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QUALITY DIFFERENTIATION AND THE LABOUR MARKET EFFECTS OF INTERNATIONAL TRADE*

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Abstract

This paper offers a new treatment of the labour market effects of international trade, based on a model in which intra-industry trade is explained on Heckscher-Ohlin principles. The model is more consistent with stylised facts about North-South trade than the traditional Heckscher-Ohlin model of inter-industry trade. Applying the model to trade between Italy and 'non-advanced countries' and inferring the factor content of intra-industry trade from the inter-sectoral relationship between factor intensity and average unit values of exports, we find that the labour market effects of intra-industry trade add significantly to the estimated factor market impact of trade. [97 words]

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1. Introduction

This paper offers a new approach to investigating the links between international trade and the labour market.

Dramatic changes in relative wages that have taken place in the United States since the mid-1970s (documented, for example, by Krugman, 1994, and by Freeman, 1995, who writes 'an economic disaster has befallen low-skilled Americans, especially young men') and the almost as dramatic increases in European unemployment in the same period can be interpreted as different manifestations of a common phenomenon: the labour market misfortunes of the less skilled (Alogoskoufis *et al.*, 1995, for example, give data on the differential incidence of unemployment among unskilled workers as well as on the growth of European unemployment rates). The period of these dramatic changes have also seen a very rapid growth of international trade in manufactured goods with developing countries, especially the 'tigers' of south-east Asia.

The standard textbook model of international trade, the two-good, two-factor Heckscher-Ohlin-Samuelson model, provides a means of interpreting these phenomena. Take the two factors as skilled and unskilled labour, suppose that the rapidly growing developing countries are abundant in unskilled labour (Wood, 1994, notes that 'unskilled' in this context is to be interpreted as 'having basic education', since workers without basic education do not generally engage in the production of traded goods), and the model predicts that growth of trade between developed and developing countries will in developed countries shift production towards

skill-intensive products, drive down the relative price of unskilled-intensive goods, raise the real wages of skilled workers and reduce the real wages of the unskilled. Add a story about downward rigidity of the real wages of the unskilled in socially-regulated labour markets and the model will generate unemployment rather than relative wage changes.

Faced with two striking empirical phenomena and a theory which links the two, there is an almost overwhelming temptation to see the empirical phenomena as confirming the theory, and the perceived link between globalisation and labour markets is politically influential in many quarters, particularly in France and in the United States.

However, the weight of academic opinion, at least among international economists, is opposed to the view that there is a strong link between the growth of trade and the growth of labour market inequality. Freeman (1995) surveys the differing positions taken and notes the paradoxical fact that trade theorists are in the forefront of those denying the importance of trade in income distribution.

Lawrence and Slaughter (1993) was an influential contribution, with popularising support from Krugman and Lawrence (1994) and Krugman (1994). Sachs and Shatz (1994) find more support for a link between trade and labour markets than Lawrence and Slaughter, but still fall short of confirming the conventional wisdom. Wood (1994) and Leamer (1995) are unusual among trade economists in finding evidence of strong links between trade and labour markets.

A particularly striking contribution to the debate was Lawrence and Slaughter's comparison of the predictions of the Stolper-Samuelson analysis with the facts of industrial adjustment in the United States. The theoretical story has three steps: (1) growing exports of unskilled-intensive products by developing countries drives down the price of these products in developed countries, thereby (2) driving down the relative wage of unskilled labour, causing substitution in production towards unskilled labour, and (3) maintaining full employment by inter-sectoral substitution of production towards more skill-intensive products. Lawrence and Slaughter, proxying the skilled/unskilled distinction by nonproduction/production workers, (1) find no evidence of relative price changes (though Sachs and Shatz do), (2) they demonstrate (at three different levels of aggregation) in their Figure 7 that the rise in the relative wages of non-production workers has been accom-

panied by an increase in the relative employment of non-production workers in almost all sectors, and (3) they find no evidence of an inter-sectoral shift in production. The evidence they present is strongly suggestive of a chain of causation that runs from an exogenous increase in the demand for skilled workers in most sectors (arising from technological change) driving up the relative wage of such workers rather than the chain of causation in the Stolper-Samuelson story.

Other authors (such as Wood) have focused on the effect of trade on the demand for labour, rather than on prices. The computable general equilibrium (CGE) simulations reported in Smith (1998) offer results concerning both labour demands and relative wages within a single model. Both sets of results seem to confirm the conclusion that the labour market effects of trade are small. Even an extraordinarily large shock - removing all EU trade with non-advanced countries - seems to have remarkably small impacts on labour markets.

However, there are two broad reasons why estimates of the impact of trade on labour markets, whether based on factor content, factor price, or on CGE calculations, are generically likely to produce small numbers.

The first relates to the level of aggregation. The CGE computations in Smith (1998) are done at the 3-digit level of the NACE industrial classification, a level of aggregation comparable to those used in most studies of this subject. But at this level, there is first of all fairly modest sectoral variation in factor market shares, and secondly a fair degree of intra-industry trade even in trade between the EU and non-advanced countries. With only limited difference in the sectoral distribution of imports and exports and only limited variation in the sectoral difference in factor shares, it is arithmetically inevitable that trade will have small labour market effects. In similar vein, one might worry that Lawrence and Slaughter's failure to find the shifts in techniques of production towards less skill-intensity and in production patterns towards more skill-intensive products predicted by the Stolper-Samuelson theorem could reflect the fact that these shifts were present, but *within* sectors and not showing up at the level of aggregation of the data. Lawrence and Slaughter attempt to deal with this issue by showing the same phenomena at three levels of aggregation, of which the

least aggregated is at four-digit SIC level. They suppose that disaggregation to this level will reveal the impact of vertical disintegration of production. However, even disaggregation to the four-digit level may fail to detect effects associated with quality and skill-content differences between similar products.

There is, secondly, an issue about the characterisation of labour skills. Smith (1998), as in other work on European data, divides labour between non-manual and manual, a different distinction from that between production and non-production workers commonly used in American work on this issue. But it is arguable that neither distinction does a good job of capturing the distribution of skills in the labour force. Figure 7 in Lawrence and Slaughter (1993) has a glaring but unremarked feature that should cast strong doubt on whether their data can be interpreted within a Heckscher-Ohlin approach. At the four digit level, they show sectoral changes in the relative wages of production to non-production workers that vary between -55% and 130%; while the ranges are -8% and +18% at two-digit level, -50% and +45% at three-digit level. All of these numbers are wildly inconsistent with a model in which there are two kinds of intersectorally mobile labour, and in which the same relative wage should be observed in each sector. Sectoral 'skill ratios' apparently fail to capture much quality differentiation at product level, and so may be largely irrelevant to the actual skill composition of trade.

However, from this we conclude not that the effects of trade in labour markets are really unimportant, but rather that the ‘mainstream’ empirical trade model is ill-suited to provide good estimates of the labour market effects of trade, because its structure fails to provide an appropriate model either of the skill endowments of the economy or of the skill intensity of production.

All of this suggests a need for a serious and systematic approach to quality differentiation in trade. The analytical model presented below deals with the issue of aggregation by providing an account of intra-industry trade that is based on comparative advantage. Each sector is modelled as containing a continuum of techniques. This permits factor substitution within sectors at the level of the individual product, allowing a much richer range of substitution effects. In principle, the model could be adapted to offer a more sophisticated treatment of the skill-intensity of produc-

tion, but the current version has two types of labour, manual and non-manual proxying for unskilled and skilled labour. The model explains both intra-industry trade and inter-industry trade as deriving from factor endowment differences between countries, it implies that trade will affect inequality, and the properties of the model are consistent with the three stylised facts which Lawrence and Slaughter use to dismiss the Stolper-Samuelson explanation of American wage change.

2. The model

2.1 Demand

The focus of the model is on quality differentiation in production, so the demand side is based on the simplest model of demand for differentiated products, a version of the Dixit-Stiglitz (1977) model, in which it is assumed that there is a continuum of varieties of each good, and that consumer preferences can be represented by a two-stage utility structure.

Suppose that there is a continuum of varieties of product X_i, and that aggregate consumption of the product can be represented by the sub-utility function

$$X_i = \left(\int_0^b a_i(v)^{\frac{1}{e}} x_i(v)^{\frac{e-1}{e}} dv\right)^{\frac{e}{e-1}} \tag{1}$$

where $e > 1$. The price index (unit cost function) representing the cost of producing a single unit of X_i is then given by

$$P_i = \left(\int_0^b a_i(v) p_i(v)^{1-e} dv\right)^{\frac{1}{1-e}} \tag{2}$$

where $p_i(v)$ is the price of variety $x_i(v)$, and the demand for an individual variety is

$$x_i(v) = a_i(v)(\frac{p_i(v)}{P_i})^{-e} X_i \quad (3)$$

so e is the elasticity of demand for a variety with respect to its price relative to the price index of the product group. There is no loss of generality is assuming that the product range [0, b] is the same for every product group *i*, while the assumption that e is independent of *i* could easily be relaxed.

The aggregate cost of all varieties of this product group is

$$\int_0^b p_i(v)x_i(v)dv = P_i X_i \quad (4)$$

If there are *n* such product groups and upper-level preferences across product groups are Cobb-Douglas, with product group X_i having a share a_i of total expenditure *m*, the demand function (2) for an individual variety becomes

$$x_i(v) = a_i a_i(v) p_i(v)^{-e} P_i^{e-1} m \quad (5)$$

2.2 Supply

Production of each variety requires both skilled and unskilled labour. Let the unit marginal cost of production be

$$c_i(v) = w_s s_i(v) + w_u u_i(v) \quad (6)$$

where $s_i(v)$ and $u_i(v)$ are the input requirements of skilled and unskilled labour respectively. With Chamberlinian monopolistic competition, in which firms ignore the impact of their decisions on the aggregate price index, each firm will set its price as a fixed mark-up over marginal cost

$$p_i(v)\left(1-\frac{1}{e}\right) = c_i(v) \quad (7)$$

and the number of firms producing varieties of the product will in a free-entry equilibrium depend on the level of fixed costs.

The Chamberlin large-group assumption implies that a product variety will be supplied by the lowest cost producer.

2.3 Trade

If products are arranged on the spectrum [0, *b*] in order of skill intensity, then countries will specialise in different parts of the spectrum, depending on their ratios of skilled to unskilled wages. Thus if $s_i(v)/u_i(v)$ is increasing in v, and if there are two countries, with

$$w_s^1 / w_u^1 > w_s^2 / w_u^2 \tag{8}$$

and if both countries can produce variety v_i^*, so

$$w_s^1 s_i(v_i^*) + w_u^1 u_i(v_i^*) = w_s^2 s_i(v_i^*) + w_u^2 u_i(v_i^*) \tag{9}$$

then country 2, the skill-abundant country, will produce only varieties $v \geq v_i^*$, while country 1 will produce varieties $v \leq v_i^*$ and it is clear that $w_s^1 > w_s^2$ and $w_u^1 < w_u^2$, though introducing an assumption that the skill-abundant country has a technical advantage, whether neutral or skill-augmenting, would obviously permit both wages to be higher in that country.

Writing the ratio of wage differences as

$$W = \frac{w_u^2 - w_u^1}{w_s^1 - w_s^2} \tag{10}$$

equation (9) can be rewritten as

$$\frac{s_i(v_i^*)}{u_i(v_i^*)} = W \tag{11}$$

For products *j* for which

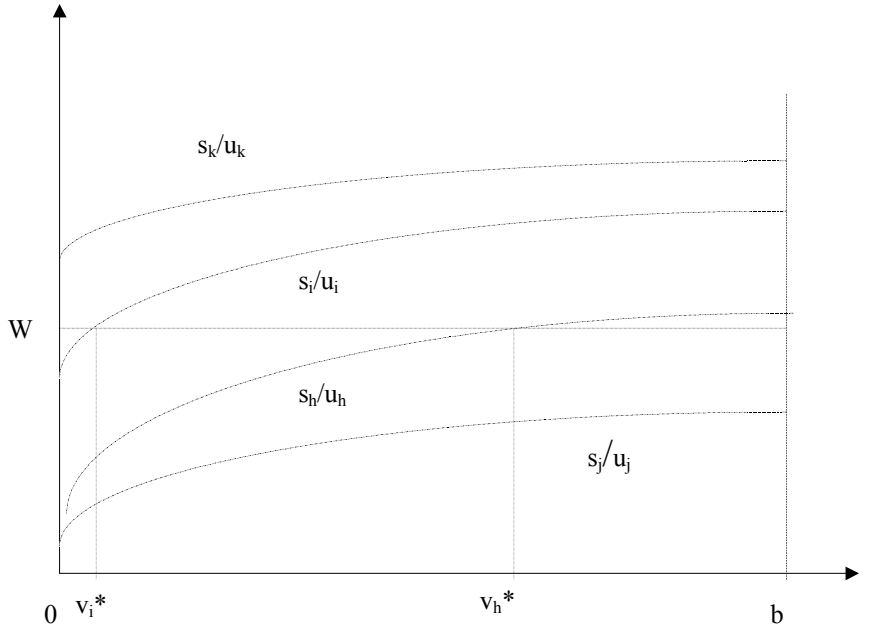
$$\frac{s_j(b)}{u_j(b)} < W \tag{11}$$

the whole spectrum of production will be located in country 1, while for products *k* for which

$$\frac{s_k(0)}{u_k(0)} > W \tag{11}$$

all production will be located in country 2. The three possibilities are illustrated in Figure 1.

Figure 1: intra-sectoral specialisation



Since the skill-intensity of all production processes in country 1 is less than W and in country 2 is greater than 1, the factor content version of the Heckscher-Ohlin theorem in the standard two-factor model continues to hold: all exports are more skill-intensive than imports, so trade will embody a net outflow of the abundant factor.

Figure 1 shows two products, i and h, which have varieties produced in both countries. Unless the distributions of the $a_i(v)$ and $a_h(v)$ are extraordinarily skewed, the range of specialisation in varieties will give a rough approximation to the level of relative output so we should expect the skill-abundant country to be a net exporter of product *i* and a net importer of product *h.* Thus the skill-abundant country will be a net exporter of goods whose skill-intensity, *averaged across the full product range*, is high, so if we measure factor intensity at the world level, we will observe countries being net exporters of products which are intensive in their abundant factors.

However, information on the skill-intensity of production is usually derived from a single country's statistics, and here the model makes slightly fuzzier predictions. Figure 1 indicates that there is an expectation that the skill-abundant country will be a net exporter of goods whose skill intensity, *measured in that country*, is high; though this proposition is vulnerable to skewness in the distribution of demand.

This model is closely related to that used by Falvey (1981) and Falvey and Kierzkowski (1985) to model vertical product differentiation, but in the version here product varieties enter the utility function in a symmetrical fashion: all the vertical product differentiation is on the production side. In the spirit of the Heckscher-Ohlin model, it is assumed that consumer tastes, as described in section 2.1, are the same in different countries. With free trade, therefore, the same distribution of products and of product varieties enters consumption in all countries. The production side of the model is a multi-sector version of that used by Feenstra and Hanson (1996) to model the effects of capital flows.

This then is a model which is firmly in the Heckscher-Ohlin tradition in which countries have common tastes and technology, and trade arises from differences in factor endowments of countries and factor requirements of goods. The model differs from the

standard textbook HOS model in that factor endowment differences explain intra-sectoral rather than inter-sectoral specialisation: it is a Heckscher-Ohlin model of intra-industry trade.

2.4 The effects of growth of North-South trade

Now consider trade in a two-country setting, in which the less skill-abundant country ('the South') grows. This could be interpreted as a stylised model of developments in the world economy in the 1980s, with rapid growth of South East Asian economies and with China entering the world market.

The growth of international trade with the South will lead to the North moving up the quality spectrum in every sector, and will increase the demand for labour skills and push up the skill premium, without there necessarily being any inter-sectoral specialisation. In Feenstra and Hanson's model, a flow of capital from North to South raises the skill-intensity of production and the skill premium in *both* countries. This property runs contrary to the prediction of the standard two-good two-factor HOS model, but is in line with some evidence on what has happened to wage differentials in low-wage trading economies (Robbins, 1994). Whether the skill premium rises in the South in the present model depends on the specification of the exogenous change that drives the growth of trade: but either uniform growth of both kinds of Southern labour or a simple trade liberalisation would have that effect.

The rise in the skill premium in the North will raise the relative price of skill-intensive product varieties but will have weak and uncertain effects on relative sectoral price indices (Lawrence and Slaughter observation 1), there will be an increase in the relative employment of skilled workers in all sectors (observation 2), and there will be no systematic inter-sectoral shifts in production (observation 3). In other words, the Heckscher-Ohlin model of intra-industry trade is consistent with *all* the phenomena which Lawrence and Slaughter use to cast doubt on the link between trade and the labour market. It is a model in which, clearly, trade will have factor market effects and we now turn attention to the issue of the likely size of these effects.

3. An empirical application

Empirical implementation of the ideas set out in the previous section is far from straightforward, because much less direct information is available about intra-sectoral trade than inter-sectoral trade. The evidence advanced here should therefore be interpreted as suggestive rather than conclusive.

We have chosen as the empirical case-study the trade of Italy with a group of countries we label 'less advanced countries' (LACs) which are all the world except the EU, EFTA, the USA, Canada, Japan, Australia and New Zealand. (The LACs are not quite the same as non-OECD countries: they include Turkey and the countries which joined OECD in the 1990s.) It is a wider category of countries than 'less developed countries' as usually defined, because of the inclusion of East European countries, all of Latin America and even the most advanced of the South East Asian countries. Trade with LACs is more than half of Italy's non-EU trade and thus more than 20% of all of Italy's trade. Furthermore, this is the part of Italy's foreign trade that might be expected to have the largest labour market impact.

The analysis focuses on manufacturing (NACE 241-495) excluding metals and minerals (221-232) and food, drink and tobacco (41, 42), this latter exclusion because when we compare 3-digit and 8-digit data, it is difficult to disentangle agriculture from food processing. The year for the analysis is 1993.

A conventional estimate of the effects of trade with the LACs on the Italian labour market may be undertaken at the 3-digit NACE level at which both trade data (from the European Commission's COMEXT database) and industrial data (from the EC's INDE database) are available. Smith (1998) provides evidence which suggests that measurement of the factor content of trade gives a good approximation to the effects of trade on factor markets even though it ignores general equilibrium interactions, and all of the analysis of this section will use factor content calculations.

The 3-digit factor content calculation takes the ratios of manual and non-manual labour to the value of production in the industrial data and assumes that these ratios will apply to the production of exports and import substitutes. Such a calculation shows that

trade with LACs raises the demand for manual labour in Italian non-food manufacturing by 5.23% and for non-manual labour by 6.64%. Both numbers are positive, because Italy has a trade surplus with LACs, and both numbers are non-trivial, reflecting the quantitative significance of trade with LACs. However, if one is interested in the effects of trade on the relative fortunes of skilled and unskilled labour, it is the difference between the two numbers above that is of interest, and the fact that trade with LACs raises the demand for non-manual labour by 1.5% more than the demand for manual labour is not a very impressive statistic given the scale of this trade. This calculation is in line with the now conventional wisdom among trade economists that trade with less advanced countries has a small effect on the labour markets of advanced economies.

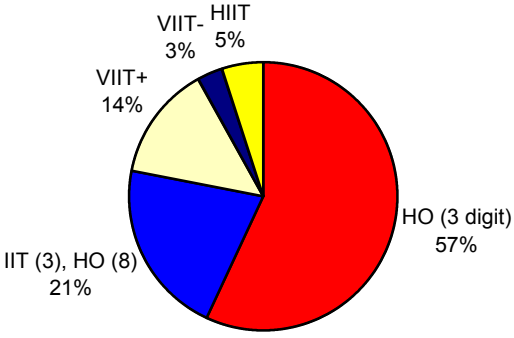
However, the conventional wisdom is based on the Heckscher-Ohlin model of inter-industry trade applied to three-digit sectors. At the three digit level, the Grubel-Lloyd index of intra-industry trade is 43% for Italy-NAC trade in 1993. Thus almost half of trade is excluded from the factor-content calculation because 43% of trade consists of offsetting flows of imports and exports within 3-digit sectors, that is to say flows which have zero effect in the factor content calculation.

Compare the statistics calculated at the 8-digit CN level. It is not possible to make an exact match between the product categories chosen for analysis in the two classifications, but the 8555 commodities in chapters 28 to 99 on the CN classification correspond reasonably closely with the 83 NACE classes in the 3-digit non-food manufacturing sectors. Now the Grubel-Lloyd index is under 22%, so half of the trade excluded from the 3-digit analysis as intra-industry trade is inter-industry trade at the 8-digit level. Different 8-digit products with a 3-digit sector can have quite different factor requirements.

The difference between the two classifications is illustrated by the fact that there are 100 times more 8-digit commodities than 3-digit sectors. It can also be illustrated by example: CN code 84182199 refers to ‘Household refrigerators, compression-type, capacity between 250 and 340 litres, excluding table models and building-in types’ and this is one of 68 commodities which correspond to NACE sector 346 ‘domestic electrical appliances’.

Thus, at the 8-digit level it is possible to use unit-values (the ratio of value to weight) as a meaningful indicator of product quality. We follow Abd-el-Rahman, 1991, Torstensson, 1991, Landesmann and Burgstaller (1997) and Fontagné et al. (1998) in using differences between the unit values of imports and exports of products in the same 8-digit class to distinguish between horizontal and vertical intra-industry trade. If the unit values of imports and exports diverge by more than 15%, this is taken as indicating that imports and exports are of different quality so that there is vertical intra-industry trade (VIIT); while differences of less than 15% indicate horizonal intra-industry trade (HIIT). One can further distinguish between 'VIIT+' trade, where the unit values of the export flow is greater (by at least 15%) than the import unit value; while 'VIIT-' trade describes the case where it is import unit values that are larger.

Figure 2: Italy-LAC trade 1993



Of the 22% of Italian-LAC trade that is IIT at the 8-digit level, only 5% is HIIT, 14% is VIIT+, and 3% is VIIT- (the division between the two categories of VIIT reflecting the fact that Italy is

more advanced than virtually all the LACs). The different categories are illustrated in Figure 2, where 'HO (3-digit)' refers to trade that is inter-industry at the 3-digit level, 'IIT (3), HO (8)' is the part of trade that appears to be intra-industry at the 3-digit level but inter-industry at the 8-digit level, while the different forms of intra-industry trade at the 8-digit level are labelled in accordance with the terminology used above.

Thus whereas 43% of trade is counted at the 3-digit level as intra-industry trade which has no factor market impact, disaggregation to the 8-digit level suggests that only 5% of trade is actually intra-industry trade in products of the same type and comparable quality. The remaining 38% consists of matching flows of imports and exports, but the matching is either of different products in the same sector or of different qualities of the same product. These two kinds of matched trade are what Wood refers to as 'non-competing imports'; and both have the potential to have significant labour market effects.

However, in the absence of industrial or labour market data at the level of disaggregation of the 8-digit CN, the task of trying to deduce how significant these labour market effects might be is a formidable one. This paper attempts to make a start on that task, but it needs to be emphasised that the calculations presented here are of a tentative nature. Confidence in the robustness of the numbers presented here would require the exercise to be repeated on data for other countries and would also be helped by a less crude treatment of the skill composition of the labour force.

The first step is to follow Greenaway and Torstensson (1996) in seeking evidence that unit value comparisons do indeed provide evidence that is consistent with the kind of model presented. Landesmann and Burgstaller (1997) have computed unit value comparisons for a number of 3-digit NACE sectors for trade between the EU and a number of countries, EU and non-EU. Unit value differences between a country's exports to the EU and all countries' exports to the EU are computed at 8-digit level and then averaged to the 3-digit level. Cross-country regressions of income and educational data against these 'price gaps' reveal significant relationships which are consistent with the model of section 2: differences in countries' relative endowments of human capital (measured by the percentage of the adult population with com-

pleted high school education) and of development general (measured by GDP per worker) give rise to specialisation in different parts of the quality spectrum. (Interestingly, however, a measure of schooling gives the wrong sign when the Eastern European countries are included in the regression: suggesting that educational statistics for these countries overstate the economic value of the education provided.) For details, see Ferragina and Smith (1999).

The key requirement, however, is to find some indicator at product level of skill-intensity. The model implies that within an 8-digit product category there will be a systematic relationship between the prices of product varieties and their skill intensity, and given the tight definition of an 8-digit product, we can have a degree of confidence that the main source of unit value differences is likely to be in the characteristics of the product (rather than, say, in how much raw material or intermediate product is incorporated in it). There is no such reason to suppose that there will be a systematic relationship between unit values and the skill-intensity of production across 8-digit products or, *a fortiori*, across 3-digit sectors. A relationship between unit values and skill-intensity at the 3-digit level should therefore reflect the underlying relationship within the 8-digit categories, overlain by a great deal of noise. But given that data on skill-intensity are available only at the 3-digit level, this is where we have to look for empirical evidence.

On the input side, the most readily available data on skill inputs are 1993 INDE data for Italian inputs of manual and non-manual labour in 3-digit sectors, and input coefficients were defined as ratios of non-manual labour to turnover (UNY) and manual labour to turnover (SKY). Regression of the average unit-value of Italian 1993 exports to LACs (UVX) (calculated at 8-digit level and averaged for each sector across all 8-digit commodities) against these input coefficients across 73 3-digit sectors gave:

$$\begin{aligned} SKY &= 1.3255 + 0.304847 \ln (UVX) \\ &\quad (11.18) \quad (6.93) \qquad R^2=0.40 \\ UNY &= 4.6876 + 0.33478 \ln (UVX) \\ &\quad (13.29) \quad (2.56) \qquad R^2=0.08 \end{aligned} \tag{12}$$

(t-statistics in parentheses).

At first sight the positive coefficient in the second regression may seem surprising, but it is easily checked that the two regressions together imply that the ratio of non-manual to manual labour is increasing in the unit value of exports, which is consistent with the notion of product quality being skill-intensive. It is also acceptable that higher quality products require more of both kinds of labour.

We now take the large step of applying equations (12) to data on the unit values of Italian exports and imports of individual 8-digit products to predict input requirements of individual products and then use the derived coefficients to conduct a factor content calculation on the full 95% of Italian-LAC trade that is not horizontal intra-industry trade. The slope coefficients in the regressions are used to adjust the input coefficients for individual products relative to the sector average, so that within each 3-digit sector, the sectoral input coefficients remain at the levels given in the INDE data and used in the 3-digit factor content calculation.

A variant on the calculation in the spirit of Wood (1995) is also undertaken: using the unit values of *imports* and the regression coefficients above to impute input coefficients to import-competing production in the factor content calculation.

The first calculation therefore attempts to calculate the labour market effects of the 21% of Italian-LAC trade that is measured as intra-industry trade at the 3-digit level but as inter-product trade at the 8-digit level by imputing labour input coefficients to each 8-digit commodity, but the same input coefficients to exports and to import substitutes. The second calculation goes further: by imputing separate coefficients to exports and import substitutes, it allows for factor market effects from vertical intra-industry trade at the 8-digit level.

Since Italy had a substantial trade surplus with the LACs in 1993, the results are better interpreted with the effects of the trade surplus removed. This is done by considering the effect of balanced trade change: where the factor content of exports is scaled down in proportion to the excess of exports over imports.

In the 3-digit factor-content calculation, balanced Italian-LAC trade implies a 0.68% increase in the demand for non-manual labour in Italy and a 0.09% reduction in the demand for manual labour. These numbers are smaller than the 6.64% and 5.23% de-

rived from the unbalanced trade calculation. Again it is the difference between the two numbers which is most meaningful: balanced trade with NACs raises the relative demand for non-manual labour in Italy by 0.72%.

The 8-digit factor content calculation using only export unit values gives a 1.15% increase in demand for non-manual labour and a 0.11% increase in demand for manual labour, so the relative demand for non-manual labour rises by 1.04%.

The 8-digit calculation allowing for vertical intra-industry trade implies respective changes of 1.24% and 0.16%, so a change in relative demand of 1.08%.

The model provides an alternative approach to that of Wood for the calculation of the impact of what he calls 'non-competing imports', effectively intra-industry trade, on the labour market effects of trade. We draw three conclusions. (1) The more disaggregated calculations produce significantly larger labour market effects of trade. (2) The scale of the difference is less than in Wood's calculations - he doubles the labour market impact of North-South trade in manufactures by taking account of non-competing imports, whereas we calculate that intra-industry trade has an additional impact of less than 50% (raising the relative demand effect from 0.72% to 1.04% or 1.08%). (3) Most of the labour market effect of intra-industry trade comes from allowing for inter-product specialisation within sectors rather than for intra-product trade.

4. Conclusions

We have here presented a model in which intra-industry trade is explained on Heckscher-Ohlin lines by factor endowment differences between countries and factor intensity differences between products. The properties of the model are more consistent with stylised facts about North-South trade than the traditional Heckscher-Ohlin model of inter-industry trade.

Applying the model to trade between Italy and a broad definition of 'non-advanced countries' and inferring the factor content of

intra-industry trade from the inter-sectoral relationship between factor intensity and average unit values of exports, we find that allowing for trade that is intra-industry but inter-product adds significantly to the estimated factor market impact of trade, while the additional impact of intra-product trade is small. The overall additional effect of intra-industry trade is smaller than that which Adrian Wood ascribes to 'non-competing imports'.

The empirical estimates are based on a heroic inference from two rather fragile statistical relationships and the robustness of the empirical work needs further exploration. Further, we have emphasised that a less crude approach to the modelling of the skill content of production would also be desirable.

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