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Has China de-industrialised other developing countries?

Adrian Wood* and Jörg Mayer**[1]

adrian.wood@qeh.ox.ac.uk joerg.mayer@unctad.org

China's opening to trade is interpreted as a shift in world average factor endowments, which altered the comparative advantage of other countries. In the rest of the world on average, this shift reduced the ratio of labour-intensive manufacturing to primary production by 7-10% for output and 10-15% for exports. China's impact is clearest on East Asian countries: in other developing regions, it was swamped by other causes of structural change. The de-industrialising effect was significant, but not big enough to be a serious threat to growth or equity in most other developing countries.

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* Department of International Development, Queen Elizabeth House, Oxford
** United Nations Conference on Trade and Development, Geneva

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1. Introduction

The least disputable of China's impacts on the world has been the explosion of studies of China's impact on the world. These range from broad analyses of global payments imbalances and interest rates (*e.g.* Dooley *et al.*, 2004) to detailed examination of the exports of particular commodities by particular countries (*e.g.* Gallagher *et al*., 2008). Most of them refer to the past, but some forecast the future (*e.g.* Yang, 2003; Mayer and Fajarnes, 2008). They have used various methods, including inspection of trade data (*e.g.* Lall *et al*. 2005; Mesquita Moreira, 2007; Kaplinsky and Morris, 2008), revealed comparative advantage calculations (Lederman *et al*., 2008), gravity models (*e.g.* Hanson and Robertson, 2007; Greenaway *et al*., 2008) and computable general equilibrium (CGE) models (*e.g.* Dimaranan *et al*., 2006). To survey this literature would require an entire paper, but good bibliographies are available in Goldstein *et al* (2006), Winters and Yusuf (2006) and Broadman (2007).

The focus of the present paper is on how the entry of China into world markets over the past three decades has affected the broad sectoral structures of other economies, especially developing ones. It looks in particular at the balance between the two broad traded sectors that matter most to developing countries, namely labour-intensive manufacturing, which is often said to have been harmed by competition from China, and primary production, which is often said to have gained from increased demand by China. The effects of China on both these sectors in other developing countries have aroused concerns and suspicions about retarded industrialisation, reduced employment and increased inequality in Africa, Latin America and the rest of Asia.

The analysis in this paper goes beyond most other studies of the impact of China by examining the sectoral structure not only of exports but also of output (in this respect being similar to the CGE studies). It is also set in a more clearly specified theoretical framework – that of Heckscher and Ohlin (H-O) – than most other studies. The relevance of H-O is contested by Rodrik (2006), who finds China's exports to be more sophisticated than normal for its level of development, but his results are challenged by Xu (2007), Amiti and Freund (2008) and Schott (2008). Our own earlier work (Mayer and Wood, 2001) also suggests that China's export structure is rather well explained by its factor endowments.

Section 2 shows how, in H-O theory, the entry of China into world markets should affect the sectoral structures of other countries. It also outlines the empirical method to be applied in the rest of the paper. Section 3 describes the sources of our data, and their strengths and weaknesses. Section 4 explains and applies our methods for calculating the impact of China on world average endowments. Section 5 estimates the effects of endowments on output and export structures. Section 6 combines the results of the two previous sections into predictions of the impact of China on output and export structures in other countries, and then compares the predictions with actual changes in these structures. Section 7 concludes.

2. Theory and method

The impact of China on other countries can be interpreted in H-O theory as occurring through a shift in world average factor endowments. The comparative advantage of a country depends on its endowments not in isolation but relative to the endowments of all other countries involved in trade. This comparator group was altered by China's emergence from near-autarky, because of its size and distinctive endowment structure, and hence so was the comparative advantage of other countries.

More specifically, as will be documented later, China's opening to trade effectively lowered the world average land/labour ratio and increased the share of workers with a basic education in the world labour force. The relative endowments of other countries were thus shifted in the opposite directions, which tended to move their comparative advantage away from labour-intensive manufacturing, which requires a lot of workers with a basic education but not much land. The corresponding increase in comparative advantage for developing countries was mainly in primary production, which uses a lot of land; for developed countries, it was mainly in skill-intensive manufacturing and services, which need workers with more than a basic education.

The mechanism by which this shift in world average endowments took effect was a vast expansion of China's exports, concentrated on labour-intensive manufactures, in which its own endowments give it a comparative advantage, and of its imports, which are concentrated on primary products and skill-intensive manufactures, in which it has a comparative disadvantage. These changes in trade flows altered relative prices on world markets and shifted the demand functions faced by producers in other countries – inwards for labour-intensive manufactures, and outwards for primary commodities and skill-intensive manufactures.

A formal model

The impact of China can be analysed more precisely by extending the H-O model in Wood (2009), which refers to one country and holds world endowments constant, to include the effects of changes in world average endowments. We begin by explaining the single-country model, before turning to its extension.

Equation (1) shows how a country's relative outputs of labour-intensive manufactures (*M*) and primary products (*P*) are influenced by its endowments of three factors: workers with a basic education (*B*), land or natural resources (*N*) and the total labour force (*L*). The equation links proportional changes (denoted by hats) in relative sales of *M* and *P* by country *z* in market *ž*, $\hat{q}_M^{z\check{z}} - \hat{q}_P^{z\check{z}}$, to proportional changes, $\hat{v}_B^z - \hat{v}_L^z$ and $\hat{v}_N^z - \hat{v}_L^z$, in two endowment ratios, *B*/*L* and *N*/*L*.

$$\hat{q}_M^{z\check{z}} - \hat{q}_P^{z\check{z}} = \varepsilon_{MP}^{z\check{z}}\left[(\theta_{BM} - \theta_{BP})\varphi_{BL}^z\left(\hat{v}_B^z - \hat{v}_L^z\right) + (\theta_{NM} - \theta_{NP})\varphi_{NL}^z\left(\hat{v}_N^z - \hat{v}_L^z\right)\right] \qquad (1)$$

The terms in the square bracket specify how changes in endowments alter the relative production costs of *M* and *P*. Changes in endowment ratios change the relative prices of the factors concerned (in the opposite directions, via the φ's, whose size depends inversely on the scope for substitution among factors and goods).[2] The changes in

[2] More precisely, on the scope both for substitution among factors in particular sectors in response to changes in factor prices and for shifts in the sectoral structure of production in response to changes in the prices of goods (across all the sectors of the economy, not only between *M* and *P*). The scope for such sectoral shifts depends inversely on the level of the country's trade costs. The negative sign on the elasticity φ is cancelled in equation (1) by the negative sign on ε. In the standard Heckscher-Ohlin-Samuelson model, with countries in a single cone of diversification, changes in endowments would not

factor prices alter the relative production costs of *M* and *P* via the ($\theta - \theta$) terms. Each θ is the share of a factor in the cost of a good: for example, θ_{NP} is the share of land in the cost of primary production. The effects of changes in relative factor prices on the relative production costs of the two goods depend on the differences between the cost shares: for example, because $\theta_{BM} - \theta_{BP}$ is positive, a relative rise in the price of basic-educated workers raises the relative cost of labour-intensive manufactures.

Changes in relative production costs and thus in relative producer prices (at the farm gate or factory gate) alter the relative sales, and hence outputs, of *M* and *P*, to a degree governed by the first term of equation (1), $\varepsilon_{MP}^{z\check{z}}$, which is the elasticity of relative demand for country *z*'s varieties of *M* and *P* in market $\check{z}$. As explained in Appendix A and in Wood (2008), this elasticity can be written more fully as

$$\varepsilon_{MP}^{z\check{z}} = \frac{\beta_{MP} - s_{MP}^{z\check{z}}\left(\beta_{MP} - \gamma_{MP}\right)}{1 + \tau_{MP}^{z\check{z}}} \tag{2}$$

where γ_{MP} is the elasticity of substitution in consumption between the two goods, β_{MP} is the elasticity of substitution in consumption among different national varieties of *M* and *P* (averaged across the two goods, and likely to be much larger than γ_{MP}), and $s_{MP}^{z\check{z}}$ is an average of country *z*'s shares of market $\check{z}$ for *M* and *P*. The numerator of (2) is a weighted average of β_{MP} and γ_{MP}: the larger is country *z*'s share of market $\check{z}$, the closer to γ_{MP} (and thus the lower) is its demand elasticity. The demand elasticity depends also on trade costs, in two ways: they influence the market share; and they damp the transmission of changes in relative producer prices into changes in relative purchaser prices. This second channel is captured in equation (2) by $\tau_{MP}^{z\check{z}}$, which is country *z*'s average ratio of trade costs to production costs for *M* and *P* in market $\check{z}$ (excluding the part of trade costs that varies strictly in proportion to production costs).

Equation (3) extends equation (1) to include the effects on country *z*'s relative sales of *M* and *P* in market $\check{z}$ of changes in the endowments of the rest of the world (which is identified by a * superscript instead of a *z*). Its first line is equivalent to equation (1), but with $\varepsilon_{MP}^{z\check{z}}$ replaced by (2) and with the square-bracketed term in (1) written more compactly. It continues to show how a country's relative sales are influenced by its own endowments.

$$\begin{aligned}\hat{q}_M^{z\check{z}} - \hat{q}_P^{z\check{z}} &= \frac{\beta_{MP} - s_{MP}^{z\check{z}}\left(\beta_{MP} - \gamma_{MP}\right)}{1 + \tau_{MP}^{z\check{z}}} \sum_{i=B,N}\left(\theta_{iM} - \theta_{iP}\right)\varphi_{iL}^{z}\left(\hat{v}_i^{z} - \hat{v}_L^{z}\right) \\ &- \frac{\left(1 - s_{MP}^{z\check{z}}\right)\left(\beta_{MP} - \gamma_{MP}\right)}{1 + \tau_{MP}^{*\check{z}}} \sum_{i=B,N}\left(\theta_{iM} - \theta_{iP}\right)\varphi_{iL}^{*}\left(\hat{v}_i^{*} - \hat{v}_L^{*}\right)\end{aligned} \tag{3}$$

The second line of (3), which is derived in Appendix A, is similar in form to the first line. The terms in the summation specify how changes in world endowment ratios

alter factor prices (since full adjustment of factor demands could be achieved by shifts in the sectoral structure of production): φ would be infinite, as would be ε in equation (1), which would collapse back into the standard Rybczynski relationship between relative outputs and relative endowments. The basic difference between the present model and the standard model is that ε is less than infinite, as explained in Wood (2008) and Wood (2009).

alter world relative producer prices, in the same sort of way as in an individual country, namely by changing relative factor prices, whose effect on relative goods prices depends on cost shares.[3] The cost shares can be assumed to be the same for the world as for an individual country, but the effects of relative endowments on relative factor prices tend to be larger for the world (φ^{*}_{iL}), which is a closed economy, than for an individual country open to trade (φ^{z}_{iL}), which can respond to changes in its endowments by altering exports and imports as well as by substitution among factors in production and domestic consumption.

The second line of (3) is of opposite sign to the first line, which makes intuitive sense (for example, a fall in country z's relative price of M would raise its relative sales of M, while a fall in the world relative price would reduce them). The double-decker demand elasticity in the second line of (3) also differs from its counterpart in the first line. The numerator is smaller in the second line, but in both lines is inversely related to country z's share of market $\check{z}$. In the denominator, the world average ratio of trade costs to production costs in market $\check{z}$ may differ from that of country z (though if z were an average country, and $\check{z}$ were an export market, the two would be similar).

China's entry into world trade affected the q_M/q_P ratios of other countries by altering the v^* terms in the second line of (3). The equation implies that the effect was always in the same direction, but that its size varied, being smaller where market shares, $s^{z\check{z}}_{MP}$, were larger and trade costs, $\tau^{*\check{z}}_{MP}$, were higher. The impact of China is thus likely to have been less on bigger countries, which tend to have larger market shares. It is also likely to have had less effect on sales in home markets, in which shares are raised by a trade cost advantage, than in export markets, the difference being bigger for countries whose home markets are more protected. The impact of China on countries' relative outputs of M and P is thus likely to have been smaller than the impact on their relative exports, particularly for countries that export only small shares of their output.

In this sort of H-O model, the China impact is in the same direction as in the standard Heckscher-Ohlin-Samuelson model, but is different in magnitude and mechanism.[4] Another difference from the standard H-O model is that non-human capital plays no part in the analysis – the factors in the present model are just land and different sorts of labour. Our reason for omitting capital is that it is internationally mobile and thus does not influence the comparative advantage of individual countries (as explained more fully in Wood 1994: section 2.2).

Overview of method

Our estimates of the impact of China on the ratio of labour-intensive manufacturing to primary production in other countries, which will be made separately for total output and for exports, involve several steps, whose details and limitations will be discussed

[3] If world endowments were held constant, the ($v^* - v^*$) terms would be zero and the second line would thus vanish, reducing equation (3) back to the substance of equation (1).

[4] In the standard model, China's impact on the world market prices of goods causes changes in factor prices in each country, inducing changes in the mix of factors used in each sector. The sectoral mix of output then needs to alter to allow factor markets to clear. In the present model, because countries face less-than-infinitely elastic demand curves as a result of product differentiation and trade costs (Wood, 2008), China's impact on world market prices has more direct effects on other countries' relative sales and hence their production of the goods concerned.

in the relevant sections below. But the general approach can be outlined on the basis of equation (3), since what needs to be done is to estimate its second line.

A first step is to calculate (in section 4) the effect of China's opening on world factor endowments – the v^* terms. However, there is no way of estimating directly the rest of the second line, which would require long time series on endowments and sectoral structures for the world as a whole. Instead, we estimate the corresponding part of the first line of equation (3) – which is equivalent to equation (1) – using data on many individual countries (in section 5). In section 6, we use the coefficients from section 5 and the world endowment effects from section 4 to predict the impact of China on sectoral structures in other countries, and then compare these predictions with actual changes in sectoral structures.

A limitation of this approach is that the non-v terms in the first line of equation (3) differ from those in its second line. The trade cost ratios are different: for exports, our estimates of the first line should capture world average $\tau_{MP}^{*\bar{z}}$, but for output they may understate it and thus overstate the impact of China.[5] The other two differences pull in opposite directions. The elasticity of relative demand for a country's goods with respect to its own prices, $\beta_{MP} - s_{MP}^{z\bar{z}}(\beta_{MP} - \gamma_{MP})$, is larger than with respect to foreign prices, $(1 - s_{MP}^{z\bar{z}})(\beta_{MP} - \gamma_{MP})$. But as already mentioned, the elasticity of factor prices with respect to endowments is smaller for an individual country ($\varphi^z{}_{iL}$) than for the world as a whole ($\varphi^*{}_{iL}$). There is no obvious reason to suppose that one of these two effects is larger, so we assume that they roughly offset each other.

3. Data sources and problems

The data used in this paper are similar to those in our earlier work (for instance, Wood and Jordan, 2000; Wood and Mayer, 2001; Mayer and Wood, 2001), and still exclude countries with populations below one million, but with two improvements: we have matching data on the sectoral structure of both exports and output; and at several points in time, rather than a single cross-section. Our new data, however, have all the problems of our previous data, and some extra ones, too.

Primary products, *P*, correspond to the category labelled *BP* in our earlier papers, which includes both unprocessed and processed agricultural and mineral products (in the International Standard Industrial Classification (ISIC), processed primary products are a part of manufacturing). Labour-intensive manufactures, *M*, covers the category that was labelled *NML* in our earlier papers, including textiles, clothing, footwear, leather and wood products (Mayer and Wood, 2001, table 1). In this paper, however, we add to *M* electronics (ISIC Rev. 2 group 383 and Standard International Trade Classification Rev. 2 divisions 75–77), though only for developing countries, because labour-intensive assembly of such items is now an important export activity in many of them. For developed countries, electronics stays in skill-intensive manufactures.

Classifying electronics as labour-intensive or skill-intensive simply on the basis of a country's developing or developed status is crude, but the best that can be done with

[5] The trade costs relevant to the effect of world prices on output include international as well as internal trade costs. For individual countries, however, trade cost ratios for output include home market sales (as well as exports), on which countries do not need to pay international trade costs.

the available data (and we will test the sensitivity of our results to omitting electronics from *M*). This specific problem, moreover, illustrates a more general problem, which is the internal heterogeneity of our product categories: the composition of *M* varies across countries with their endowments (Schott, 2003); and for each country it differs between exports and output (the former including more items with low trade costs).

Our export data are from the UNCTAD database. Our output data are derived by combining UN national accounts statistics with UNIDO industrial output statistics (whose country coverage is unfortunately rather limited). Sectoral shares of ISIC manufacturing value added from UNIDO are used to split the value of manufacturing output in the UN national accounts between processed primary products (whose value is added to the UN agriculture and mining categories to generate *P*), labour-intensive manufactures, and skill-intensive manufactures (for details, see Appendix B).

A weakness of both our output and our export data is that they are measured in terms of values rather than of volumes, without matching price or unit value series. This is a problem because the theory refers to volumes (q_M and q_P) and because the impact of China has involved changes in prices. In addition, the output and export data are not strictly comparable, because sectoral output is value added, while sectoral exports are measured gross of intermediate inputs (and re-exports).[6] Imported intermediates grew rapidly during the period of China's entry into world markets, and are a large share of the value of some export products, including electronics (though the domestic content of non-assembly processing exports in China has risen – Aziz and Li, 2007: 8).

Two of the factor endowment variables are identical to those in our earlier work: land, *N*, which is the surface area of the country concerned; and labour, *L*, which is its adult (over-15) population, taken from Barro and Lee (2001). The number of workers with a basic education, *B*, is also taken from Barro and Lee: it includes those with complete primary schooling and with secondary (but not tertiary) schooling. We tried narrower (omitting complete secondary) and broader (including incomplete primary) measures of *B*, but these seem intuitively less appropriate and yielded worse statistical results.

The limitations of the skill and land variables were discussed in our earlier papers – the main problem of both being that they fail to capture variation in the quality of the endowments concerned – but are more serious in the present paper because it uses time-series as well as cross-section data. Length of schooling is an acceptable cross-country proxy for human capital, because it is correlated with variation in the quality of schooling and non-school learning, but it is less reliable as a measure of changes over time, for example because rises in school attendance may be associated with falls in school quality.[7] The surface area measure of *N* not only fails to reflect differences among countries in what is on or under their land, but also stays the same over time for each country, regardless of (for example) oil discoveries or desertification.[8]

[6] Input-output tables can be used to separate off the value added content of exports, but do not exist for enough countries, years and sectors (the best available data are those of Nicita and Olarreaga, 2007).
[7] A debate on this issue started by Pritchett (2001) led to the development of a new data set by Cohen and Soto (2007), with which we experimented as an alternative to Barro and Lee (2001).
[8] Our earlier efforts (*e.g.* Wood and Mayer 2001) to improve on this measure with more detailed data on natural resources were largely unsuccessful.

4. Effect of China on world endowments

The task of this section is to estimate the impact of China's opening on world factor endowments. It requires a method of aggregating endowments across countries. In principle, the right method is implicit in equation (3), namely to weight each country's endowments by the effect (per unit of the factors) that they have on world prices of *M* and *P*. This effect must depend on how productively the country uses its factors, what proportion of them is used to produce *M* and *P*, and how much the country is involved in trade. In practice, we lack the data to apply this method, but its logic is helpful in suggesting simpler approximations and in understanding their limitations.

The method implicit in a well-known paper by Freeman (2006) is to classify countries as open or closed, and then simply to add up the endowments of the open ones. Thus, for example, labelling for brevity the *B*/*L* ratio as *b*, its world average would be

$$b_t^* = \sum_{z=1}^{z=Z} B_t^z \Big/ \sum_{z=1}^{z=Z} L_t^z = \sum_{z=1}^{z=Z} w_t^z b_t^z \qquad (4)$$

where *t* is the year, and *z* indexes the *Z* open countries. The factor ratios of individual countries, b_t^z, are weighted by their shares, w_t^z, of the open world's total labour force. The impact of China is the difference between b_t^* with and without China included in *Z* (and similarly for world average *N*/*L*, labelled for brevity below as *n*).

A concern about this method is its polarised categorisation of countries as either fully integrated into the world economy or wholly detached from it, since all of them trade to some extent. One possible variant, which we will use, is just to extend *Z* to include all countries for which endowment data exist, regardless of how much they trade. A more radical alternative, which we will also use, and which follows Spilimbergo *et al.* (1999) and IMF (2007), is to adjust the weight of each country in the world average by the extent of its involvement in trade. World average *b* thus becomes

$$b_t^{o*} = \sum_{z=1}^{z=Z} o_t^z B_t^z \Big/ \sum_{z=1}^{z=Z} o_t^z L_t^z = \sum_{z=1}^{z=Z} b_t^z \frac{o_t^z L_t^z}{\sum o_t^z L_t^z} = \sum_{z=1}^{z=Z} w_t^{oz} b_t^z \qquad (5)$$

where o_t^z is the ratio of trade to GDP in country *z* at time *t*, and *Z* covers all countries with data. The world average, b_t^{o*}, is weighted by country shares, w_t^{oz}, of the world's openness-adjusted labour force. It can be calculated with and without China in *Z*, and the impact of China is the difference between the changes in these two estimates of b_t^{o*} over the period during which China opened to trade.

This approach, too, is open to criticism. The right measure of trade for this purpose is its domestic value added content, reflecting factor inputs, but in practice, as already mentioned, exports are measured gross of intermediate inputs and include re-exports, which distorts the calculation by giving undue weight to countries with high gross-to-value-added trade ratios. It can also be argued that what drives a country's impact on world prices is not just its exports and imports but its production and consumption of tradable goods, so that equation (5) gives too little weight to large countries with low trade-to-tradables ratios.

The methods in both equation (4) and equation (5) are vulnerable to another criticism, which is that they fail to take account of differences among countries in efficiency or factor productivity. A country which produces more output per unit of factor input will tend to exert more influence on world prices, so its endowments should be given more weight in calculating the effective world average. The important question is how China's efficiency compares with that of other countries: in particular, if China is of below-world-average efficiency, equations (4) and (5) will overstate the impact of its opening on effective world endowments.

There is currently no accurate and accepted answer to this question, partly because of controversy about the undervaluation of China's exchange rate and about the size of its GDP at purchasing power parity (estimates of which were reduced substantially in 2007 by the International Comparisons Project).[9] Casual observation suggests that China's efficiency is well below that of most developed countries, but well above that of most developing countries, especially in labour-intensive manufacturing, and hence probably not far from the relevant world average (implying that this potential error in applying equations (4) and (5) may not be serious).

Table 1 presents the results of our calculations by both methods. They include the 94 countries, including China, for which we have data (which accounted for 86% of the world's adult population in 1990), and they cover 1980-2000, the period during which China opened to trade. The trade-to-GDP ratios in the openness-adjusted calculations measure 'trade' as the mean of merchandise exports and merchandise imports, are at official exchange rates, and are from the UNCTAD database. The table includes information not only on the two endowment ratios discussed above (B/L and N/L) but also on average adult years of schooling, the skill-to-labour ratio that we used in our earlier work. China's own endowment ratios are shown at the bottom of the table.

Considering first the labour-force-weighted numbers in the upper panel, the top row shows that world average endowments (with China included) changed in the expected directions during 1980-2000: years of schooling rose by one-fifth; the share of basic-educated workers in the labour force rose by one-tenth; and land per worker fell by one-third (because of population growth). The second row shows world averages without China, and the third row the proportional (log) effect of including China.

Including China hardly alters world average years of schooling in 2000, but it raises the world average share of basic-educated workers in the labour force by 0.09 log points (about 10%), which is one of our estimates of the impact of China on effective world endowments. World average land per worker is reduced by including China: in 2000, this makes a difference of 0.19 log points (about 20%), which is another of our estimates of the impact of China on effective world endowments.

The openness-adjusted numbers are in the lower panel of the table. In both years, the openness adjustment somewhat increases both of the world average skill ratios: more

[9] This controversy also affects the trade-to-GDP ratio for China used in our application of equation (5) – the openness-adjusted world endowment calculations.

educated countries tend to have higher trade-to-GDP ratios, though to a lesser extent in 2000 than in 1980 because developing countries had become more open. The rise in the openness-adjusted average share of basic-educated workers over the period is almost entirely due to China. Including China causes the average to rise by 0.07 log points more than if China is excluded (when it hardly alters).[10] This is another of our estimates of China's impact on effective world endowments.

The openness-adjusted world average of land per worker (including China) was above the labour-force-weighted average in 1980, because land-abundant countries tended to have higher trade-to-GDP ratios than land-scarce ones. This difference had vanished by 2000, because of large increases in exports from land-scarce Asian countries, one of which was China. Including China causes the world average to fall over the period by 0.10 log points more than if China is excluded, which provides the last of our estimates of its impact on effective world endowments.[11]

In summary, we have two estimates of the impact of China's opening on the effective world B/L ratio (+0.07 and +0.09 log points) and two estimates of its impact on the effective world N/L ratio (–0.10 and –0.19 log points). For each ratio, the openness-adjusted estimate is, as expected, smaller than the labour-force-weighted one, the gap being smaller for B/L than for N/L. The impact on B/L is roughly half the size of that on N/L. Neither of these impacts is vast, but nor is either of them trivial.

5. Effects of endowments on structure

The task of this section is to estimate the effects of factor endowments on sectoral structure. Its results are used in the next section to translate our estimates of China's impact on world endowments into estimates of China's impact on the ratio of labour-intensive manufacturing to primary production in other economies. We proceed, as explained earlier, by estimating equation (1) as an approximation to what we should ideally estimate, which are the non-v terms in the second line of equation (3).

We use a panel of data on individual countries, with observations in three years (1980, 1990 and 2000) spanning the period of China's opening.[12] Our dependent variable is the ratio of labour-intensive manufacturing to primary production in each country and year. We measure this ratio in terms of both output and exports: the former includes sales in both home and foreign markets, the latter sales only in foreign markets. We estimate the output regression for as many countries as possible (53), and the export regression both for these 53 countries and for a larger set of 96 countries – the extra 43 being countries with data on exports and endowments but not on output. A list of the countries is in Appendix C. China is excluded from the regressions.

The basic specification of the regression is

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[10] The rise appears roughly twice as large in the 1980s as in the 1990s, partly because China's B/L rose faster (from 0.46 in 1980 to 0.54 in 1990, and then to 0.58 in 2000), and partly because its trade/GDP ratio rose faster (from 0.07 in 1980 to 0.15 in 1990, and then to 0.21 in 2000).

[11] All of this fall appears to have occurred in the 1980s, partly because China's N/L fell faster (from 1.45 in 1980 to 1.12 in 1990, and then to 0.98 in 2000), as a result of slowing population growth, and partly because its trade/GDP ratio rose faster (see previous footnote for details).

[12] In each year, variables are measured (where possible) as three-year centred averages.

$$\ln\left(q_{Mt}^{z}/q_{Pt}^{z}\right)=\xi+\xi_b\ln b_t^z+\xi_n\ln n_t^z+u_t^z \qquad (6)$$

in which u is the error term, t indexes time periods and z as before indexes countries. It relates proportional differences in sectoral structure to proportional differences in endowment ratios, as in equation (1) but measured in (natural) logs. For example, $\ln b_t^z$ corresponds to $\hat{v}_B^z-\hat{v}_L^z$ in equation (1), and $\xi_b=\varepsilon_{MP}^{zz}\left(\theta_{BM}-\theta_{BP}\right)\varphi_{BL}^{z}$. The main aim of this section is to estimate ξ_b and ξ_n, which we try by three methods: pooled ordinary least squares (POLS), fixed effects (FE) and first differences (FD).[13]

Because our interest is in China's impact on other developing countries, we include an intercept dummy D_1 for developing countries (in all three years). Because we are also interested in changes over time, we include time period dummies, too, separately for developed countries (A_1 and A_2) and for developing countries (D_2 and D_3). Table 2 defines the dummy variables (to be discussed further in the next section) and provides summary statistics for the other variables. The full specification is thus

$$\ln\left(q_{Mt}^{z}/q_{Pt}^{z}\right)=\xi+\xi_b\ln b_t^z+\xi_n\ln n_t^z+\xi_{A1}A_1+\xi_{A2}A_2+\xi_1D_1+\xi_2D_2+\xi_3D_3+u_t^z \qquad (7)$$

The results are presented in table 3, whose three panels contain the output regressions, the 53-country export regressions and the 96-country export regressions. Its columns correspond to the variables in equation (7). In each panel, the top three rows show the POLS, FE and FD results. The fourth row is a variant on the FD regression with only the dummy variables included, to be discussed in the next section.

Consider first the three POLS regressions. In all of them, the coefficients on b and n are of the expected sign (positive for ξ_b, because of the sign of $\theta_{BM}-\theta_{BP}$, and negative for ξ_n, because of the sign of $\theta_{NM}-\theta_{NP}$), statistically significant, and big enough to matter.[14] The coefficients in the output regression are both (absolutely) smaller than in the matching 53-country export regression.[15] The output regression also fits the data a bit better than the 53-country export regression.

There is not much difference in the values of ξ_b and ξ_n between the 53-country and 96-country export regressions, nor in their goodness of fit. The extra 43 countries, almost all developing, have a much lower average ratio of labour-intensive manufactured to

[13] What we need to calculate the impact of China are world average time-series elasticities. The POLS estimates of ξ_b and ξ_n, on which we will mainly rely, depend heavily on the cross-section dimension of the data. For individual countries, as explained in Wood (2008), time-series elasticities can differ greatly from cross-section elasticities, but the world average time-series elasticity is close to the world average cross-section elasticity implied by the slope of a regression across all countries.

[14] In these respects, they resemble the coefficients estimated in our earlier work (*e.g.* Wood and Berge, 1997; Wood and Jordan, 2000; Wood and Mayer, 2001; Mayer and Wood, 2001), though in most of this earlier work we used a different measure of skill (average years of schooling). In all our work, when the dependent variable is some ratio of manufactures to primary exports or output, the coefficient on n is remarkably consistent in size (about 0.6 in export regressions and about 0.3 in output regressions). The coefficients on skill variables are more sensitive to specification and country coverage of the data.

[15] Referring back to the first line of equation (3), this difference implies that the generally larger share that a country has of its home market than of its export markets outweighs the generally lower level of trade costs for home sales than for export sales. Part of the explanation is probably that our data refer not to homogeneous goods but to broad sectoral aggregates, within which the mix of goods sold on the home market includes more items with high trade costs than the mix of goods exported.

primary exports (unlogged, it is 0.16, compared to 0.62 for the 53 countries). But this is explained largely by their lower endowments of skill (*b*, the share of basic-educated workers in the labour force, is on average 24% for the 43 extra countries, compared to 44% for the 53 countries) and by their higher land/labour ratios (*n* averaging about 4 km^2 per 100 workers, compared to 2 km^2 for the 53 countries).[16] The numbers cited in this paragraph are derived from those in table 2.

In all three POLS regressions, the coefficient on the developing-country dummy, D_1, is negative, significant and of similar size. Its value of -0.7 implies that the *M*/*P* ratio for both output and exports is on average in developing countries roughly half of what would be predicted for developed countries with the same endowments of skill and land. The inclusion of the D_1 dummy also substantially lowers the value of ξ_b (which would otherwise be above unity in all three regressions). A plausible interpretation is that developed countries are better endowed, relative to developing countries, with the skills needed for labour-intensive manufacturing than is implied by comparing their numbers of primary and secondary school graduates – as a result partly of better-quality schooling and partly of more training and practical experience.

In the FE and FD regressions, D_1 disappears. In all these regressions, moreover, all the estimates of ξ_b and ξ_n are insignificantly different from zero at conventional test levels, and about half have the wrong sign (five out of six for ξ_n). The FE and FD estimates thus differ radically from the POLS estimates, and are unusable for our purpose of estimating the impact of China on other economies.[17]

Specification tests give some support to the FE and FD results: Breusch-Pagan tests suggest that, with our data, random-effects estimation would be preferable to POLS; Hausman tests suggest that FE or FD estimates would be preferable to random-effects estimates. It is hard to believe, however, that endowments have no effect on sectoral structure. There are also plausible econometric reasons for the insignificance of the FE and FD estimates. These two methods reduce the ratio of signal to noise, biasing coefficients towards zero and raising standard errors; and this problem is particularly serious with our data, partly because endowments change slowly over time, compared to their cross-section variation, and partly because our measures of endowments are subject to even more error in time-series than in cross-section.

In estimating the impact of China, we shall therefore rely on the POLS estimates of ξ_b and ξ_n. However, as a sensitivity test we re-ran the POLS regressions with electronics excluded from labour-intensive manufacturing in developing countries. Electronics is already excluded for developed countries, so this amendment enlarged the negative coefficients on D_1. It hardly changed ξ_n, but somewhat reduced ξ_b, particularly in the

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[16] The coefficients ξ_b and ξ_n in the 96-country regression do differ slightly from those in the 53-country regression. The lower ξ_b implies that the 43 countries have somewhat higher *M*/*P* ratios than would be predicted from their skill ratios using the 53-country coefficients. The absolutely larger ξ_n implies that the 43 countries have somewhat lower *M*/*P* ratios than would be predicted from their land/labour ratios using the 53-country coefficients.

[17] Although our model is, in theory, not dynamic (sectoral structure depends on current endowments), there may in practice be lags, so we also tried four methods of GMM estimation (details on request). This yielded more sensible signs: 8/12 estimates of ξ_b were positive, no better than 4/6 for FE and FD; but 11/12 estimates of ξ_n were negative, compared to 1/6 for FE and FD. However, only two of the 24 coefficients were statistically significant at conventional levels.

53-country export regression, because electronics exports are of most importance for the well-educated developing countries of East Asia.[18]

6. Predicted and actual impact of China

Table 4 contains our estimates of the impact of China's opening on the ratio of labour-intensive manufacturing to primary production in other countries. These estimates are based on the formula

$$\Delta \ln\left(q_M / q_P\right) = -\xi_b \Delta \ln b^* - \xi_n \Delta \ln n^* \qquad (8)$$

where Δln b^* and Δln n^* are our estimates of the impact of China on world average endowments of *B*/*L* and *N*/*L* from table 1, and ξ_b and ξ_n are our POLS estimates of the effects of endowment ratios on the *M*/*P* ratio from table 3. The terms have negative signs because a change in the world average shifts the relative endowment ratios of individual countries in the opposite direction (for example, since China's opening reduced world average *n*, it made other countries relatively more land abundant).

We have two estimates of Δln b^* and Δln n^* (one labour-force-weighted and the other also openness-adjusted), and hence, in the two columns of table 4, two alternative sets of estimates of the impact of China on *M*/*P* ratios. We also calculate separately the impact on the *M*/*P* output ratio (in the upper panel of table 4) and the *M*/*P* export ratio (in its lower panel). The lower panel has two rows, based on our 53-country and 96-country estimates of ξ_b and ξ_n for exports, though the results are almost the same (the differences in the coefficients happen to offset one another).

The results suggest that China's opening to trade reduced the ratio of labour-intensive manufacturing to primary output in other countries by between 0.07 and 0.11 log points (7-10%). The impact on the corresponding export ratio was a reduction of between 0.10 and 0.16 log points (10-15%). In each case, the range of the estimates arises mainly from the difference between our alternative estimates of China's impact on the world average land/labour ratio. The smaller estimated impact on output than on exports is in line with the theoretical expectation that China's opening would have less effect on sales in countries' home markets than in their export markets.[19]

These predicted impacts are the same for all countries, but their economic significance varies with the initial level of the *M*/*P* ratio. Consider, for example, a 10% reduction, holding the combined output of the two sectors constant. In a country whose initial *M*/*P* ratio was 10, *M* would fall by only 1% and *P* would rise by 9%, whereas in a country whose initial *M*/*P* ratio was 1/10, *M* would fall by 9% and *P* would rise by 1%. In both cases, the effect on the share of *M* in *M*+*P* would be tiny – a reduction of under one percentage point. For a country whose initial *M*/*P* ratio was unity, the fall in *M* and the rise in *P* would both be the same size (5%), and the effect on the share of *M* in *M*+*P* would be larger – about 3 percentage points – but still small.

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[18] Excluding (including) electronics, ξ_b is 0.51 (0.60) for output, 0.58 (0.77) for 53-country exports, and 0.54 (0.59) for 96-country exports.

[19] This difference reflects the smaller estimated coefficients in the output regressions than in the export regressions. The true difference may be larger than these numbers imply, since, as mentioned earlier, the coefficients derived from individual-country data may exaggerate the output elasticity.

How do these predicted changes in *M*/*P* ratios compare with actual changes? Did *M*/*P* ratios in other countries fall, or did they rise less than would otherwise have been expected, after China's opening? Some answers to these questions can be obtained from the coefficients on the time dummy variables in the regressions in table 3.[20] It is assumed that the impact of China was concentrated in the 1990s (China's trade policy changed most in the second half of the 1980s, and the effects would have been felt in other countries with some lag). It is also assumed that other forces causing changes in *M*/*P* ratios during the 1980s continued in the 1990s, so that the impact of China can be detected by comparing changes over the 1990s with changes over the 1980s.[21]

For developed countries, the relevant comparison in the POLS regressions is between A_1, which measures any step change in 1990 relative to 1980, and A_2, which measures any further step change by 2000. In the FD regressions, from which A_1 vanishes, A_2 measures the difference between changes in the 1990s and in the 1980s. None of the results suggests that China had a negative impact: in all three POLS regressions, the coefficients on A_2 are larger than on A_1, and in the FD regressions, the coefficients on A_2 are positive (albeit insignificant), implying that *M*/*P* output and export ratios rose more, not less, in the 1990s than in the 1980s. A possible explanation is that by 1990 most truly labour-intensive manufacturing in developed countries had ceased, and that the rise in *M*/*P* in the 1990s reflects the expansion of other, skill-intensive activities within our coarse 'labour-intensive' aggregate.

In developing countries, the impact of China on which is the main focus of this paper, there is, by contrast, some evidence of a downward shift in *M*/*P* ratios. In the POLS regressions, D_2, which measures any step change in 1990, has to be compared with D_3, which measures any further step change by 2000, while in the FD regressions, the key variable is D_3, which shows the difference between changes in the 1990s and in the 1980s. In the output regressions in the top panel of table 3, the POLS coefficient on D_3 is smaller than that on D_2, by -0.05, which is also the size of the coefficient on D_3 in the FD regression (though this is far from significant). The conclusion is that the *M*/*P* output ratio in developing countries in 2000 was roughly 5% lower than would have been expected from its trend in the 1980s, which is consistent with our predicted 7-10% reduction as a result of China's opening.

Evidence of a China impact can be seen also in the export regressions in the middle panel of table 3 (whose 53-country coverage matches that of the output regressions). In the POLS regression, the coefficients on D_2 and on D_3 are both positive, indicating upward shifts in the *M*/*P* export ratios of developing countries in both the 1980s and the 1990s. But the shift in the 1990s is smaller than in the 1980s, by 0.20 log points. The coefficient on D_3 in the FD regression is similar, -0.22 (though insignificant). The *M*/*P* export ratio of developing countries was thus roughly 20% lower in 2000 than it would have been if its rise of the 1980s had continued at the same rate, which

[20] We re-ran these regressions with individual-country endowment ratios normalised on without-China world average endowments in the year concerned, to see whether some of the actual changes could be explained by changes in the endowments or openness of countries other than China. This made almost no difference to the results, other than to shift all the intercepts.

[21] The period covered by these calculations could in principle be altered, for example by going further back than 1980 and (when more data become available) further forward than 2000. This would have some advantages (fuller capture of the post-1990 China impact) but also disadvantages (making it less plausible to argue that other causes of change in *M*/*P* were the same before as after 1990).

again fits with our predicted reduction of 10-15% as a result of China's opening – and with the prediction of a larger China impact on exports than on output.

The coefficients on D_2 and D_3 in the 96-country export regressions in the bottom panel of table 3, which include 43 countries for which we lack data on the *M*/*P* output ratio, differ substantially from those in the middle panel. The coefficient on D_2 in the POLS regression is close to zero, implying no upward shift in the *M*/*P* export ratio in the 1980s on average for this larger group of developing countries, and the coefficient on D_3 is positive, albeit statistically insignificant, implying an upward shift in the 1990s. The coefficient on D_3 in the FD regression is likewise positive, implying that the *M*/*P* export ratio rose by more in the 1990s than in the 1980s, counter to our prediction of a reduction as a result of China's opening.

Different outcomes in different groups of countries could in principle be explained by them having been affected differently by China's opening. This explanation is not plausible, however, for these two groups of developing countries (the 33 that are part of the 53-country set, and the 70 that are part of the 96-country set), because in theory, as mentioned in section 2, the impact of China should be in the same direction on all countries and vary only in magnitude. (Nor, more generally, were we able to capture empirically the theoretically expected pattern of variation in magnitude.[22])

The other possible explanation for the difference in export outcomes between these two groups of developing countries is that non-China forces acted differently on them. In particular, for the 37 extra developing countries in the larger group other influences on *M*/*P* export ratios might have been not, as our time-dummy method assumes, the same in the 1990s as in the 1980s, but rather differed between the 1980s and 1990s in ways that offset the impact of China. Examples of such differences would be policy changes in these countries or in their trading partners that provided more incentives or markets for their manufactured exports in the 1990s compared to the 1980s.

This explanation is fairly plausible. Of the 37 extra countries, 28 are in Latin America or sub-Saharan Africa, regions in which there was widespread liberalisation of trade regimes in the 1990s. Many countries in these regions lack comparative advantage in manufacturing, so these policy changes would not have raised their *M*/*P* export ratios (and would have reduced their *M*/*P* output ratios), but they stimulated manufactured exports from some more densely populated countries. In Latin America, moreover, many countries introduced structural policies to improve the competitiveness of their manufactured exports (Melo, 2001) and there was an intensification in the 1990s of regional trade schemes that are likely to have stimulated manufactured exports.

In table 5, to examine actual outcomes more closely, we divide developing countries into five regional groups (East Asia, South Asia, Latin America, Middle East and sub-Saharan Africa). For each group, and for China, the table shows the average changes in *M*/*P* ratios in the 1980s and 1990s and the differences between these decades, for

[22] Equation (3) predicts that the size of the China impact will be smaller, the larger is the share of the country concerned in the market concerned. We tried to measure this variation by interacting D_3 with (a) each country's size (measured by its PPP GDP in the mid-1990s), expecting a positive sign, and (b) each country's ratio of trade to GDP in the mid-1990s, expecting a negative sign. However, the size interaction coefficients were all near zero, and the openness interaction coefficients were significant but of the wrong sign (picking up rising *M*/*P* ratios in East Asian countries with high trade/GDP ratios).

output and for the two sets of export data (53 and 96 countries). The table also shows the standard deviations within each group, which in almost all cases exceed the averages, partly because of genuine differences among countries and partly because of errors of measurement in the data, amplified by differencing and double-differencing.

To clarify the relationship between the averages in table 5 and the regressions in table 3, we show, in the fourth row of each panel of table 3, a variant on the FD regression that excludes the (statistically insignificant) endowment variables and includes only the dummy variables. For developed countries, the differences between decades in table 5 (0.11, 0.03 and 0.03) are the same as the coefficients on A_2 in the fourth-row regressions (and close to those in the third-row regressions). For developing countries as a group, these differences are the same as the coefficients on D_3 in the fourth-row regressions, which again are close to those in the third-row regressions.[23]

The numbers for China in the 'difference' columns are positive: its output *M*/*P* ratio was constant in the 1980s, but rose in the 1990s; while its export *M*/*P* ratio rose much faster in the 1990s than in the 1980s. Two developing regions show a consistently opposite pattern of negative differences. One is East Asia, where rapid rises in both output and export *M*/*P* ratios in the 1980s slowed in the 1990s. That this slowdown was caused by China's opening seems particularly plausible because of the similarity of endowments and trade patterns in other East Asian countries to those of China, and is consistent with most other studies.[24] The negative differences in East Asia are larger if electronics is omitted from *M*, probably because in the 1990s competition from China was strongest in traditional labour-intensive manufactures.[25]

The other developing region where all the differences are negative is the Middle East and North Africa. Both output and export *M*/*P* ratios rose in the 1980s, but for output the rise slowed in the 1990s and for exports it was sharply reversed. It seems unlikely that these changes were caused mainly by China's opening. This region's exports are dominated by oil, and the *M*/*P* ratio (since it is measured in value rather than volume) is strongly affected by the oil price. China probably had only a small effect on the oil price up to 2000, although labour-intensive manufacturing in the non-oil countries of this region must have suffered from Chinese competition in the 1990s.

The difference between the two decades in the *M*/*P* output change is negative also for Latin America, where the ratio rose in the 1980s but fell in the 1990s. This pattern is consistent with the widely-held view that labour-intensive manufacturing in the region contracted as a result of greater competition from imports from China and other Asian countries.[26] However, this rise in imports was caused as much by Latin America's liberalisation of its own trade policies as by China's opening. Moreover, the region's *M*/*P* export ratio moved in the other direction, from little change in the 1980s to rapid rise in the 1990s: the most likely cause is regional integration schemes, some of which

[23] The 1980-90 averages for developed countries are the intercepts of the fourth-row regressions and for developing countries as a group are the intercepts plus the coefficients on D_2.

[24] For example, Ianchovichina and Walmsley (2003) and Eichengreen *et al.* (2007). Greenaway *et al.* (2008) by contrast conclude from a gravity model that China displaced manufactured exports from other Asian countries only to a very limited extent (mainly in developed-country markets).

[25] Excluding (including) electronics, for East Asia the output change difference is -0.29 (-0.19), the 53-country export change difference is -0.82 (-0.45), and the 96-country export change difference is -0.62 (-0.34). For no other region does the exclusion of electronics much alter the results.

[26] Lall *et al*. (2005), Devlin *et al* (2006), Freund and Ozden (2006), Lederman *et al*. (2008).

(*e.g*. Mercosur) fostered trade in manufactures among Latin American countries and others of which (*e.g*. NAFTA) opened North America to their manufactured exports.

In South Asia, the *M*/*P* output ratio rose in the 1990s, after remaining constant in the 1980s. The reasons for this change must have been internal, because, although policy barriers were lowered in some countries, the region remained largely closed to trade because of the large size of its countries and their poor infrastructure, so that its output structure could not have been greatly affected by China's opening. South Asia's *M*/*P* export ratio rose in both the 1980s and the 1990s, and at about the same speed. The growth of China's competing exports must have tended to slow this rise, but the effect on South Asia, whose exports of *M* were concentrated on clothing, was damped by the Multi-Fibre Arrangement and was also offset by export-promoting policy changes.[27]

The numbers for sub-Saharan Africa in table 5 suggest little change in the *M*/*P* output ratio in the 1980s or the 1990s, but are based on only 7 countries. There is no sign of the shrinkage of manufacturing that is believed to have occurred in African countries as a result of the reduction of policy barriers to imports, including those from China.[28] In the 96-country data, in which the number of African countries rises from 7 to 23, the average *M*/*P* export ratio is constant in the 1980s but rises in the 1990s, which is contrary to the predicted impact of China (and is too early to be explained by AGOA and EBA). However, little weight should be put on these numbers: the *M*/*P* export ratio is so low in most of these countries that the estimated changes, and especially the differences in changes, are probably dominated by measurement errors.

7. Conclusions

This paper has attempted to measure the effects of China's opening to the world on the sectoral structures of other countries, especially developing ones and especially on the balance between labour-intensive manufacturing and primary production, which matters for overall economic progress, for income distribution and for employment. Its method has been to apply Heckscher-Ohlin trade theory, treating China's opening as a shift in effective world average factor endowments which altered the relative endowments and hence the comparative advantage of all other countries.

Subject to a variety of qualifications discussed in the paper, we estimate that China's opening lowered the ratio of labour-intensive manufacturing to primary output in other countries by 7-10%, and the corresponding ratio of exports by 10-15%. These are average effects. The theory predicts that China's impact should have been larger on smaller countries and in more open markets: this is consistent with the bigger effect on exports than on output (which includes sales in less open home markets), but we were unable to measure other aspects of this predicted pattern of variation.

The paper also compares these estimates of China's impact with actual changes in the relevant ratios in developing countries, controlling for other influences on these ratios by a differences-in-differences approach. On average for the 33 developing countries

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[27] Yusuf *et al.* (2006) and Dimaranan *et al* (2007) emphasise that the effect of China on South Asia's manufactured exports varies among products, and conclude that the future evolution of these exports will depend heavily on the speed at which China upgrades its own exports

[28] *E.g* Goldstein *et al*. (2006), Broadman (2007). Kaplinsky and Morris (2008) argue that expansion of African manufactured exports requires sustained preferential access to the US and EU markets.

for which all the necessary data exist, the ratio of labour-intensive manufacturing to primary production did tend to fall during the 1990s, for both output and exports, but across a larger set of 70 developing countries, the average export ratio tended to rise, contrary to what would have been predicted from the impact of China.

A closer examination, dividing these developing countries into regions, suggests that the impact of China was clearest on the rest of East Asia, whose countries are similar to China in terms of endowments and sectoral structure. In other regions, changes in actual ratios of labour-intensive manufacturing to primary production, whether falls or rises, appear to have been dominated by other, region-specific influences, with China as just one determinant of the direction and size of the outcome.

The frequent dominance of other influences is partly because the impact of China was fairly small. Despite China's vast size and amazing growth, our estimates suggest that its opening did not on average have a large effect on the broad sectoral structures of other countries, and we can see no plausible modification of our approach that could make this effect appear much larger. The impact is not trivial, and in some countries and more narrowly defined sectors must have been much bigger than average, but our estimates imply that the common view of China's emergence as a threat to economic progress and equity in the rest of the developing world is exaggerated.

China's opening to the world was a one-off event, which caused a step change in the comparative advantage of other countries. Its rapid growth, based on accumulation of more skills, capital and modern technology, is by contrast a continuing event, and one whose effects will change with the passage of time. Up to now, China's growth has mainly amplified the effects of its opening: raising both its supply of labour-intensive manufactures and its demand for primary products. Over the longer-term future, this rising demand for primary products will continue, but China's accumulation of skills will move it out of labour-intensive manufacturing, tending to increase rather than (as initially) to reduce the size of this sector in other developing countries.

References

Amiti, M., and C. Freund (2008). The anatomy of China's export growth. *Policy Research Working Paper* 4628. World Bank. Washington DC.

Aziz, J., and X. Li (2007). China's changing trade elasticities. *Working Paper* 07/266. International Monetary Fund. Washington DC.

Barro, R., and J.-W. Lee (2001). International data on educational attainment: updates and implications. *Oxford Economic Papers*. 53(3): 541–563.

Broadman, H. (2007). *Africa's Silk Road: China and India's New Economic Frontier*. Washington DC: World Bank.

Cohen, D., and M. Soto (2007). Growth and human capital: good data, good results. *Journal of Economic Growth*. 12(1): 51–76.

Devlin, R., A. Estevadeordal and A. Rodriguez-Clare (eds) (2006). *The Emergence of China. Opportunities and Challenges for Latin America and the Caribbean*. Washington, DC: Inter-American Development Bank.

Dimaranan, B., E. Ianchovichina and W. Martin (2006). Competing with giants: who wins, who loses? In L. Winters and S. Yusuf (eds), *Dancing with Giants. China, India, and the Global Economy*. Washington DC: World Bank and Institute of Policy Studies.

Dimaranan, B., E. Ianchovichina and W. Martin (2007). China, India, and the future of the world economy: fierce competition or shared growth. *Policy Research Working Paper* 4304. World Bank. Washington DC.

Dooley, M., D. Folkerts-Landau and P. Garber (2004). The revived Bretton Woods system: the effects of periphery intervention and reserve management on interest rates and exchange rates in center countries. *Working Paper* 10332. National Bureau of Economic Research (NBER). Cambridge (Mass.).

Eichengreen, B., Y. Rhee and H. Tong (2007). China and the exports of other Asian countries. *Review of World Economics*. 143(2): 201–226.

Freeman, R. (2006). Labor market imbalances: shortages, or surpluses, or fish stories? Paper presented at Boston Federal Reserve Conference. Available at http://www.bos.frb.org/economic/conf/conf51/papers/freeman.pdf

Freund, C., and C. Ozden (2006). The effect of China's exports on Latin American trade with the world. Mimeo. Available at http://siteresources.worldbank.org/INTLACOFFICEOFCE/Resources/IndustryLevelTradeFlows.pdf

Gallagher, K., J. Moreno-Brid and R. Porzecanski (2008). The dynamism of Mexican exports: lost in (Chinese) translation? *World Development*. 36(8): 1365–1380.

Goldstein, A., N. Pinaud, H. Reisen and X. Chen (2006). *The Rise of China and India: What's in it for Africa?* Paris: OECD Development Centre.

Greenaway, D., A. Mahabir and C. Milner (2008). Has China displaced other Asian countries' exports? *China Economic Review*. 19(2): 152–169.

Hanson, G., and. R Robertson (2007). China and the manufacturing exports of other developing countries. Forthcoming in R. Feenstra and S. Wei (eds), *China's Growing Role in World Trade*. Chicago: University of Chicago Press. Available at http://www.nber.org/books_in_progress/china07/cwt07/hanson.pdf

Ianchovichina, E., and T. Walmsley (2003). The impact of China's WTO accession on East Asia. *Policy Research Working Paper* 3109. World Bank. Washington DC.

International Monetary Fund (IMF) (2007). The globalisation of labor. *World Economic Outlook*, April, Chapter 5. IMF. Washington DC.

Kaplinsky, R., and M. Morris (2008). Do the Asian drivers undermine export-oriented industrialization in SSA? *World Development*. 36(2): 254–273.

Lall, S., J. Weiss and H. Oikawa (2005). China's competitive threat to Latin America: an analysis for 1990-2002. *Oxford Development Studies*. 33(2): 163–194.

Lederman, D., M. Olarreaga and E. Rubiano (2008). Trade specialization in Latin America: the impact of China and India. *Review of World Economics*. 144(2): 248–271.

Mayer, J., and P. Fajarnes (2008). Tripling Africa's primary exports: What? How? Where? *Journal of Development Studies*. 44(1): 80–102.

Mayer, J., and A. Wood (2001). South Asia's export structure in a comparative perspective. *Oxford Development Studies*. 29(1): 5–29.

Melo, A. (2001). Industrial policy in Latin America and the Caribbean at the turn of the century. *Working Paper* 459. Inter-American Development Bank. Washington DC.

Mesquita Moreira, M. (2007). Fear of China: is there a future for manufacturing in Latin America? *World Development*. 35(3): 355–376.

Nicita, A., and M. Olarreaga (2007). Trade, production and protection database, 1976–2004. *World Bank Economic Review*. 21(1): 165–71.

Pritchett, L. (2001). Where has all the education gone? *World Bank Economic Review*. 15(3): 367–91.

Rodrik, D. (2006). What's so special about China's exports? *China and World Economy*. 14(5): 1–19.

Schott, P. (2003). One Size Fits All? Heckscher-Ohlin specialisation in global production. *American Economic Review*. 93(3): 686–708.

Schott, P. (2008). The relative sophistication of Chinese exports. *Economic Policy*. January: 5–49.

Spilimbergo, A., J. Londono and M. Szekely (1999). Income distribution, factor endowments, and trade openness. *Journal of Development Economics*. 59(1): 77–101.

Winters, L., and S. Yusuf (eds) (2006). *Dancing with Giants. China, India, and the Global Economy*. Washington DC: World Bank and Institute of Policy Studies.

Wood, A. (1994). *North-South Trade, Employment and Inequality*. Oxford: Clarendon Press.

Wood, A. (2008). Openness is a matter of degree: how trade costs reduce demand elasticities. *Working Paper* 169. Queen Elizabeth House, Oxford University.

Wood, A. (2009). Heckscher-Ohlin in theory and reality. In P. Arestis and J. Eatwell (eds), *Issues in Economic Development and Globalisation*, London: Palgrave Macmillan. Longer version available as *Working Paper* 157, Queen Elizabeth House, Oxford University.

Wood, A., and K. Berge (1997). Exporting manufactures: human resources, natural resources, and trade policy. *Journal of Development Studies*. 34(1): 35–59.

Wood, A., and K. Jordan (2000). Why does Zimbabwe export manufactures, and Uganda not? *Journal of Development Studies*. 37(2): 91–116.

Wood, A., and J. Mayer (2001). Africa's export structure in a comparative perspective. *Cambridge Journal of Economics*. 25(3): 369–94.

Xu B (2007). Measuring China's export sophistication. Mimeo. Available at http://www.ceibs.edu/faculty/xubin/Measuring.pdf

Yang, Y. (2003). China's integration into the world economy: implications for developing countries. *Working Paper* 03/245. International Monetary Fund. Washington DC.

Yusuf, S., K. Nabeshima and D. Perkins (2006). China and India reshape global industrial geography. In L. Winters and S. Yusuf (eds), *Dancing with Giants. China, India, and the Global Economy*. Washington DC: World Bank and Institute of Policy Studies.

Appendix A. Derivation of equations (2) and (3)

Following Wood (2008), the demand elasticity in equation (1), which measures the response of country *z*'s relative sales of *M* and *P* in market *ž* to changes in country *z*'s relative producer price, can be expanded to

$$\varepsilon_{MP}^{z\check{z}} = \tilde{\varepsilon}_{MP}^{z\check{z}} \delta_{MP}^{z\check{z}} \tag{A1}$$

where $\tilde{\varepsilon}_{MP}^{z\check{z}}$ is the elasticity of country *z*'s relative sales in market *ž* with respect to its relative purchaser price, and $\delta_{MP}^{z\check{z}}$ is the elasticity of its relative purchaser price in that market with respect to its relative producer price.

It is also shown in Wood (2008) that $\tilde{\varepsilon}_{MP}^{z\check{z}}$ depends on the elasticities of substitution among national varieties of goods *M* and *P* (β_M and β_P) and between goods *M* and *P* (γ_{MP}). More precisely, $\tilde{\varepsilon}_{MP}^{z\check{z}}$ is a weighted harmonic mean of these three elasticities, in which the key weights are country *z*'s shares of market *ž* for the two goods. A more tractable approximation for the present paper is the weighted arithmetic mean

$$\tilde{\varepsilon}_{MP}^{z\check{z}} \approx s_{MP}^{z\check{z}} \gamma_{MP} + \left(1 - s_{MP}^{z\check{z}}\right) \beta_{MP} = \beta_{MP} - s_{MP}^{z\check{z}} \left(\beta_{MP} - \gamma_{MP}\right) \tag{A2}$$

where β_{MP} is an average of the two elasticities of substitution among national varieties and $s_{MP}^{z\check{z}}$ is an average of country *z*'s shares of market *ž* for *M* and *P*.

For changes in prices over time, which are what matter for the impact of China, it is also shown in Wood (2008) that the price ratio elasticity $\delta_{MP}^{z\check{z}}$ can be written as

$$\delta_{MP}^{z\check{z}} \approx \frac{1 + a_{MP}^{z\check{z}} \tau_{MP}^{z\check{z}}}{1 + \tau_{MP}^{z\check{z}}} \tag{A3}$$

where $\tau_{MP}^{z\check{z}}$ is country *z*'s ratio of trade costs in market *ž* to producer prices, averaged across goods *M* and *P*, and $a_{MP}^{z\check{z}}$ is the fraction of trade costs that are proportional to producer prices. To simplify the algebra, the definition of trade costs can be restricted to those that are independent of producer prices and the definition of producer prices expanded to include proportional trade costs, so that (A3) becomes

$$\delta_{MP}^{z\check{z}} \approx \frac{1}{1 + \tau_{MP}^{z\check{z}}} \tag{A4}$$

Equation (2) in the main text is obtained by substituting equations (A2) and (A4) into equation (A1). Moving now towards deriving equation (3) in the main text, equations (1) and (2) can be combined more compactly as

$$\hat{q}_M^{z\check{z}} - \hat{q}_P^{z\check{z}} = -\tilde{\varepsilon}_{MP}^{z\check{z}} \left(\hat{p}_M^{z\check{z}} - \hat{p}_P^{z\check{z}}\right) \tag{A5}$$

being alert to the risk of confusion between lower-case *p* (purchaser price) and upper-case *P* (primary products), where

$$\left(\hat{p}_M^{z\check{z}} - \hat{p}_P^{z\check{z}}\right) = -\frac{\sum_{i=B,N}(\theta_{iM} - \theta_{iP})\varphi_{iL}^{z}\left(\hat{v}_i^{z} - \hat{v}_L^{z}\right)}{1+\tau_{MP}^{z\check{z}}} \tag{A6}$$

Everything so far holds constant the prices of foreign suppliers to market $\check{z}$. Allowing foreign prices to change involves extending (A5) into an equation of the form

$$\hat{q}_M^{z\check{z}} - \hat{q}_P^{z\check{z}} = -\tilde{\varepsilon}_{MP}^{z\check{z}}\left(\hat{p}_M^{z\check{z}} - \hat{p}_P^{z\check{z}}\right) + \tilde{\varepsilon}_{MP}^{*\check{z}}\left(\hat{p}_M^{*\check{z}} - \hat{p}_P^{*\check{z}}\right) \tag{A7}$$

where $\tilde{\varepsilon}_{MP}^{*\check{z}}$ is the elasticity of country z's relative sales in market $\check{z}$ with respect to the relative purchaser prices of foreign suppliers, changes in which are determined by an equation of the same general form as (A6)

$$\left(\hat{p}_M^{*\check{z}} - \hat{p}_P^{*\check{z}}\right) = -\frac{\sum_{i=B,N}(\theta_{iM} - \theta_{iP})\varphi_{iL}^{*}\left(\hat{v}_i^{*} - \hat{v}_L^{*}\right)}{1+\tau_{MP}^{*\check{z}}} \tag{A8}$$

in which the z superscripts are replaced with *s. The sign of $\tilde{\varepsilon}_{MP}^{*\check{z}}$ in (A7) is opposite to that of $\tilde{\varepsilon}_{MP}^{z\check{z}}$ because a rise, say, in country z's price would lower its sales whereas a rise in the prices of foreign suppliers would raise its sales. Its size is determined by

$$\tilde{\varepsilon}_{MP}^{*\check{z}} = \tilde{\varepsilon}_{MP}^{z\check{z}} - \gamma_{MP} \tag{A9}$$

meaning that it is smaller than $\tilde{\varepsilon}_{MP}^{z\check{z}}$ by the size of the elasticity of substitution between the two goods.

The convenient relationship in (A9), which does not depend on the simplification of using an arithmetic rather than a geometric average in (A2), exists because alterations in relative prices (by country z or by the rest of the world) have two different effects on sales. The first effect is on relative market shares, by altering the prices of country z's varieties of the two goods relative to the prices of other countries' varieties: a rise in $p_M^{z\check{z}}/p_P^{z\check{z}}$ lowers country z's share of market $\check{z}$ for M and raises it for P; while a rise in $p_M^{*\check{z}}/p_P^{*\check{z}}$ has an opposite and symmetrical impact, raising country z's share of this market for M and lowering its share for P. The second effect is on relative total sales of M and P in market $\check{z}$, by altering the relative prices of (all varieties of) these goods, with asymmetrical effects: a rise in $p_M^{z\check{z}}/p_P^{z\check{z}}$ shrinks the whole market for M relative to P and so compounds the market-share effect on country z's relative sales of M and P; whereas a rise in $p_M^{*\check{z}}/p_P^{*\check{z}}$, though also shrinking the whole market for M relative to P, tends to offset the market-share effect on country z's relative sales of M and P.

The difference between the compounding and offsetting aspects of this second effect is the change in the overall relative sales of the two goods caused by a change in their overall relative prices, which depends on γ_{MP}. For example, if both its own and foreign suppliers' relative purchaser prices changed by an equal amount, country z's share of market $\check{z}$ would remain constant and the change in its relative sales would be determined entirely by the elasticity of substitution between the two goods. Hence, substituting into (A9) for $\tilde{\varepsilon}_{MP}^{z\check{z}}$ from (A2) and rearranging,

$$\tilde{\varepsilon}_{MP}^{*\check{z}} = \left(1 - s_{MP}^{z\check{z}}\right)\left(\beta_{MP} - \gamma_{MP}\right) \qquad \text{(A10)}$$

Equation (3) in the main text is derived by expanding equation (A7), using equations (A2), (A6), (A8) and (A10), and rearranging. The second line of equation (3) gets its negative sign from that of equation (A8).

Appendix B. Derivation of the output data

This appendix explains how output data for primary products, *P*, and labour-intensive manufactures, *M*, were derived by combining UN national accounts statistics with UNIDO industrial output statistics.

Our primary category, *P*, as in the Standard International Trade Classification (SITC), includes processed primary products (*PP*), which the International Standard Industrial Classification (ISIC) treats as manufactures. That is:

P (broad or SITC primary) = *NP* (narrow or ISIC primary) + *PP* (processed primary)
NM (narrow or SITC manufacturing) = *BM* (broad or ISIC manufacturing) – *PP*.

We also need to divide the narrow SITC manufactures category into labour-intensive manufactures (*NML*), skill-intensive manufactures (*NMH*) and electronics (*EL*):

$BM = PP + NM = PP + NML + NMH + EL.$

The first step of the calculation was to use the UNIDO data to calculate four shares: $\psi_{PPBM} = PP/BM$; $\psi_{NMLBM} = NML/BM$; $\psi_{NMHBM} = NMH/BM$; and $\psi_{ELBM} = EL/BM$.

The second step of the calculation was to convert National Accounts sectoral output data for agriculture (*NPA*), mining (*NPM*) and ISIC manufacturing (BM_{NA}) into *P* and *NM*, as follows:

$P = NPA + NPM + (\psi_{PPBM} * BM_{NA})$
$NM_{NA} = (1 - \psi_{PPBM}) * BM_{NA}$

The third step of the calculation was to split up *NM*, as follows

$NML_{NA} = \psi_{NMLBM} * NM_{NA};$
$NMH_{NA} = \psi_{NMHBM} * NM_{NA};$
$EL_{NA} = \psi_{ELBM} * NM_{NA}.$

Our category *M* was then defined for developing countries as $NML_{NA} + EL_{NA}$, and for developed countries simply as NML_{NA}, for reasons explained in the main text.

The ISIC (Revision 2) 3-digit groups included in each of the categories into which we split broad manufacturing were as follows:

PP: 311, 313, 314, 353, 354, 372
NML: 321, 322, 323, 324, 331, 332, 341, 342, 355, 356, 361, 362, 369, 371, 381, 390
NMH: 351, 352, 382, 384, 385.
EL: 383

We encountered four problems in deriving the required output data from the UNIDO Industrial Statistics Database 2006.

1) For some countries and years, some data were aggregated across 3-digit groups. To disaggregate them, we applied the shares of the relevant groups in the aggregate in the previous three years for which disaggregated data were available. Countries for which there were no disaggregated data for any year were excluded.

2) Missing data for some groups and years. Such gaps were filled (i) by calculating an average value if the missing observation was between two available ones, or (ii) by calculating the percentage change for the three previous or following years, depending on whether the observations were missing at the end or at the beginning of a period. Countries for which these calculations could not be made were excluded.

3) Data for some countries had to be combined to obtain consistent time series. Data for West Germany (available up to 1993) were combined with data (available from 1998) for Germany (which includes the former East Germany). Data for Belgium and Luxembourg were combined to match the only available trade data. Data for Ethiopia were combined with data for Eritrea, using the dollar exchange rates in the UNIDO dataset to convert the data for Eritrea into Ethiopian Birr.

4) Part of the data for Burundi and for Trinidad and Tobago appear to be misreported. We thus assumed that for Burundi group 383 had been wrongly placed in group 390 from 1986 to 1991, and that for Trinidad and Tobago groups 382 and 383 had been wrongly aggregated into group 383 between 1982 and 1987.

Appendix C. Country coverage of the data sets

The 53-country data set contains:

Developed countries (20 countries): Australia, Austria, Belgium and Luxembourg, Canada, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Norway, Poland, Portugal, Spain, Sweden, United Kingdom, United States.

East Asia (6 countries): Hong Kong (China SAR), Indonesia, Malaysia, Philippines, Republic of Korea, Singapore.

South Asia (3 countries): Bangladesh, India, Sri Lanka.

Latin America (10 countries): Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Mexico, Trinidad and Tobago, Uruguay, Venezuela.

Middle East and North Africa (7 countries): Egypt, Iran, Jordan, Kuwait, Syrian Arab Republic, Tunisia, Turkey.

Sub-Saharan Africa (7 countries): Cameroon, Kenya, Malawi, Mauritius, Senegal, South Africa, United Republic of Tanzania.

The 96-country data set contains the following additional countries:

Developed countries (6 countries): Bulgaria, Denmark, Netherlands, New Zealand, Romania, Switzerland.

East Asia (3 countries): Papua New Guinea, Taiwan (Province of China), Thailand.

South Asia (4 countries): Afghanistan, Myanmar, Nepal, Pakistan.

Latin America (12 countries): Argentina, Brazil, Cuba, Dominican Republic, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru.

Middle East and North Africa (2 countries): Algeria, Iraq.

Sub-Saharan Africa (16 countries): Benin, Central African Republic, Democratic Republic of the Congo, Ghana, Guinea-Bissau, Liberia, Mali, Mozambique, Niger, Rwanda, Sierra Leone, Sudan, Togo, Uganda, Zambia, Zimbabwe.

Table 1. Impact of China on world average endowment ratios

	Adult years of schooling		Log_e	Basic-educated share of labour force (B/L)		Log_e	Land (km^2) per 100 workers (N/L)		Log_e
	1980	2000	change	1980	2000	change	1980	2000	change
Labour-force-weighted average									
Including China	5.34	6.50	0.20	0.42	0.47	0.10	3.58	2.40	-0.40
Excluding China	5.53	6.54	0.17	0.41	0.43	0.04	4.34	2.90	-0.40
Log_e difference	-0.04	-0.01	0.03	0.03	**0.09**	0.06	-0.19	**-0.19**	0.00
Openness-adjusted average									
Including China	5.75	6.65	0.15	0.46	0.50	0.07	4.24	2.43	-0.56
Excluding China	5.89	6.74	0.14	0.46	0.47	0.01	4.65	2.96	-0.45
Log_e difference	-0.02	-0.01	0.01	0.00	0.06	**0.07**	-0.09	-0.20	**-0.10**
China's endowment ratios	4.80	6.40	0.29	0.46	0.58	0.24	1.45	0.98	-0.39

Note: sources and methods explained in text; our estimates of the impact of China's opening to trade are indicated with bold font. The 'world' in this table covers 93 countries (plus China), three fewer than for the 96-country export regressions in later tables: Liberia is omitted because its recorded trade/GDP ratio in 2000 of over 4 is not credible; Egypt and Guinea-Bissau are omitted because of incomplete endowment data. Their omission has a negligible effect on the averages.

Table 2. Details of variables used in regressions

	Mean	Std dev	Max	Min
Dependent variable ($\log_e M/P$)				
Output (53 countries)	-0.83	1.04	2.24	-3.48
Exports (53 countries)	-0.48	1.52	2.54	-4.18
Exports (96 countries)	-1.08	1.87	2.78	-7.31
Endowment ratios (logged)				
$b = B/L$ (53 countries)	-0.83	0.47	-0.14	-2.26
$b = B/L$ (96 countries)	-1.09	0.70	-0.14	-4.34
$n = N/L$ (53 countries)	-3.98	1.51	-0.35	-8.57
$n = N/L$ (96 countries)	-3.66	1.46	-0.35	-8.57

Dummy variables

A_1 1 for developed countries in 1990 and 2000, 0 otherwise

A_2 1 for developed countries in 2000, 0 otherwise

D_1 1 for developing countries in all three years, 0 otherwise

D_2 1 for developing countries in 1990 and 2000, 0 otherwise

D_3 1 for developing countries in 2000, 0 otherwise

Note: Eastern Europe included in 'developed' for purposes of defining coverage of dummy variables. On this basis, developed countries are 38% of the 53-country data and 27% of the 96-country data. China is omitted from all the regressions.

Table 3. Regression results 1980-2000 (dependent variable in all rows is $\log_e q_M/q_P$)

Method	Intercept	Coefficients on independent variables							R^2
		$\log_e b$	$\log_e n$	A_1	A_2	D_1	D_2	D_3	
Output ratio (53 countries, 3 years)									
POLS	-1.06	0.60	-0.30	0.00	0.14	-0.75	0.00	-0.05	0.57
	(0.00)	(0.01)	(0.00)	(0.97)	(0.02)	(0.01)	(0.97)	(0.59)	
FE	0.58	0.32	0.32		0.21		0.20	0.14	0.12
	(0.70)	(0.19)	(0.41)		(0.04)		(0.13)	(0.28)	
FD	0.01	0.05	-0.14		0.11		0.09	-0.05	0.02
	(0.90)	(0.83)	(0.80)		(0.15)		(0.56)	(0.63)	
FD	0.02				0.11		0.12	-0.06	0.01
	(0.62)				(0.15)		(0.17)	(0.61)	
Export ratio (53 countries, 3 years)									
POLS	-1.60	0.77	-0.50	0.14	0.20	-0.72	0.30	0.10	0.48
	(0.00)	(0.07)	(0.00)	(0.13)	(0.05)	(0.13)	(0.14)	(0.62)	
FE	2.98	-0.28	1.06		0.40		0.83	0.60	0.33
	(0.42)	(0.63)	(0.27)		(0.10)		(0.01)	(0.05)	
FD	0.24	0.21	0.82		0.04		0.48	-0.22	0.03
	(0.05)	(0.74)	(0.52)		(0.78)		(0.18)	(0.42)	
FD	0.17				0.03		0.34	-0.21	0.02
	(0.03)				(0.83)		(0.09)	(0.46)	
Export ratio (96 countries, 3 years)									
POLS	-2.14	0.59	-0.58	0.14	0.21	-0.71	0.02	0.15	0.45
	(0.00)	(0.03)	(0.00)	(0.06)	(0.02)	(0.04)	(0.88)	(0.33)	
FE	2.82	-0.22	1.28		0.45		0.68	0.72	0.35
	(0.32)	(0.51)	(0.11)		(0.04)		(0.01)	(0.00)	
FD	0.30	0.06	1.27		0.02		0.33	0.07	0.01
	(0.00)	(0.86)	(0.22)		(0.86)		(0.17)	(0.74)	
FD	0.19				0.03		0.11	0.07	0.00
	(0.01)				(0.79)		(0.42)	(0.72)	

Note. All regressions exclude China. P values in parentheses.

Table 4. Predicted impact of China's opening on ratio of labour-intensive manufacturing to primary production in other countries

	Alternative estimates of impact on world endowment ratios	
	Labour-force-weighted	Openness-adjusted
Impact on $\log_e M/P$ output ratio	-0.11	-0.07
Impact on $\log_e M/P$ export ratio		
53-country coefficients	-0.16	-0.10
96-country coefficients	-0.16	-0.10

Note. Calculations explained in text, using data from tables 1 and 3

Table 5. Changes in logged ratios of labour-intensive-manufacturing to primary output and exports, 1980-2000, regional averages

Region (number of countries in 53-country data)	Output (53 countries)			Exports (53 countries)			Exports (96 countries)			
	1980-1990	1990-2000	Difference	1980-1990	1990-2000	Difference	Extra countries	1980-1990	1990-2000	Difference
China	-0.02	0.24	0.26	0.34	1.13	0.79		0.34	1.13	0.79
Developed (20)	0.02	0.13	0.11	0.17	0.20	0.03	6	0.19	0.21	0.03
Developing (33)	0.14	0.08	-0.06	0.51	0.30	-0.21		0.29	0.37	0.07
East Asia (6)	0.43	0.24	-0.19	1.20	0.75	-0.45	3	0.88	0.54	-0.34
Standard deviation	0.48	0.37	0.28	1.07	0.76	1.03		1.17	0.77	0.88
South Asia (3)	0.00	0.29	0.29	0.77	0.81	0.04	4	0.73	0.68	-0.05
Standard deviation	0.15	0.23	0.25	0.79	0.49	0.71		0.83	1.05	1.21
Latin America (10)	0.10	-0.07	-0.17	0.04	0.73	0.69	12	0.08	0.47	0.39
Standard deviation	0.38	0.57	0.64	1.01	0.76	1.23		0.89	0.64	1.10
Middle East (7)	0.21	0.07	-0.14	0.57	-0.43	-1.00	2	0.46	-0.73	-1.19
Standard deviation	0.42	0.51	0.86	1.24	1.79	2.42		1.38	1.71	2.17
Sub-Saharan Africa (7)	-0.08	0.08	0.16	0.40	-0.19	-0.59	16	0.07	0.53	0.45
Standard deviation	0.50	0.36	0.68	0.72	0.86	1.26		0.77	1.59	2.02

Notes: regional averages are unweighted; Eastern Europe included in 'developed' group (Hungary and Poland in 53-country data; plus Bulgaria and Romania in 96-country data); East Asia excludes China; Latin America includes Caribbean; Middle East includes North Africa.