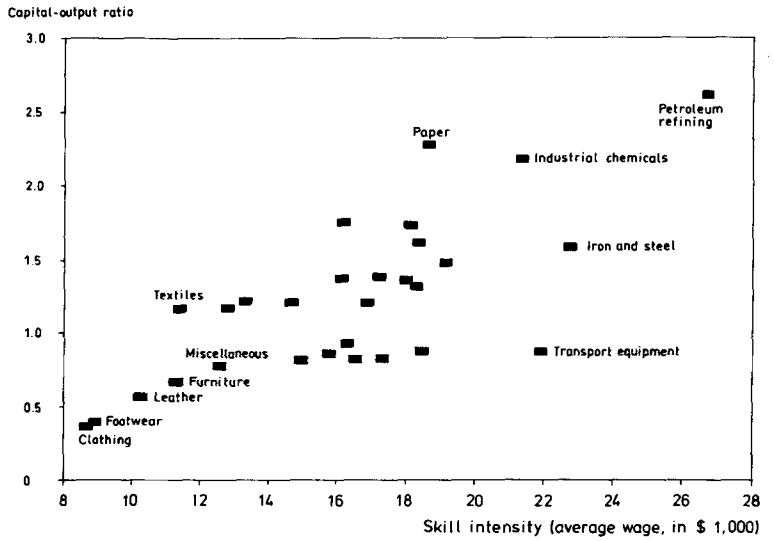
Complementarity between Skill and Capital

Although in some cases the alleged differences in capital intensity vanish when properly measured, in other cases – as will be seen – they remain. In some studies, more specifically, the North's exports of manufactures to the South are genuinely more capital-intensive as well as more skill-intensive than its imports of manufactures from the South. This finding, however, is harder to interpret than is usually recognised, because there is a positive correlation across manufacturing industries between capital intensity and skill intensity. Figure 1 illustrates this with 1980 US data on 3-digit sectors, using the average wage in each sector as the measure of its skill intensity. Forstner and Ballance [1990, p. 98] report similar results, using averages of data for 43 countries in 1970–77 and 1978–85.[10]

The equations in the preceding subsection make it clear that there is no obvious *accounting* explanation for this cross-sectoral correlation between skill intensity and capital intensity. It appears to be simply a feature of industrial technology, related to the empirical complementarity between skill and capital [Freeman, 1986, p. 367; Hamermesh, 1986, pp. 460–461], which may be interpreted as arising

[10] Forstner and Ballance measure capital intensity by non-wage value added per worker, a close relative of the capital-labour ratio. Capital-output ratios cannot be derived from their data (as with the data used for Figure 1). However, comparisons with the data used for Figure 1 suggest that the positive correlation found by Forstner and Ballance would remain if their data were reworked using a more appropriate capital intensity measure.

Figure 1 – *Correlation between Skill Intensity and Capital Intensity (across 3-digit manufacturing industries in the US in 1980)*



Source: Derived from data in Fischer and Spinanger [1986, Table AII.2]. For details of derivation, see Wood [1994, Figure 3.1].

from a more basic complementarity between skill and technology (as defined in this paper [Wood, 1994, pp. 43–44]).

The correlation in Figure 1 is fairly strong ($R = 0.73$), but is heavily influenced by six industries – petroleum refining, in the top right-hand corner, and five others in the bottom left-hand corner. These five (with both low skill intensity and low capital intensity) are clothing, footwear, leather goods, furniture and miscellaneous. Their products account for a considerable share of the South's manufactured exports to the North, and have been especially prominent in the initial stages of each developing country's manufactured export growth.

The characteristics of these five industries are probably the main reason why some FCT studies have found that the manufactures which flow from the North to the South are on average more capital-intensive, as well as more skill-intensive, than those which flow the other way. On the face of it, this result is consistent with three alternative hypotheses. The present hypothesis is that North-South trade is based only on differences in skill availability – the association with capital intensity being a coincidence. The second hypothesis is that

this trade is based solely on differences in capital availability, and only coincidentally linked with skill, while the third would be that both skill and capital availability are influential.

Factor Content and Factor Endowments

To discriminate among these three alternative hypotheses, it is clearly necessary to introduce additional evidence on factor endowments – and in particular to compare the availability of skill and capital in the North and the South. This leads to the rejection of all but the first of the hypotheses. The second one (that differences in availability of capital are the *sole* basis of trade) is untenable because there is strong evidence of large North-South differences in the relative availability of skilled and unskilled labour, and hence good reason to expect differences in the skill intensity of trade flows between the two regions. Table 1 gives an indication of the magnitude of the difference in skill supplies.

The third hypothesis (that both skill and capital matter) is not credible because there is no evidence that capital – other than infrastructure – is generally scarcer or more expensive in the South than in the North. For instance, World Bank [1989, Fig. 4.2] compares the real interest rates in 35 developing countries during 1967–85 with the US. The developing-country average is below the US rate in most years, and is never appreciably above it. In Asia, one of the four regions into which the developing countries are grouped, the real interest rate fluctuates around the US level. In the other regions it is usually much lower (although the difference is probably exaggerated,

Table 1 – *North-South Comparison of Skill Availability (selected indicators)*

	Industrial countries	Developing countries
Scientists and technicians 1985–89 (per 1000 people)	81.0	8.9
Tertiary graduates 1986–88 (as % of corresponding age group)	9.4	1.2
Mean years of schooling 1990 (in population over 24)	10.0	3.7
Adult literacy rate 1990 (% of population over 14)	>95.0	64.0

Source: UNDP Human Development Report 1992 (Indicators Table 5).

since the official rates used in these estimates lie further below the average rates paid by borrowers in the South than in the North).

Essentially the same result emerges from a study by Harberger [1977], who used national accounts data to estimate real rates of return on capital in 1969–71 in 18 countries. He found little difference between the developed and developing countries in his sample. Likewise, over the period 1965–85, rates of return on US overseas investment in manufacturing were generally similar in developed and developing countries [Evans, 1989, Table A9.1.2 panel 3b; UNCTC, 1983, annex Table II.5; UNCTC 1988, Table V.3].

It is worth recalling in this connection that empirical studies of trade which measure endowments of capital by the size of capital stocks, rather than by real rates of interest, and have thus concluded that the relative abundance of capital varies widely among countries, have generated a long series of peculiar results [surveyed by Findlay and Kierzkowski, 1983, pp. 958–959; Deardorff, 1984, pp. 478–493; Leamer, 1984, ch. 2; Evans, 1989, section 9.2]. Though few of these studies are focused specifically on North-South trade in manufactures, the striking inconsistency of their results supports the present argument. The apparent influence of capital is sometimes "right", sometimes "wrong", and sometimes insignificant. A lot of effort has been put into trying to resolve these inconsistencies, without much success.

If the present line of argument is correct, though, there is no reason to expect consistency. If real interest rates are similar in most countries, because capital is internationally mobile, capital endowments should not affect the pattern of trade. There will, of course, be exceptions to this rule – caused by sustained divergences between domestic and international interest rates. In addition, FCT calculations will often reveal embodied net exports or imports of capital that have no causal connection with the capital endowments of the country concerned, but arise simply because the goods in which, for other reasons, the country has a comparative advantage happen to be of high or low capital intensity. This point is nicely made in the ESG model. The complementarity between skill intensity and capital intensity discussed above provides a concrete example, with another being the exports of Canada to the US, which are derived from natural resources whose exploitation is capital-intensive [Niroomand, 1991, p. 751].

In summary, calculations of the capital content of North-South trade must be disregarded as evidence of the influence of capital on the

composition of trade, since there is no corroborating evidence of a general North-South difference in real interest rates. However, because there is evidence of a North-South difference in the relative scarcity and cost of skilled labour, skill content calculations can be regarded as confirming or rejecting the hypothesis that this trade is based on differences in skill availability.

IV. Factor Content of Trade Studies

This section summarises the results of FCT studies of North-South trade in manufactures, limiting the coverage to those which explicitly measure skill and/or capital content. It looks first at studies of developing countries, then at studies of developed countries.

Studies of the South

The classic work is by Krueger et al. [1981] and Krueger [1982; 1983], using data from the late 1960s and early 1970s. Table 2 sums up its skill- and capital-related results for nine countries, each number

Table 2 – *Factor Intensity of Trade in Manufactures in Developing Countries (exporting sectors as ratio of import-competing sectors)*

		Skill intensity[a]		Capital-labour ratio	Capital-output ratio
		Numbers measure	Wages measure		
Argentina	1973			0.45	0.59
Brazil	1971–72		0.92		
Chile	1966–68		0.26	1.08	2.00
Colombia	1973	0.53	0.60		
Hong Kong	1973	0.51		0.67	0.81
Indonesia	1971	0.55	0.45	0.28	0.49
Ivory Coast	1972	0.62			
Tunisia	1972	<1	0.65		
Uruguay	1968	0.49		0.42	0.79
Unweighted averages		0.54	0.58	0.58	0.93

[a] "Numbers" measure of skill intensity is number of skilled workers (usually white-collar) as ratio of unskilled workers, "wages" measure is based on the average sectoral wage per worker.

Source: Derived from Krueger et al. [1981], Krueger [1983]; for details see Wood [1994, section 3.3.1].

Table 3 – *Factor Intensity of Trade in Manufactures in Korea and Taiwan (exporting sectors as ratio of import-competing sectors)*

		Skilled share of employment	Capital-labour ratio	Capital-output ratio
Korea	1968		0.66	0.80
Taiwan	1966–71	0.75	0.51	0.82

Source: Derived from Westphal and Kim [1982, Table 8.22]; Lee and Liang [1982, Table 10.20]; for details, see Wood [1994, Table 3.5].

being the ratio of the average factor intensity of export-oriented sectors to that of import-competing sectors. The first two columns of the table refer to skill, one being based on the relative numbers of skilled and unskilled workers, the other on the average wage in each sector (see equation (3)). In every case for which one of these measures is available, the ratio is less than unity, which implies that exporting sectors are less skill-intensive than import-competing sectors. The ratios vary, but in both columns their average is between 0.5 and 0.6.

Five of the countries have some data on capital – albeit measured in five different ways (by value of fixed assets, depreciation, horsepower and use of electricity or energy). The third column of the table compares *capital-labour* ratios, and shows that exporting sectors generally use less capital per worker than import-competing sectors (on average about 40 per cent less). The fourth column refers to *capital-output* ratios (or more precisely to capital per unit of domestic value added), which were argued above to be the better measure of capital intensity. These ratios vary widely, but their average value of 0.93 is close to unity, implying that there is little difference between the capital intensity of exporting and import-competing sectors.

The FCT calculations of Lee and Liang [1982] for Taiwan and of Westphal and Kim [1982] for Korea fill a significant hole in the Krueger studies, though they use slightly different methods. Table 3 sums up their results. There is no information on skill for Korea, but in Taiwan, exporting sectors are less skill-intensive than import-competing sectors (although the difference is less pronounced than in most of the countries in Table 2). The relative capital intensity of exports, measured by the capital-output ratio, is much the same in both economies (0.80 in Korea and 0.82 in Taiwan). A similar figure for Korea (0.86) can be derived from Krueger [1983, Table 6.3]; and these ratios are close to that for Hong Kong (0.81) in Table 2. Thus in about 1970

Table 4 – *Factor Intensity of Developing Countries North-Bound Manufactured Exports (relative to developed countries manufactured exports)*

	Skill intensity (average wage per worker)			Capital-output ratio		
	1965	1973	1983	1965	1973	1983
Taiwan	0.83	0.83	0.87	0.95	0.88	0.93
Korea	0.84	0.85	0.91	1.02	0.94	0.95
Brazil	0.88	0.88	0.95	1.10	1.13	1.18
Singapore	0.96	0.94	0.96	1.28	0.99	0.91
Hong Kong	0.82	0.83	0.85	0.88	0.87	0.85
China	0.87	0.80	0.84	1.05	1.02	1.05
Mexico	0.92	0.94	0.96	1.09	1.04	1.01
Malaysia	1.04	0.95	0.95	1.28	1.17	1.00
India	0.79	0.81	0.86	1.08	1.11	1.23
Thailand	0.92	0.90	0.88	1.23	1.12	1.09
Turkey	0.88	0.86	0.84	1.02	1.07	1.09
Indonesia	0.98	0.95	1.00	1.27	1.13	1.21
Argentina	0.86	0.87	0.90	1.03	1.03	1.10
Philippines	0.85	0.89	0.87	1.02	1.07	1.00
Pakistan	0.69	0.75	0.75	0.92	1.05	1.06
Colombia	0.85	0.85	0.87	0.97	1.05	1.04
Morocco	0.92	0.87	0.88	1.09	1.03	1.11
Ivory Coast	0.86	0.85	0.84	0.97	0.99	1.02
Tunisia	0.91	0.94	0.86	1.14	1.17	1.05
Egypt	0.76	0.75	0.83	1.02	1.08	1.18
Kenya	0.83	0.83	0.84	0.98	0.99	1.01
Unweighted averages	0.87	0.86	0.88	1.07	1.04	1.05

Source: Derived from Fischer and Spinanger [1986, Table AII.4]; for details, see Wood [1994, Table 3.6].

in these three East Asian economies, which supplied most of the South's exports of manufactures to the North, exports were somewhat less capital-intensive, as well as less skill-intensive, than competing imports.

Table 4 is based on a study by Fischer and Spinanger [1986], which covers the manufactured exports of 21 developing countries in 1965, 1973 and 1983, using 1980 US sectoral input coefficients to estimate their factor content, which in this table is shown as a ratio of the corresponding figure for the manufactured exports of four large developed countries (used as a proxy for developing-country imports). The first three columns show that the exports of these Southern

countries are less skill-intensive than their imports in 61 out of 63 cases, which is in accordance with all the evidence presented earlier. The last three columns refer to capital intensity, as measured by the capital-output ratio: for the four little East Asian tigers, 10 of the 12 numbers are below unity (which fits with the results noted above), but in most other cases the numbers are close to unity, implying that there is little difference between the capital intensity of exports and imports.

Clague [1991] uses data on factor prices in five Asian developing countries and (an average of) seven developed countries to predict differences in the relative costs of producing different sorts of manufactured goods. He then uses the predicted relative costs (PRC) to explain the composition of trade in manufactures between these Asian countries and the North in 1975. The factor prices used in his PRC calculations are the wages of skilled and less-skilled workers, and the prices of machinery and buildings. The rate of return on capital, however, is taken to be the same in all countries.

In effect, then, Clague fits a model which corresponds closely with the present hypothesis, and his good results tend to support this hypothesis. Regressing sectoral net exports on a version of the PRC variable based only on differences in factor prices yields an R^2 of 0.51, better than in many other studies. However, Clague shows that additional influences shape the detailed pattern of North-South trade in manufactures. Allowing for scale economies in the PRC calculations raises the R^2 to 0.63. Adding variables reflecting some likely causes of North-South differences in the relative efficiency of different manufacturing sectors raises it further, to 0.71.

Studies of the North

Table 5 summarises the classic study by Balassa [1979a], which calculates the factor content of the North's trade in manufactures with the South by applying 1975 all-OECD trade weights to US factor input coefficients. The occupational data in panel A show that in exporting industries the shares of professional and technical workers, and of skilled manual workers, are far higher than in import-competing industries. The share of semiskilled and unskilled manual workers is correspondingly lower. The greater skill intensity of exporting sectors is confirmed by the wage-based comparisons in panel B of the table (similar calculations for Belgium are reported in de Grauwe et al. [1979, Table 2]).

Table 5 – *Factor Intensity of OECD Trade in Manufactures with the South, 1975*

	Exports to South	Imports from South	Exports/ imports
A. Skilled and unskilled workers (share of labour force %)			
Professional and technical	11.2	6.0	1.86
Managers and administrators	5.6	4.9	1.14
Clerical and sales	14.0	12.0	1.16
All white collar	30.8	23.0	1.34
Foremen and skilled manual	23.2	13.5	1.73
Semi- and unskilled manual	46.0	63.6	0.72
All manual	69.3	77.0	0.90
Total	100.0	100.0	1.00
B. Wage-based measures of skill content ($1,000 per worker)			
Average wage	9.6	7.5	1.28
Human capital[a]	29.7	20.6	1.44
C. Capital-labour ratio measures ($1,000 per worker)			
Fixed assets	16.6	10.5	1.58
Non-wage value added	8.6	5.8	1.48
D. Capital-output ratio measures			
Fixed assets/gross output	0.31	0.30	1.02
Fixed assets/value added	0.91	0.79	1.16
Non-wage share of value added	0.47	0.44	1.08

[a] "Human capital" measured as discounted value of difference between average wage and unskilled wage.

Source: Balassa [1979a, Tables 5 and 6].

Table 6, which uses occupational and educational measures of skill, shows the results of several other FCT studies of developed countries, together with Balassa's results for the US. The data on labour force shares in the three columns reveal that in every case, the proportion of skilled workers is higher in sectors that export to the South than in those which compete with imports from the South. Some of the studies have more than two skill categories. Where workers are categorised by the amount of their education or training (the Netherlands and Germany), the ratio between the shares of exporting and import-competing sectors rises monotonically with the level of skill. The US occupational data imply a similar relationship: the ratio

Table 6 – *Skill Intensity of Northern Trade in Manufactures with the South (occupational or educational skill categories)*

	Shares of labour force (%)		
	Exports to South	Imports from South	Exports/ imports
United States 1975			
Professional and technical	13.3	6.8	1.96
Managers and administrators	6.0	5.0	1.18
Clerical and sales	14.8	12.3	1.20
Foremen and skilled manual	20.8	13.4	1.55
Semi- and unskilled manual	45.3	62.5	0.72
Netherlands 1973			
Semi-high and high	4.2	2.8	1.50
Medium	12.0	10.0	1.20
Broadened lower	41.9	40.6	1.03
Basic lower	40.7	45.6	0.89
Germany 1972–76			
University	2.6	2.0	1.29
Formal vocational/technical	9.4	7.9	1.19
On-the-job vocational	52.2	46.1	1.13
No vocational	35.8	43.9	0.81
Germany 1985			
Non-manual plus skilled manual	63.3	44.4	1.43
Semi- and unskilled manual	36.7	55.6	0.66
France 1985			
Non-manual plus skilled manual	68.6	54.5	1.26
Semi- and unskilled manual	31.4	45.5	0.69
Italy 1985			
Non-manual plus skilled manual	53.3	45.7	1.17
Semi- and unskilled manual	46.7	54.3	0.86
Netherlands 1985			
Non-manual plus skilled manual	57.3	42.4	1.35
Semi- and unskilled manual	42.6	57.6	0.74
Belgium 1985			
Non-manual plus skilled manual	57.1	47.0	1.21
Semi- and unskilled manual	42.9	53.0	0.81
United Kingdom 1985			
Non-manual plus skilled manual	58.7	48.4	1.21
Semi- and unskilled manual	41.3	51.6	0.80

Source: Balassa [1979a, Table 5]; UNIDO [1978, Table 29]; Schumacher [1989, Tables A.10–24].

is highest for professional and technical workers, with skilled manual workers second, and managers and clerical workers equal third.

Balassa's [1979a] appears to be the only developed-country FCT study of North-South trade to have measured capital content explicitly. Table 5 contains his results (using all-OECD trade weights and US coefficients). Panel C shows, using two alternative indicators, that the capital-labour ratio of exporting industries is on average about 50 per cent higher than that of import-competing industries. The capital-output ratios in panel D, which are better measures of capital intensity, show a much smaller difference: with each of the three indicators, the export/import-competing ratio is greater than unity, but on average by less than 10 per cent. The results of the study of Belgium by de Grauwe et al. [1979] can be reworked, taking non-wage value added as a measure of capital, to reveal much the same result, with a substantial difference in capital-labour ratios but only a small difference in capital-output ratios.

The capital-related results of Balassa and de Grauwe are a rather small sample of evidence, and in both cases are somewhat out-of-date. However, they are consistent with the Southern FCT studies reviewed above. In the early 1970s, the capital intensity of the North's manufactured exports to the South was slightly greater than that of its imports from the South – matching the pattern observed in the East Asian economies which supplied the bulk of the South's manufactured exports.

A recent regression study of the US during 1963–80 by Niroomand [1991] is consistent with the results of the Northern FCT studies. He regresses net exports on factor inputs across three-digit manufacturing industries, doing this separately for different trading partners. (Other Northern regression studies lump all partners together, neglecting the advice of Krueger [1977].) Niroomand concludes that the comparative advantage of the US vis-à-vis its trading partners in the South is based on human, not physical, capital.

In summary, FCT studies of particular countries, developing and developed, always reveal that the manufactured exports of the North to the South are more skill-intensive than those of the South to the North. Because there is also strong evidence of a large North-South difference in the relative abundance of skilled and unskilled labour, this FCT result gives powerful support to the hypothesis that a skill-based H-O-model can provide a good explanation of North-South trade in manufactures. The FCT results on the capital intensity of this trade are much less clear-cut, and, for reasons mentioned earlier,

cannot be accepted as evidence that its composition is influenced by a North-South difference in the abundance of capital.

V. Cross-Country Regression Studies

Other studies have tried directly to relate variations in trade patterns among countries to variations in their factor endowments. Recent examples include Leamer [1984], Bowen, Leamer and Sveikauskas [1987], Balassa and Bauwens [1988], Minford [1989] and Forstner and Ballance [1990]. Although these studies have not focussed on North-South trade, their data span both developed and developing countries, and they implicitly test the hypothesis of this paper that North-South trade is based on differences in skill (but not capital) availability. The results of these studies, moreover, are so mixed, and so often appear inconsistent with the present hypothesis, that they demand some explanation.

Specification

All these studies recognise that H-O theory postulates a particular set of relationships among three sorts of variables – trade flows (T), sectoral factor intensities (FI) and country factor endowments (FE). However, they specify their tests in different ways. The ideal specification is used by Bowen, Leamer and Sveikauskas: they calculate the factor content (FC) of each country's trade from T and FI, and then compare variations in FC and FE across countries.

Balassa and Bauwens approximate the ideal specification, first regressing T on FI across sectors for each country separately, then using the estimated T/FI coefficients as the dependent variables in a cross-country regression on FE. They also combine the two stages in a "one-pass" procedure. In one of his tests, Minford uses the same two-step specification as Balassa and Bauwens. In another test, he treats export and import unit values as a proxy for FC, and regresses these on FE across countries within sectors.

Forstner and Ballance use various tests. Their two-stage method is first to regress T on FE across countries for each sector, then to regress the estimated T/FE coefficients across sectors on FI. Leamer [1984] regresses T on FE across countries within commodity clusters, which were identified from trade data but turned out (within manufacturing) to have similar FI characteristics [ibid., p. 66].

Measurement of Endowments

Leamer (with and without Bowen and Sveikauskas) considers trade in primary products as well as manufactures, and thus has to measure natural resources as well as endowments of skill and capital. The other studies are confined to trade in manufactures, variously defined. Balassa and Bauwens, Leamer, and Minford all stick to "narrow" manufactures (SITC 5–8), while Forstner and Ballance also include some processed primary products.

The measures of sectoral skill and capital intensity (FI) used in these studies are much the same as those discussed in earlier sections of this paper. Skill intensity is measured by the average wage or the relative numbers of workers in different skill categories. Capital intensity is measured by capital per worker (or, as a proxy, non-wage value added per worker). None of these studies uses the capital-output ratio, which was argued in Section III above to be the right measure of capital intensity.

The measures of skill and capital endowments (FE) used in these studies vary. For skill endowments, Leamer [1984] and Forstner and Ballance break the labour force into three groups: illiterates, professional and technical workers, and the rest (literate workers not in professional and technical jobs). They note some of the limitations of this breakdown, including its neglect of manual craftsmen and skilled managers, and the widely varying skill levels of professional and technical workers in different countries. But they underestimate the seriousness of these limitations. Both studies also fail to recognise that the "unskilled" labour force in manufacturing needs to be literate [Wood, 1984, pp. 48–49, 95].

Bowen, Leamer and Sveikauskas use the standard international breakdown of the labour force into seven occupational categories. This is even less appropriate. Not only does it neglect the large cross-country (and in particular North-South) differences in the amount and quality of education and training of workers in each of these categories, but it also fails to recognise that, even within a given country at a given time, the standard occupational classification is not a categorisation of workers by level of skill. Skilled and unskilled "production" workers are lumped together, and most of the categories are based on the type of work done (service, sales, clerical, agricultural) rather than on level of education or training.

Balassa and Bauwens (following unsuccessful experiments with occupational data, reported in Balassa [1979b, p. 262]) measure a

country's skill endowment by the average education level of its population, using the Harbison-Myers index, which is the secondary school enrollment rate plus five times the university enrollment rate, lagged six years. This is a more appropriate measure, but it suffers from being based on enrollment data rather than on direct information on the educational composition of the workforce. Nor does it allow for cross-country differences in educational quality or in other forms of training.

Minford attempts to overcome these problems by measuring skill endowments simply by the national average wage level, converted into dollars at the official exchange rate. His assumption that variations in wages among countries are due mainly to variations in the average skill level of their labour forces is untested and unlikely to be exactly correct. However, it is a plausible first approximation. (None of these authors uses data on the relative wages of skilled and unskilled workers, though Forstner and Ballance [1990, p. 74] mention this as a possibility for future research.)

Endowments of capital are measured in all these studies (except that of Minford, who omits capital altogether) as the cumulated stock of past investment flows. This measure is highly inappropriate, for theoretical reasons discussed in Section II above. If capital were internationally immobile, and trade did not fully equalise factor prices, the appropriate indicator of its "abundance" in a country would be the real interest rate. However, in a world in which financial capital is internationally mobile, tending to equalise interest rates, theory suggests that capital should simply be omitted from H-O analyses of trade, as in Minford's [1989] study.[11]

The capital stock, as measured in the other studies, is closely correlated with GNP. This is because the main source of cross-country variation in absolute levels of investment (from which the capital stock estimates are derived) is variation in GNP – the share of investment in GNP varies much less. The stock of capital per worker is thus strongly correlated across countries with GNP per worker [Leamer, 1984, p. 275]. GNP per worker in turn is bound to be correlated with the average wage, which is Minford's measure of skill endowment. The "capital stock" variable is thus probably acting mainly as a proxy for skill endowments. This interpretation is supported by the collinear-

[11] Leamer [1984, pp. 233–234] admits to "discomfort" about his capital variable, on both conceptual and measurement grounds. Forstner and Ballance [1990, pp. 13, 125] note at various points that the international mobility of capital could account for their odd results.

ity which Balassa and Bauwens [1988, p. 31] discover between their measures of physical and human capital endowments.

Results

The preceding review of the variations and deficiencies of specification and measurement in these cross-country regression studies should make it easier to understand why their results have been mixed and in many cases peculiar – sometimes severely testing their authors' faith in H-O theory. A detailed evaluation of their results would go well beyond the scope of this paper, but the main findings may be summarised as follows.

Leamer [1984] is able to show that the pattern of trade in primary products is governed largely by international differences in natural resources. But his regressions do not provide a clear, consistent and credible explanation of the pattern of trade in manufactures [pp. 115, 170–175, 187, 260–273]. This is not really acknowledged in Leamer's book, but in his later paper with Bowen and Sveikauskas, using a better specification, he concedes that his results were presented in too positive a light [Bowen et al., 1987, p. 805]. This joint paper comes to negative conclusions – its results give almost no support to H-O theory. However, its authors also note signs that this may be due to errors in the measurement of variables, which there certainly are, as explained above.

Forstner and Ballance (who measure their variables in much the same way as Leamer) have no more success than Leamer in relating trade in manufactures to differences in endowments of capital and skill – although, like Leamer, they take a positive view of their results. Their coefficients are often insignificant or have the wrong signs or contradict other information about the sectors concerned [Forstner and Ballance, 1990, pp. 85–86, 105, 120–125]. However, when allowance is made for errors of measurement and interpretation, most of their results can be reconciled with the present hypothesis that North-South trade is based on differences in the availability of skill but not capital.

Balassa and Bauwens are much more successful in explaining the pattern of trade in manufactures, largely because they use a better measure of skill endowments.[12] Their misconceived measure of capi-

[12] A fine commodity disaggregation, and restriction of the country sample to substantial exporters of manufactures, probably also contribute to their greater statistical success.

tal endowments does not damage their results because (as mentioned above) it is so collinear with their skill endowment measure that for most purposes they combine the two into a single variable [Balassa and Bauwens, 1988, pp. 30–31]. They also often combine their measures of skill and capital intensity into a single variable, which again does not much affect their results, because these two indicators are collinear across sectors (as shown in Section III above).

The estimated coefficients in the cross-country regressions of Balassa and Bauwens are thus consistently significant, with the right signs. The only shortcoming is in the way the authors interpret their results. Balassa and Bauwens conclude that the pattern of trade in manufactures depends on skill and capital endowments. However, their results really only show dependence on *skill* endowments – as in the other studies, the influence of capital is not properly tested for.

Minford, whose theoretical framework is essentially the same as that of this paper, makes various tests of the hypothesis that the pattern of trade in manufactures depends on international differences in skill endowments. First, he regresses export unit values (a proxy for skill content) against national wage levels (proxying skill endowments) across countries within each of 18 selected three-digit manufacturing sectors [Minford, 1989, Table 8.1]. In 15 cases the estimated coefficient is positive – and in 9 cases significantly so (at the 2.5 per cent level). Regressions using *import* unit values yield much the same results, with the signs of the coefficients reversed.

Minford then tries an alternative dependent variable: net exports in four-digit subsectors. He expects the sign of the coefficient on the wage level to be positive within two-digit sectors of (presumed) high skill intensity, and negative within sectors of low skill intensity. About one third of the coefficients are significant with the right signs (Table 8.3). Minford's final test (which is similar to that of Balassa and Bauwens) is to regress net exports on skill intensity across sectors in each country (using data on UK sectoral wage levels to measure skill intensity), and then to compare the signs of the estimated coefficients with national wage levels. As his hypothesis predicts, the signs are usually positive in high-wage countries and negative in low-wage countries (Table 8.4.).

In summary, the results of these cross-country regression studies, which are superficially rather puzzling, turn out upon closer examination to be consistent with the present hypothesis that North-South trade is based on differences in the abundance of skills, but not capital. The consistency is most apparent in the Minford study, but is also

clear from the results of Balassa and Bauwens. The other studies [Leamer, 1984; Bowen, Leamer and Sveikauskas, 1987; and Forstner and Ballance, 1990] do not actively support the present hypothesis, but the apparent inconsistencies – in some cases insignificant results, in others significant but conflicting results – can plausibly be attributed to errors in the measurement of endowments.

VI. Conclusions

The *general* conclusion is that H-O theory probably provides a much better description of reality than is usually supposed, so long as the definition of factors of production is restricted to inputs that are internationally immobile – skilled and unskilled labour, land, and infrastructure. Most tests of H-O theory have violated this restriction by treating all capital as a factor of production. It is thus unsurprising – and unilluminating – that these tests have generally suggested that H-O theory performs badly.

The *specific* conclusion is that a skill-only (or more exactly a skilled-and-unskilled-labour-only) H-O model provides a rather good explanation of North-South trade in manufactures. The combination of differences in the skill intensity of these trade flows and in the relative skill endowments of the two regions is firmly established, while the common view that this trade is influenced also by differences in endowments of capital does not stand up to scrutiny.

What has been tested, it should be noted, is the "weak" or "qualitative" version of H-O theory, much as it was originally advanced by Ohlin: that factor abundance determines which commodities are exported and which are imported [Bowen, Leamer and Sveikauskas, 1987, p. 794]. No attempt has been made here to assess whether North-South trade is consistent with the more precise but more restrictive versions of H-O theory offered by Samuelson and Vanek. In particular, it remains to be seen how closely this trade conforms with the Heckscher-Ohlin-Vanek formulation advocated by Leamer [1984; and with Bowen and Sveikauskas, 1987], and in what specific respects it fails to do so. The skill-only H-O model is surely not the whole story, just a useful first approximation, to which other elements can be added.

It should reiterated, too, that the present paper has looked at only one instance of the practical relevance of H-O theory, ignoring other areas in which it also seems relevant, most notably trade in primary products. At the same time, it is important to recognise that in some

spheres of trade H-O forces are of comparatively minor importance, especially in explaining the detailed pattern of trade in goods of similar factor intensity among countries whose factor endowments are also similar. North-North trade in manufactures is a clear (and large) instance: H-O forces have some effect, for example because the skill structure of the labour force differs among developed countries, but tend to be dominated by the forces emphasised in new trade theory – economies of scale, variation in tastes, and imperfect competition. This domination is greater, the finer the disaggregation of manufactured goods considered.

Most trade economists, before reading this paper, would surely agree with this proposition: that H-O theory and new trade theory have different but complementary strengths, and can thus coexist, each specialising in those spheres of trade where its comparative advantage lies, and sometimes even getting together. What, then, should a reading of this paper have added? An awareness, hopefully, that the strengths of H-O theory, and hence its domain of relevance (in research and in policy formulation), may be much greater than is now generally believed.

References

Balassa, Bela [1979a], "The Changing International Division of Labor in Manufactured Goods." *Banca Nazionale del Lavoro Quarterly Review*, Vol. 130, 1979, pp. 243–285.

– [1979b], "The Changing Pattern of Comparative Advantage in Manufactured Goods." *Review of Economics and Statistics*, Vol. 61, 1979, pp. 259–279.

–, **Luc Bauwens,** *Changing Trade Patterns in Manufactured Goods: An Econometric Investigation.* Amsterdam 1988.

Bliss, Christopher, "Trade and Development." In: Hollis B. Chenery, Thirukodikaval N. Srinivasan (Eds.), *Handbook of Development Economics, Vol. II.* Amsterdam 1989, pp. 1187–1240.

Bowen, Harry P., Edward E. Leamer, Leo Sveikauskas, "Multicountry, Multifactor Tests of the Factor Abundance Theory." *The American Economic Review*, Vol. 77, 1987, pp. 791–809.

Clague, Christopher K., "Factor Proportions, Relative Efficiency and Developing Countries' Trade." *Journal of Development Economics*, Vol. 35, 1991, pp. 357–380.

de Grauwe, Paul, Walter Kennes, Theo Peeters, Robert van Straelen, "Trade Expansion with Less Developed Countries and Employment: A Case Study of Belgium." *Weltwirtschaftliches Archiv*, Vol. 115, 1979, pp. 99–115.

Deardorff, Alan V., "Testing Trade Theories and Predicting Trade Flows." In: Ronald W. Jones, Peter B. Kenen (Eds.), *Handbook of International Economics, Vol. I.* Amsterdam 1984, pp. 467–517.

Ethier, Wilfred J., Lars E.O. Svensson, "The Theorems of International Trade with Factor Mobility." *Journal of International Economics,* Vol. 20, 1986, pp. 21–42.

Evans, H. David, *Comparative Advantage and Growth: Trade and Development in Theory and Practice.* Brighton 1989.

Feldstein, Martin, Charles Horioka, "Domestic Saving and International Capital Flows." *The Economic Journal,* Vol. 90, 1980, pp. 314–329.

Findlay, Ronald, Henryk Kierzkowski, "International Trade and Human Capital: a Simple General Equilibrium Model." *Journal of Political Economy,* Vol. 91, 1983, pp. 957–978.

Fischer, Bernhard, Dean Spinanger, *Factor Market Distortions and Export Performance: An Eclectic Review of the Evidence.* Institut für Weltwirtschaft, Kiel Working Papers, 259, Juni 1986.

Forstner, Helmut, Robert Ballance, *Competing in a Global Economy: An Empirical Study on Specialisation and Trade in Manufactures.* London 1990.

Freeman, Richard B., "The Demand for Education." In: Orley Ashenfelter, Richard Layard (Eds.), *Handbook of Labor Economics, Vol. I.* Amsterdam 1986, pp. 357–386.

Gaisford, James D., "International Capital Mobility, the Factor Content of Trade and Leontief Paradoxes." Department of Economics, University of Calgary, to appear in *Journal of International Economics.*

Hamermesh, D.S., "The Demand for Labor in the Long Run." In: Orley Ashenfelter, Richard Layard (Eds.), *Handbook of Labor Economics, Vol. I.* Amsterdam 1986, pp. 429–471.

Harberger, Arnold C., "Perspectives on Capital and Technology in Less Developed Countries." In: M.J. Artis, A.R. Nobay (Eds.), *Contemporary Economic Analysis.* London 1977, pp. 15–42.

Keesing, Donald B., "Labour Skills and International Trade: Evaluating Many Trade Flows with a Single Measuring Device." *Review of Economics and Statistics,* Vol. 47, 1965, pp. 287–294.

–, "Labour Skills and Comparative Advantage." *The American Economic Review, Papers and Proceedings,* Vol. 56, 1966, pp. 249–258.

Krueger, Anne O., *Growth, Distortions and Patterns of Trade Among Many Countries.* Princeton Studies in International Finance, 40, Princeton 1977.

– **(Ed.),** *Trade and Employment in Developing Countries. 2: Factor Supply and Substitution.* Chicago 1982.

– **(Ed.),** *Trade and Employment in Developing Countries. 3: Synthesis and Conclusions.* Chicago 1983.

–, **H.B. Lary, T. Monson, N. Akrasanee (Eds.),** *Trade and Employment in Developing Countries. 1: Individual Studies.* Chicago 1981.

Leamer, Edward E., *Sources of International Comparative Advantage: Theory and Evidence.* Cambridge, Mass., 1984.

Lee, T.H., Kuo-Shu Liang, "Taiwan." In: Bela Balassa (Ed.), *Development Strategies in Semi-Industrial Economies.* Baltimore 1982, pp. 310–350.

Leontief, Wassily W., "Domestic Production and Foreign Trade: The American Capital Position Re-examined." *Proceedings of the American Philosophical Society,* Vol. 97, 1953, pp. 332–349.

Metcalfe, J.S., Ian Steedman, "On the Transformation of Theorems." *Journal of International Economics,* Vol. 11, 1981, pp. 267–271.

Minford, Patrick, "A Labour-Based Theory of International Trade." In: J. Black, A.I. MacBean (Eds.), *Causes of Changes in the Structure of International Trade 1960–85.* Basingstoke 1989, pp. 196–239.

Niroomand, Farhang, "Factor Inputs and US Manufacturing Trade Structure 1963–1980." *Weltwirtschaftliches Archiv,* Vol. 127, 1991, pp. 744–763.

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

Pasinetti, Luigi L., *Structural Change and Economic Growth.* Cambridge 1981.

Schumacher, Dieter, *Employment Impact in the European Community Countries of East-West Trade Flows.* International Employment Policies Working Papers, 24, World Employment Programme, ILO, Geneva 1989.

Sinn, Stefan, "Saving-Investment Correlations and Capital Mobility: On the Evidence from Annual Data." *The Economic Journal,* Vol. 102, 1992, pp. 1162–1170.

Smith, M.A.M., "Capital Theory and Trade Theory." In: Ronald W. Jones, Peter B. Kenen (Eds.), *Handbook of International Economics, Vol. I.* Amsterdam 1984, pp. 289–321.

Steedman, Ian, *Trade Amongst Growing Economies.* Cambridge 1979.

United Nations Centre on Transnational Corporations (UNCTC), *Transnational Corporations in World Development: Third Survey.* New York 1983.

–, *Transnational Corporations in World Development: Trends and Prospects.* New York 1988.

United Nations Industrial Development Organization (UNIDO), *The Impact of Trade with Developing Countries on Employment in Developed Countries.* Working Papers on Structural Change, 3, Vienna 1978.

Westphal, L., K.S. Kim, "Korea." In: Bela Balassa (Ed.), *Development Strategies in Semi-industrial Economies.* Baltimore 1982, pp. 212–279.

Wood, Adrian, *Skill, Land and Trade: A Simple Analytical Framework.* Institute of Development Studies, University of Sussex, Brighton, unpublished paper, 1993.

–, *North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World.* Oxford 1994.

World Bank, *World Development Report.* New York 1989.

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Abstract: Give Heckscher and Ohlin a Chance! – This paper argues that criticism of the empirical inaccuracy of Heckscher-Ohlin theory has been much exaggerated. Most tests have mis-specified the theory, particularly in their treatment of capital, a factor of production which is internationally mobile and therefore generally does not influence the pattern of trade. The argument is illustrated by a review of empirical studies of North-South trade in manufactures, which is well explained by a skill-only Heckscher-Ohlin model. *JEL No. F11*

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Zusammenfassung: Gebt Heckscher und Ohlin eine Chance! – Der Verfasser ist der Ansicht, daß das Heckscher-Ohlin-Theorem mit der Wirklichkeit besser übereinstimmt, als viele Kritiker behaupten. In den meisten Tests wurde nämlich die Theorie falsch spezifiziert, insbesondere im Fall des Produktionsfaktors Kapital, der international mobil ist und deshalb im allgemeinen die Struktur des Außenhandels nicht beeinflußt. Belegt wird dieses Argument durch eine Reihe empirischer Untersuchungen des Nord-Süd-Warenhandels, der durch ein Heckscher-Ohlin-Modell ohne Kapital gut erklärt wird.