

Globalization and Structural Change around the World, 1985–2015

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Structural change is a vital element of successful development. Between 1985 and 2015, however, falling barriers to trade and transfer of technology shifted sectoral structures in different directions in different countries by intensifying endowment-related specialization. In skill-abundant developed countries, manufacturing became more skill-intensive and employed fewer workers. In land-scarce developing East Asia, labor-intensive manufacturing expanded, especially and hugely in China. In land-abundant Africa, Latin America, and the Middle East, by contrast, manufacturing shares fell, while in land-scarce South Asia labor-intensive manufacturing was constrained by low literacy and inadequate infrastructure. This pattern of structural change contributed to higher average growth rates during this period in land-scarce than in land-abundant developing countries. Future changes in sectoral structures and growth rates will continue to be shaped by differences among countries in land abundance and skill supplies that matter for development policy choices.

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Since the pioneering statistical analysis of [Kuznets \(1966\)](#), elaborated by [Chenery and Syrquin \(1975\)](#), economists have associated successful development with a process of structural change in which the share of the initially predominant agricultural sector becomes ever smaller, while the shares of the manufacturing and service sectors expand. The growth of manufacturing is most conspicuous in the early and middle stages of development, while at late stages the share of manufacturing, especially in employment, tends to decline as services continue to expand—a phase known as “deindustrialisation” ([Rowthorn and Wells 1987](#)).

Recent research has shaken confidence in this view. Even in fast-growing developing countries, there has been wide variation in the pattern of structural change

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(Diao, McMillan, and Rodrik 2017; McMillan, Rodrik, and Sepulveda 2017). Evidence that manufacturing shares have declined in some developing countries sooner than would formerly have been predicted from their levels of per capita income has led to concerns about “premature deindustrialization” and weakening of the role of manufacturing in development (Felipe, Mehta, and Rhee 2014; Rodrik 2016; Hallward-Driemeier and Nayyar 2018). The evidence underlying these concerns has been challenged, however, by Haraguchi, Cheng, and Smeets (2017), who show that for developing countries as a whole manufacturing’s share of GDP at constant prices and of employment has continued to rise.

So what actually has been happening to structural change around the world over the past few decades, and why? The answer appears to be that globalization has caused sectoral structures to move in different directions in different countries, with manufacturing shares rising in land-scarce developing regions and countries, while land-abundant developing regions and countries have deindustrialized. Globalization had this effect because reduced costs of international trade and other transactions as a result of lowered policy barriers, better transport infrastructure and advances in information technology, reinforced by more reliance on markets, caused countries to become even more specialized in the sectors in which their varying endowments of human and natural resources give them a comparative advantage.

This article begins with the economic theory of why trade causes this sort of specialization. It then describes the pattern of variation in resources among regions and countries, and documents the strong relationships between variation in resources and in sectoral structure, before showing how globalization, combined with variation in resources, caused patterns of structural change to vary among regions and countries between 1985 and 2015 (supporting details of data and methods can be found in Wood 2017). The mechanism appears to have been partly a reduction of barriers to trade, as in standard theory, but also a reduction of barriers to technology transfer associated with the expansion of outsourcing and value chains.

The article ends by asking two questions about this pattern of structural change: will it continue, and does it matter for developing-country growth? Structural change in the future will differ from that in the past, but its variation among countries will still be shaped by variation in their human and natural resources. Between 1985 and 2015, globalization-induced variation in structural change contributed to faster growth of land-scarce than of land-abundant developing countries, but the future growth rates of both sorts of countries will depend heavily on policy choices.

Theoretical Framework

The relevant theory, named “Heckscher-Ohlin” after the two Swedish economists who formulated it a century ago and still in all textbooks on trade, is based on a simple idea.¹ The mix of goods that people want to consume varies less among countries

than the mix of goods that can be cheaply produced with locally available resources (or “factors of production”). Countries thus tend to export goods whose production makes intensive use of resources of which they have a relatively large supply, and to import goods which require large inputs of resources that are locally scarce.

Heckscher-Ohlin theory is useful for analyzing globalization because it predicts what happens to countries when barriers to trade fall. The composition of production and employment tends to become more specialized in sectors in which resource endowments confer a comparative (production cost) advantage; and the earnings of abundant factors tend to rise, relative to those of scarce factors. The outcomes in any country thus depend on the composition of its resource endowments, which varies widely among countries.

The effects of reduction of trade barriers also depend on determinants of trade omitted from Heckscher-Ohlin theory, such as economies of scale and differences among countries in the relative technical efficiency of different sectors. Moreover, there was more to globalization than the reduction of cost barriers to trade on which Heckscher-Ohlin theory focuses. Developing countries also benefited from transfers of technical, marketing, and managerial know-how from developed countries, enabling them to export goods that they could not otherwise have made or sold, as a result of improvements in travel, communications, and organizational arrangements that can be summarized as reduction of “cooperation costs” (Anderson, Tang, and Wood 2006).

These transfers of know-how were mainly to sectors in which the endowments of the country concerned already gave it a comparative advantage—sometimes in primary products such as out-of-season fruit, but more often in labor-intensive manufacturing—tending to reinforce Heckscher-Ohlin determinants of sectoral structure. The combination of reductions in trade costs and in co-operation costs also fragmented manufacturing, causing more trade in components, more outsourcing, and the emergence of global value chains (WTO 2014; Baldwin 2016).

Regional Resource Endowments

Comparative advantage in Heckscher-Ohlin theory depends on endowments of internationally immobile factors, of which three broad types will be distinguished: land (natural resources), skill (human capital), and labor. Non-human capital remains in the background because it is now highly mobile internationally, in both its financial form and its physical form (machinery), making it unusual for the sectoral structures of countries to be powerfully influenced by fixed national “endowments” of capital (Wood 1994). If a country has a comparative advantage in a good because of the abundance of an immobile resource, plus access to the necessary know-how, it can usually obtain the required capital, either domestically or from abroad.

Non-human capital is of course vital for growth, and it undoubtedly has effects also on sectoral structure. Goods vary in capital intensity, and some developing

countries are poorly integrated into world capital markets. But the main differences in resource intensity among the sectors that are distinguished in the present analysis—primary, more and less skill-intensive manufacturing, and services—are in their use of land, skill, and labor, rather than of capital. Moreover, neither the continuities nor the changes in sectoral structure to be described below seem likely to have been much influenced by variation among countries in endowments of immobile capital, with the important exception of infrastructure.

One key dimension of endowment mix is the land/labor ratio, to be measured by a country's total land area divided by its adult (over-15 years old) population. Land area is evidently not an ideal measure of natural resource availability since it fails to allow for variation among countries in the quality of their land. But it is an unbiased measure because what each country has, per square kilometer of its surface area, in terms of soil fertility, water resources, minerals, and so on, can be seen as the outcome of a random draw, and it is more plausibly exogenous than other measures of natural resources, such as arable land and mineral reserves.

Another key dimension of a country's endowment mix is the skill/labor ratio, to be measured by the average years of schooling of its adult population (and its endowment of skill as its total number of person-years of schooling). Years of schooling is again far from an ideal measure of skill since it fails to allow for differences among countries and over time both in how much is learned in school and in skills acquired outside school. Years of schooling is the best available measure for worldwide analysis over a long period, but has to be interpreted cautiously.

The empirical analysis in this article is limited to countries whose total populations exceeded 1 million in 1990, of which at the end of the period there were about 150, containing 99% of the world's population. During the period, some countries split up, most notably the USSR and Yugoslavia, or united. To make comparisons between the start and end of the period, the data for the countries involved are added together—for example, combining East and West Germany and the constituent states of the former USSR. The resulting 130 countries are listed in the statistical appendix of [Wood \(2017\)](#).

Countries are grouped into ten regions. The seven developing regions closely follow the World Bank's classification: two in East Asia (separating China from Other East Asia), two in South Asia (India and Other South Asia), Latin America, Sub-Saharan Africa, and the Middle East and North Africa (MENA). The former Soviet sphere (FSS) includes the USSR and Eastern Europe. The OECD is split into two regions, separating the land-scarce countries of Western Europe and Japan from the land-abundant ones of North America, Australia, New Zealand, and Scandinavia. To avoid end-period selection bias, the country composition of all regions is as it was in 1985 (e.g., the OECD excludes Korea and Poland). All the regional variables in this article are aggregates, based on addition across countries, and so are more influenced by the larger countries in each region (though only in one region does a single country account for over half

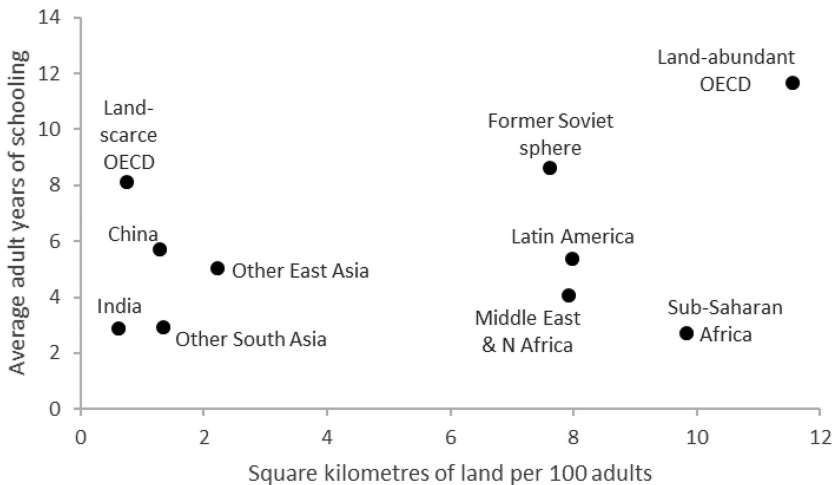
the total population: the United States accounts for four-fifths of the land-abundant OECD).

Figure 1 shows regional endowment ratios in 1985. The regions divide horizontally into two groups of widely differing land abundance—five clustered around an average of about 1.5 km² of land per 100 adults and the other five around an average of about 9 km². Within each group there is a vertical hierarchy of skill abundance, with average years of schooling rising from under 3 at the bottom of each group to 12 in the land-abundant OECD. The endowments of the regions in 1985 thus varied widely, though there was far wider variation among countries; their land/labor ratios ranged from near zero in Hong Kong to 140 in Mongolia, and their average years of schooling ranged from 0.6 in Yemen to 12.0 in the United States.

Figure 2 shows how regional endowments changed between 1985 and 2010 (the latest year for schooling data): the endowments of each region in each year are expressed as a ratio of the world average (because comparative advantage depends on one's endowments compared to those of others). In 2010, all the regions were in roughly the same relative positions as in 1985, though slower population growth in richer than in poorer regions caused their relative land abundance to move in opposite directions and poorer regions became relatively more schooled.

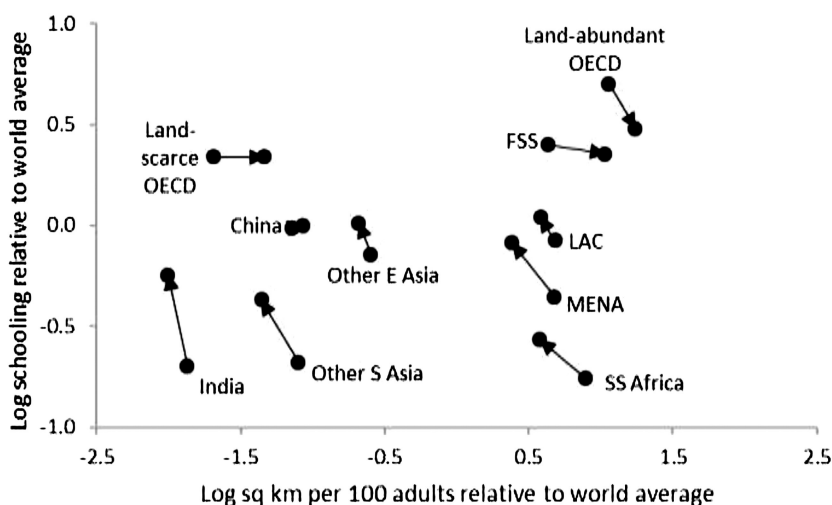
The schooling changes, however, are misleading: increased enrollments in poorer regions were associated with a fall in the average quality of schooling, so there was little narrowing of the gaps in skill per worker among regions (Pritchett 2013). Some

Figure 1. Regional Endowment Ratios, 1985



Sources: Land area and adult population taken from World Development Indicators; schooling taken from Barro and Lee (2013) education database, with gaps for nine countries filled using UNESCO data on adult literacy.

Note: Adults are defined as people over 15 years old.

Figure 2. Changes in Regional Endowment Ratios, 1985–2010

Sources: Derived from World Development Indicators and from Barro and Lee (2013) and UNESCO education data.
 Note: Average adult years of schooling and land area per adult in each region and year are logged ratios of world (weighted) averages in the year concerned. FSS = Former Soviet sphere. LAC = Latin America. MENA = Middle East and North Africa.

countries made real educational progress, but for most countries, as for regions, there was little change in relative endowments: the correlations across countries between 1985 and 2010 values are 0.94 for average years of schooling and 0.98 for land area per adult.

How Endowments Affect Structure

The powerful influence of variation in endowments on sectoral structure is illustrated by the cross-country regressions in table 1, whose focus is on the relative sizes of different broadly-defined goods-producing sectors. It is this goods dimension of sectoral structure that Heckscher-Ohlin theory suggests will depend most on endowments because there is far greater scope for trade in goods (agriculture, mining, and manufacturing) than in services, and so more opportunity for countries to specialize. Since most services are not traded, the services dimension of sectoral structure (examined later) depends much more on the composition of demand within each country.

Panel A of table 1 refers to exports, and more specifically to the ratio of manufactured to primary (agricultural plus mineral) exports, where manufactures are defined broadly to include processed primary products such as canned food and refined petroleum (to match the definitions used in the output and employment data).²

Table 1. Goods-Sector Structural Ratios Regressed Across Countries on Endowment Ratios

Dependent variable and specification	Coefficients on independent variables					Number of countries
	Av. adult years of schooling	Schooling squared	Square km of land per adult	Adult (15+) population	R-squared	
A. Manufactured/primary exports						
1985 levels	1.02		−0.33	0.23	0.43	119
2014 levels	1.59		−0.58	{0.22}	0.53	119
Change on 1985 level	[−0.07]		−0.27	[−0.03]	0.11	119
B. Skill-intensive/labor-intensive manufactured exports						
1985 levels	1.36		[0.05]	[0.01]	0.24	82
2014 levels	2.94		[0.09]	[0.02]	0.45	82
Change on 1985 level	0.68		[−0.00]	[0.08]	0.12	82
C. Manufactured/primary output						
1985 levels	1.06		−0.24	0.13	0.57	125
2014 levels	1.68		−0.43	[0.01]	0.57	125
Change on 1985 level	[0.03]		−0.23	{−0.08}	0.26	125
D1. All manufacturing/primary employment						
1985 levels	1.96		{−0.21}	[0.04]	0.66	125
2014 levels	2.80		{−0.18}	[0.06]	0.67	125
Change on 1985 level	1.33	−0.46	[−0.06]	{0.08}	0.11	111
Labor intensity change	1.80	−0.63	0.15	0.16	0.22	111
D2. Formal manufacturing/primary employment						
1985 levels	2.89		{−0.24}	[−0.02]	0.67	82
2014 levels	4.45		{−0.23}	[−0.07]	0.68	82
Change on 1985 level	2.08	−0.66	[−0.05]	[0.06]	0.14	82
Labor intensity change	1.88	−0.62	0.22	{0.12}	0.26	82

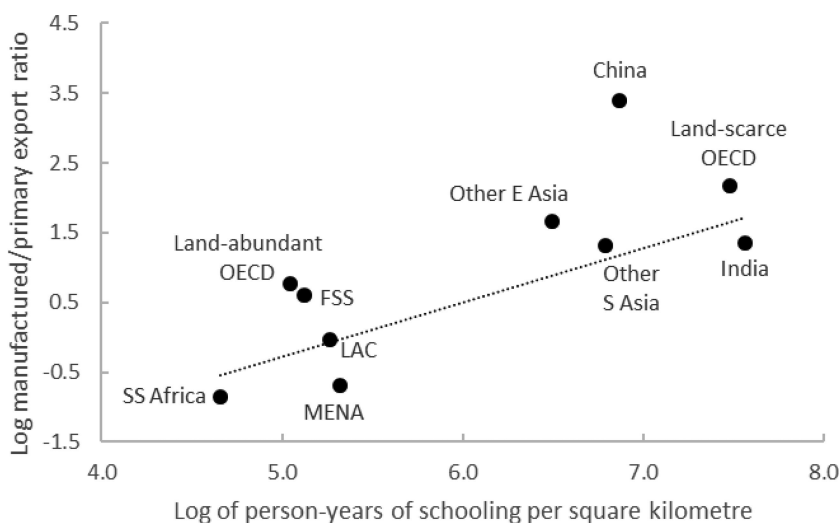
Sources: Endowment variables derived from World Development Indicators and from Barro and Lee (2013) and UNESCO education data. Export data from UNCTAD and WTO. Output data from UN National Accounts database. Employment data from Haraguchi, Cheng and Smeets (2017) database, supplemented with ILO and UNIDO data.

Definitions: “Primary” is agriculture plus mining. Manufactures and primary defined as in International Standard Industrial Classification (ISIC) rather than Standard International Trade Classification (SITC), except in panel B. “Formal manufacturing” refers to firms that meet minimum size or registration criteria for inclusion in official surveys.

Method: OLS regressions with all variables in natural logs. Coefficients are significant at 10% level or better unless they appear in square brackets. Those in chain brackets become insignificant in one or other of two robustness checks: (i) omission of all East Asian countries; (ii) omission of countries with outlying values of independent variables.

Specifications: “1985 levels” = 1985 ratio regressed on 1985 endowments; “2014 levels” = 2014 ratio on 2010 endowments; “Change on 1985 level” = 1985–2014 change in ratio on 1985 endowments. “Labor intensity change” = 1985–2014 change in employment share/output share on 1985 endowments.

Coverage: Includes all countries with data in both 1985 and 2014, except panel B (those where SITC manufactures ≥ 10% of total exports in both years) and third and fourth regressions in panel D1, which omit countries with outlying values of independent variables.

Figure 3. Manufactured/Primary Exports and Skill/Land Endowments, 2014

Sources: Endowment variables (in 2010) derived from World Development Indicators and from Barro and Lee (2013) and UNESCO education data. Export data from UNCTAD and WTO and from OECD/WTO trade-in-value-added database.

Note: Regional averages are of exports on a domestic-value-added basis. Regression line shows relationship across countries rather than across regions, with exports measured gross. FSS = Former Soviet sphere. LAC = Latin America. MENA = Middle East and North Africa.

Because manufacturing is more skill-intensive than primary production, countries with a better-educated labor force tend to export relatively more manufactures, as shown by the positive coefficient on average years of schooling. Because manufactures are also less land-intensive than primary production, land-abundant countries tend to export relatively fewer of them, as shown by the negative coefficient on land area per adult.³ In addition, the positive coefficient on adult population size shows that manufactured exports tend to be relatively greater in larger countries, perhaps because of economies of scale in manufacturing. All these relationships between export structure and endowments are observed both in 1985 and in 2014.

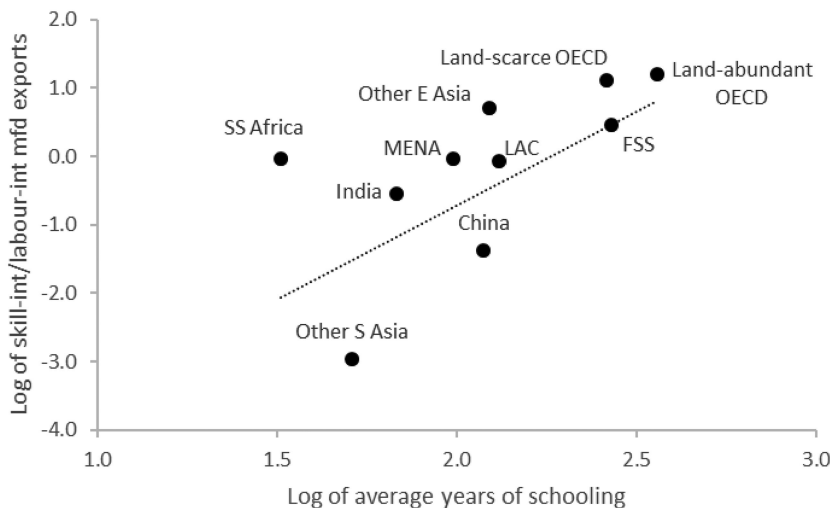
The regional pattern in 2014 is illustrated in figure 3: its vertical axis measures the ratio of manufactured to primary exports, and its horizontal axis measures endowment mix by the skill/land ratio (the total number of person-years of schooling in a country divided by its total land area), which conveniently combines the influence of skill abundance and land abundance. The ten regions divide into the same two groups as in figure 1: the five more land-abundant regions are clustered in the bottom left part of the figure, with lower manufactured/primary export ratios, while the five more land-scarce regions are in the upper right part, with higher manufactured/primary export ratios.

The relationship between export structure and endowments across regions is similar to that across countries, illustrated in the figure by the slope of a cross-country regression line, though there is wide variation around the line, including a large positive deviation for China. This variation, as in all the regressions discussed, is a result partly of inaccuracies of the data and partly of the influence on sectoral structure of forces other than endowments. These forces include variation among countries in comparative advantage caused by variation in the relative technical efficiency of different sectors and deviations of actual sectoral structure from comparative advantage caused by trade costs.

Panel B of [table 1](#) refers to another dimension of export structure: the ratio of skill-intensive to labor-intensive manufactures (excluding processed primary products). The skill-intensive category includes goods such as aircraft and chemicals, and the (unskilled) labor-intensive category goods such as garments and steel. The regressions show, in both 1985 and 2014, that skill-intensive manufactured exports are relatively larger in more skill-abundant countries, as indicated by the positive coefficient on average years of schooling, but do not depend on land abundance (because land intensity is much the same for these two sorts of manufacturing), nor on country size.

The regional pattern in 2014 is shown in [figure 4](#), with the skill-intensive-to-labor-intensive export ratio on the vertical axis and average years of schooling on the

Figure 4. Skill Intensity of Manufactured Exports and Skill/Labor Endowments, 2014



Source: Endowment variables (in 2010) derived from World Development Indicators and from [Barro and Lee \(2013\)](#) and UNESCO education data. Export data from UNCTAD and WTO.

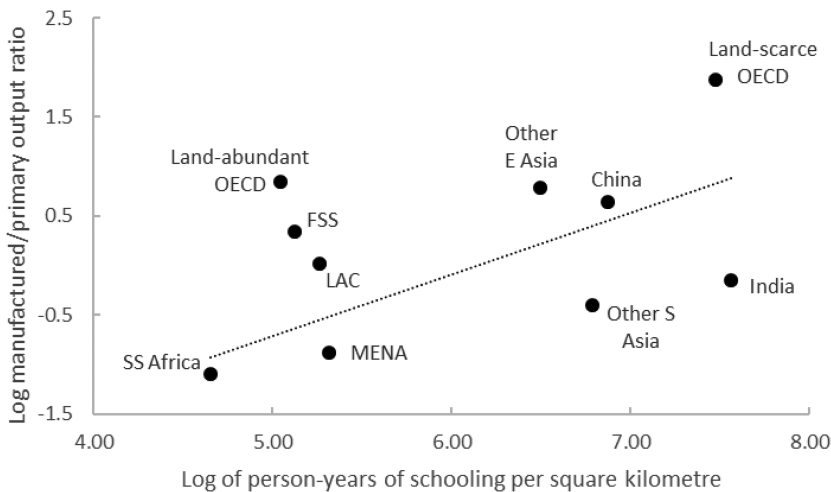
Note: Regression line shows relationship across countries where Standard International Trade Classification (SITC) manufactures are 10% or more of total exports. FSS = Former Soviet sphere. LAC = Latin America. MENA = Middle East and North Africa.

horizontal axis. The upward-sloping relationship across regions is again similar to the cross-country regression line. Two outliers are Sub-Saharan Africa, distorted upwards by South Africa's much higher weight in this regional export ratio than in regional average years of schooling, and Other South Asia, pulled down especially by the high share of garments in Bangladesh's exports.

Panel C of [table 1](#) refers to the manufactured/primary output ratio, as measured by the shares of the relevant sectors in each country's GDP. As with the export regressions in panel A, and for the same economic reasons, this ratio is positively related across countries to the education level of their workforces and negatively related to their land abundance, both in 1985 and in 2014, though it is related (again positively) to country size only in 1985.

The regional pattern in 2014 is illustrated in [figure 5](#), again with the skill/land ratio on the horizontal axis, and again showing an upward-sloping relationship across regions similar to that across countries. In the OECD and the land-abundant regions, the manufactured/primary output ratios in [figure 5](#) are similar to the corresponding export ratios in [figure 3](#). In all four Asian developing regions, though, export ratios exceed output ratios. In East Asia, and especially in China, this is because export ratios are high and output ratios normal (in relation to the cross-country regression line). In South Asia, by contrast, it is because export ratios are normal and output ratios low.

Figure 5. Manufactured/Primary Output and Skill/Land Endowments, 2014



Source: Endowment variables (in 2010) derived from World Development Indicators and from [Barro and Lee \(2013\)](#) and UNESCO education data. Output data from UN National Accounts database.

Note: Regression line shows relationship across countries, not across regions. FSS = Former Soviet sphere. LAC = Latin America. MENA = Middle East and North Africa.

These differences between East Asia and South Asia partly reflect differences in infrastructure, trade policies, and labor laws. In addition, what makes average years of schooling higher in East Asia than in South Asia is that there are more workers with a basic education and fewer with no education. Since workers with a basic education are vital for manufacturing, especially of labor-intensive products for export, this difference in schooling mix helps to explain both why East Asia's manufactured/primary export ratio is unusually high and why South Asia's manufactured/primary output ratio is unusually low.

Panels D1 and D2 of [table 1](#) refer to the manufactured/primary employment ratio: D1 to all manufacturing employment, and D2 to "formal" manufacturing employment in larger firms (widely regarded as a particularly desirable sort of job). As with exports and output, the ratio of manufacturing to primary employment tends to rise with a country's level of education, but only partly because of the higher skill intensity of manufacturing. The larger coefficients on average years of schooling in the employment regressions than in the export and output regressions reflect modernization of agriculture in the course of development, which raises its labor productivity relative to that of other sectors ([Diao, McMillan, and Wangwe 2018](#)), and in panel D2 also the rising formal share of manufacturing employment. Like the export and output ratios, the manufacturing/primary employment ratio tends to be lower in more land-abundant countries, but there is no relationship with country size.

Turning now to the services dimension of sectoral structure, the cross-country regressions in [table 2](#) relate the services/goods ratios for exports, output, and employment to the same endowment measures (and with the same method and specifications) as in [table 1](#). Goods are defined as the sum of agriculture, mining, and manufacturing and services are defined as the sum of all other sectors. In both 1985 and 2014, services exports are relatively smaller in more land-abundant countries, as shown by the negative coefficient on the land variable, because services are on average less land-intensive than goods (particularly primary products), but the schooling coefficient is insignificant, implying that on average the skill intensity of traded services is similar to that of traded goods.

The services/goods output ratio, too, is inversely related across countries to their land abundance, though insignificantly so in 1985. Unlike exports, the output ratio is positively related to skill abundance, but this relationship does not reflect comparative advantage: most services are not traded, and the higher services/goods ratio in more educated countries mainly reflects more demand for (and a higher relative price of) services in countries with higher per capita income, with which schooling is correlated. The same applies to the schooling coefficient in the services/goods employment regression, though it is larger than for output because the higher relative price of services reflects lower relative labor productivity in services.

The regional pattern of service sector shares in 2014 is shown in [table 3](#), where the regions are split into two groups on the basis of land abundance, and within each

Table 2. Services/Goods Structural Ratios Regressed across Countries on Endowment Ratios

Dependent variable and specification	Coefficients on independent variables				Number of countries
	Av. adult years of schooling	Square km of land per adult	Adult (15+) population	R-squared	
A. Exports					
1985 levels	[−0.10]	−0.19	[−0.03]	0.06	119
2014 levels	[−0.11]	−0.26	[−0.11]	0.12	119
Change on 1985 level	[−0.02]	[−0.09]	[−0.06]	0.02	119
B. Output					
1985 levels	0.39	[−0.04]	[−0.02]	0.31	125
2014 levels	0.88	−0.13	[−0.03]	0.47	125
Change on 1985 level	0.21	−0.11	[0.03]	0.24	125
C. Employment					
1985 levels	1.15	[0.05]	[−0.06]	0.46	125
2014 levels	1.86	[0.00]	[−0.07]	0.59	125
Change on 1985 level	0.11	{−0.07}	[0.02]	0.13	125
Labor intensity change	[−0.09]	[0.04]	[−0.01]	0.04	125

Sources: Endowment variables derived from World Development Indicators and from Barro and Lee (2013) and UNESCO education data. Export data from UNCTAD and WTO. Output data from UN National Accounts database. Employment data from Haraguchi, Cheng and Smeets (2017) database, supplemented with ILO data.

Note: “Services” is all sectors except agriculture, mining, and manufacturing (which together are “goods”).

group ranked in descending order of schooling. Consistent with the regressions, the services share of exports tends to be higher in land-scarce than in land-abundant regions: it is unusually low in China, perhaps because less foreign contact is permitted in its service sectors than in manufacturing, and unusually high in India, reflecting the country’s great success as an exporter of ICT services for largely sector-specific reasons. Also consistent with the regressions, the share of services in GDP and employment is higher in more educated regions.

Patterns of Structural Change between 1985 and 2015

The two previous sections emphasized continuities in the pattern of variation among countries and regions in sectoral structure and its relationship with variation in their endowments. There were only small changes between 1985 and 2010 in the relative endowments of different countries and regions (figure 2), and the signs of the coefficients in cross-country regressions of sectoral structure on endowments were all the same in 2014 as in 1985 (table 1 and table 2). There were also, however, some important changes in the pattern of variation.

Table 3. Service Sector Shares: Levels in 2014 and Changes 1985–2014

	Shares in 2014 (%)			Changes 1985–2014 (Percentage points)		
	Exports	GDP	Employment	Exports	GDP	Employment
<i>Land-scarce regions</i>						
Land-scarce OECD	28.3	81.5	81.8	7.0	10.6	14.5
Other East Asia	22.7	65.1	50.9	5.4	7.5	17.1
China	12.6	56.9	48.2	−2.3	21.3	26.8
India	38.2	62.8	32.4	10.4	14.1	12.8
Other South Asia	23.9	62.0	29.9	2.2	9.1	−0.9
<i>Land-abundant regions</i>						
Land-abundant OECD	29.6	83.2	88.2	6.5	7.0	9.5
Former Soviet sphere	16.6	70.4	63.9	4.6	18.0	17.6
Latin America	14.0	72.3	70.2	−3.8	12.5	17.6
Middle East & N Africa	11.3	59.7	69.0	−1.0	−0.3	16.3
Sub-Saharan Africa	15.2	60.5	30.2	3.4	1.9	3.8
<i>World</i>	23.2	74.1	52.1	3.6	6.0	14.4
<i>Developing countries</i>	17.2	62.5	45.7	1.4	7.0	17.4
<i>Developing without China</i>	18.6	65.5	44.5	2.9	7.5	11.8

Sources: Export data from UNCTAD and WTO. Output data from UN National Accounts database. Employment data from Haraguchi, Cheng and Smeets (2017) database, supplemented with ILO data.

Note: “Services” is all sectors except agriculture, mining, and manufacturing. “Developing countries” exclude both OECD regions and former Soviet sphere.

Sectoral Specialization

The main changes in sectoral structure between 1985 and 2014 at regional level are summarized in table 4, which focuses on changes in the share of manufacturing both in goods sectors and in the economy as a whole, and in which the regions are again arranged according to their endowments. The most striking feature of this table is the pattern of signs: the changes in manufacturing shares are almost all positive for the land-scarce regions and almost all negative for the land-abundant regions. At constant prices, all export and output share changes would look more positive because the relative world price of manufactures fell over this period, but the differences among regions would remain largely the same.

The pattern of sign differences has no exceptions in the first two columns of table 4, which refer to the share of manufacturing in goods exports and goods output. The manufacturing sector became larger, relative to agriculture and mining, in all the land-scarce regions, and smaller in all the land-abundant regions. This pattern of change occurred across countries, too: in the third regressions in panels A and C of table 1, 1985–2014 changes in the manufactured/primary ratio for both exports and output are negatively related to land area per adult in 1985.

Table 4. Manufacturing Share Changes 1985–2014 (Percentage Points)

	Share of goods-sector		Share of economy-wide		
	Exports	Output	Output	Employment	
<i>Land-scarce regions</i>				All	Formal
Land-scarce OECD	1.1	4.5	−7.9	−9.0	−7.0
Other East Asia	13.4	14.1	0.8	1.3	1.1
China	45.5	15.8	−3.8	3.4	5.5
India	16.1	15.0	1.2	0.9	0.0
Other South Asia	22.3	12.8	2.4	3.6	2.7
<i>Land-abundant regions</i>					
Land-abundant OECD	−5.8	−8.5	−6.9	−7.9	−8.1
Former Soviet sphere	−12.5	−5.0	−12.9	−12.3	−14.7
Latin America	−1.1	−12.5	−11.4	−2.0	−1.1
Middle East & N Africa	−10.8	−2.0	−0.7	−0.9	−0.5
Sub-Saharan Africa	−14.2	−1.5	−1.1	1.2	−0.3
<i>World</i>	−0.8	−4.4	−5.2	−2.0	−1.8
<i>Developing countries</i>	14.9	8.7	0.1	1.1	1.7
<i>Developing without China</i>	5.2	1.9	−2.7	0.6	0.1

Sources: Export data from UNCTAD and WTO and from OECD/WTO trade-in-value-added database. Output data from UN National Accounts database. Employment data from Haraguchi, Cheng and Smeets (2017) database, supplemented with ILO and UNIDO data.

Note: For exports and output, shares are of value-added. For employment, formal share is of formal manufacturing in all economy-wide employment. “Developing countries” excludes both OECD regions and former Soviet sphere.

The third regression in panel B of table 1 documents another change that occurred between 1985 and 2014, which is that more skill-abundant countries became more specialized in skill-intensive manufacturing, relative to less skill-abundant countries, as shown by the positive coefficient on average years of schooling in 1985. This regression, moreover, probably understates the extent of this shift in specialization because it relies on a crude classification of goods as either skill-intensive or labor-intensive, whereas in reality the production of skill-intensive and labor-intensive varieties of each good and of skill-intensive and labor-intensive intermediate inputs was increasingly split between skill-abundant and skill-scarce countries.⁴

The third regressions in panels D1 and D2 of table 1 revert to changes in the manufactured/primary dimension, but for employment. The most striking feature is a strong non-linear relationship with initial level of schooling: changes in the manufacturing/primary employment ratio are more positive in better-educated countries only up to a point, beyond which the effect reverses.

This non-linearity arises not from changes in the manufactured/primary output ratio (which were unrelated to schooling), but from changes in the labor intensity (defined as employment per unit of output) of manufacturing relative to primary

production. The negative coefficients on schooling squared in the labor-intensity-change regressions in panels D1 and D2 capture the global restructuring of manufacturing during this period: the growth of export-oriented manufacturing in developing countries (which increased the relative labor intensity of manufacturing by pulling surplus labor out of agriculture) and the shift of manufacturing in developed countries from labor-intensive to skill-intensive activities (Fontagné and Harrison 2017).

Unlike the changes in export and output ratios, which were negatively related across countries to land abundance, the third regressions in panels D1 and D2 show that changes in manufactured/primary employment ratios were almost unrelated to variation in land abundance. This difference, as the fourth regressions show, reflects a positive relationship across countries between changes in the relative labor intensity of manufacturing and initial levels of land abundance. In other words, the falls in manufacturing's share of exports and output in land-abundant countries were associated with slower growth of output per worker in their manufacturing sectors, relative to their primary sectors, than in land-scarce countries.

Premature Deindustrialization?

Some recent research suggests that developing countries are deindustrializing much earlier than would formerly have been expected (Felipe, Mehta, and Rhee 2014; Rodrik 2016), while other recent research shows that for developing countries as a whole manufacturing's shares of real output and employment have continued to rise (Haraguchi, Cheng, and Smeets 2017). This conflict of evidence can be resolved by recognizing that the industrialization was mainly in land-scarce developing regions with larger countries, while the deindustrialization (observed also by McMillan, Rodrik, and Verduzco-Gallo 2014) was mainly in land-abundant regions with smaller countries.

The last three columns of Table 4 show the changes in each region between 1985 and 2014 in manufacturing's share of economy-wide output and employment (subdivision of the period at 2000 reveals no systematic pattern of acceleration or deceleration). The two employment columns again distinguish between all and formal manufacturing employment, which changed in similar ways. The changes in all three columns are the outcome of changes both in the share of manufacturing in goods sectors and in the relative sizes of the goods and service sectors (measured in the last two columns of Table 3 by changes in the share of services in total output and employment).

In land-abundant regions, the falls in the manufacturing share of goods output were reinforced by rises in the service share of GDP, causing "output deindustrialization", though only slight in MENA and Sub-Saharan Africa, which were the least industrialized regions in 1985. In the land-scarce regions, the rises in the manufacturing share of goods output were offset by rises in the service share: in three of these

regions, manufacturing still rose as a share of GDP, but it fell in the land-scarce OECD, and also in China, which started with an unusually low service share (as did the FSS, where deindustrialization was greatest).

Across countries, controlling for variation in education and size, changes in the share of manufacturing in GDP were unrelated to land abundance (see table 5 of Wood 2017). The statistical reason for this lack of relationship is that in more land-abundant countries the tendency for manufacturing's share of goods production to fall (panel C of Table 1) was offset by a tendency for smaller increases in the service sector share of GDP (panel B of Table 2). A possible economic explanation is that less manufacturing in more land-abundant countries generated less demand for producer services: changes in the share of services in GDP are positively correlated across countries with changes in the manufactured/primary output ratio.

As measured by the share of manufacturing in GDP at current prices, the world as a whole deindustrialized by 5 percentage points, but mainly as a result of declines in the OECD and FSS regions (Table 4). In all developing regions combined – the world less the OECD and FSS – this share did not alter (as first reported by Haraguchi 2014), contrary to concerns about premature deindustrialization.

At constant prices, moreover, manufacturing's share of GDP rose for developing countries in aggregate (and fell only slightly in developed countries: Haraguchi, Cheng, and Smeets 2017, Figures 5D and 6B). In the land-abundant developing group, the drop in Latin America's manufacturing share of GDP at constant prices was only 2–3 percentage points, and in MENA this share rose slightly, though the fall in Sub-Saharan Africa seems to have been no smaller than at current prices.⁵ In the land-scarce developing countries of Asia, changes in the manufacturing share were more strongly positive at constant prices.

Manufacturing's share of employment fell substantially during 1985–2014 in both OECD regions (table 4, last two columns). It fell by even more in the FSS region, as a result of the large drop in manufacturing's output share, combined with job-shedding in formerly state-owned enterprises.

In all the land-scarce developing regions, manufacturing employment shares rose, except for formal manufacturing in India, which stagnated because of a shift away from labor-intensive activities (Sen and Das 2015). The largest share increase was for formal manufacturing in China, despite state enterprise job-shedding (though estimates of manufacturing employment in China vary widely: see the statistical appendix of Wood 2017).

All three land-abundant developing regions experienced “employment deindustrialization”, apart from a questionable rise in the all-manufacturing share in Sub-Saharan Africa.⁶ The fall in the manufacturing employment share in Latin America is much smaller than the fall in its manufacturing output share because job losses in import-competing sectors that shrank were offset by growth of labor-intensive manufactured exports from countries close to the United States, especially Mexico.⁷

Across countries, after controlling for education and size, changes in manufacturing's share of employment, as of GDP, were unrelated to land abundance (see table 7 in Wood 2017). This is again partly because of slower growth of the service sector share in more land-abundant countries (table 2), but also because there was hardly any relationship between land abundance and changes in manufacturing's share of goods employment, as a result of increases in its relative labor intensity in more land-abundant countries (table 1).

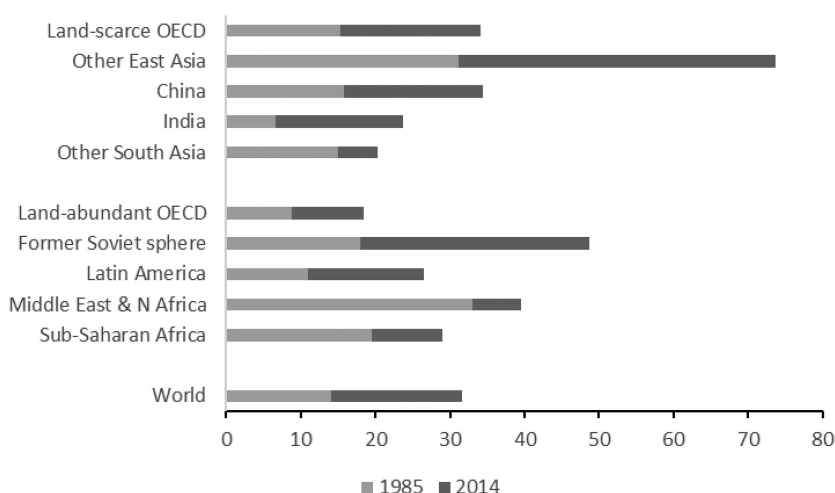
Table 4 shows that world employment deindustrialized slightly between 1985 and 2015, but that both the formal and the all-manufacturing employment shares rose in developing countries as a whole (as first reported by Haraguchi 2014). There was a massive reallocation among regions, especially of formal employment in manufacturing, whose global total in 2014 was about 225 million workers, up by 50 million since 1985. The OECD's share fell by 15 percentage points, and that of the FSS by 18 points. East Asia's share rose by 25 points (four-fifths of it in China) and South Asia's rose by 4 points. More surprisingly, the combined share of the three land-abundant developing regions also rose (by 4 points).

What Drove Structural Change?

In short, the main feature of the global pattern of structural change between 1985 and 2014 is that the changes in manufacturing shares of exports, output and employment in table 4 were almost all negative in land-abundant regions and almost all positive in land-scarce regions. The only big exceptions were the falls in manufacturing's shares of GDP and employment in the land-scarce OECD, reflecting the drop in the relative price of manufactures and the shift in developed countries from labor-intensive to skill-intensive manufacturing activities.

The two land-scarce regions with the largest rises in the employment share of manufacturing (China and Other South Asia) were also the ones with the largest rises in manufactured export shares. In Latin America, similarly, despite a big fall in the manufacturing output share, neither manufacturing's share of employment nor its share of exports declined much because of rising labor-intensive manufactured exports to the United States. Manufacturing employment shares in Sub-Saharan Africa and MENA declined even less, despite big falls in manufactured export shares, but only because there was so little manufacturing employment initially (Diao, McMillan, and Wangwe 2018).

In seeking to explain this pattern of variation, this section focuses on the goods sectors (rises in service sector shares were common to most countries and regions: table 3). As was shown earlier, variation in sectoral structure is strongly related to variation in endowments, but the variation in structural change between 1985 and 2015 was not driven by variation in endowment changes, which were small at the

Figure 6. Trade Share of GDP at Constant Prices, 1985 and 2014 (%)

Source: Data mainly taken from UN National Accounts Main Aggregates database, at 2005 prices and exchange rates.
 Note: "Trade share" is the mean of shares for exports and imports (which include both goods and services). Exports and imports include intra-regional trade (except for China, India, and in 1985 much of the former Soviet sphere).

regional level (figure 2) and have no explanatory power in cross-country regressions. The main explanation seems to have been globalization.

Figure 6 shows regional trade/GDP ratios at the start and end of the period, including services as well as goods, and measured at constant prices. Levels are not comparable across regions because intra-regional trade is included and thus the ratio varies with the number of countries. For the world as a whole, the trade ratio doubled. It also rose in every region (though the large rise in FSS partly reflects the inclusion of intra-regional trade in 2015 but not in 1985). Policy barriers to trade likewise fell on average in all regions and in four-fifths of all countries.⁸

A standard Heckscher-Ohlin interpretation would be that reduced barriers to trade caused the sectoral structures of countries to become more closely aligned with their resource endowments, and in important respects the evidence fits this interpretation. Most countries became more open to trade, land-abundant countries became more specialized in primary products relative to manufactures, and skill-abundant countries became more specialized in skill-intensive sorts of manufacturing. The reduction of barriers to trade, however, cannot be the whole story, since the regressions in table 1 imply that the changes in sectoral structure partly reflect shifts in the underlying relationships between structure and endowments.⁹

In the land/labor dimension, the negative coefficients on land per worker in the manufactured/primary export and output (though not employment) regressions are larger in 2014 than in 1985, and the fit improves only for the export regression. The

rises in manufacturing shares in land-scarce regions and the falls in land-abundant regions thus did not arise just from reduced discrepancies between actual and predicted outcomes, but also from changes in the predicted outcomes.

A more negative land-per-worker coefficient would be expected from reduction of the average level of trade barriers, which brings sectoral structure closer to comparative advantage and thus tends to raise manufactured/primary ratios in land-scarce countries and to reduce them in land-abundant countries. However, if changes in policy barriers to trade are controlled for in the export and output change regressions in panels A and C of [table 1](#), the size of the coefficient on land per worker is reduced by only about one-quarter.¹⁰ Most of the decrease in this coefficient thus appears to reflect a shift in the comparative advantage of land-scarce relative to land-abundant countries.

In the skill/labor dimension, the consistently higher coefficients on schooling in the 2014 than in the 1985 regressions in [table 1](#) partly reflect a spurious improvement in the educational levels of poorer countries. However, the 1985-to-2014 rise in this coefficient is particularly large in the skill-intensive/labor-intensive manufactured export regression, and controlling for changes in policy barriers hardly alters this coefficient in the corresponding structural change regression, both of which imply a strengthening of the comparative advantage of skill-abundant countries in more skill-intensive manufacturing.¹¹ This implication is supported by the emergence over the period of an inverse-U-shaped relationship across countries between level of schooling and the relative labor intensity of manufacturing (not reported in the table).

These results suggest that the shifts in sectoral structure between 1985 and 2015 were driven not only by falls in trade costs, but also by international transfers of technology. More specifically, the pattern of change suggests that labor-intensive manufacturing know-how flowed from skill-abundant developed countries to skill-scarce developing countries and within the latter group to countries that were also land-scarce, whose endowment mix offered the best prospects for profitable use of this know-how in exporting to the world market.¹² A transfer of this nature could explain both why comparative advantage in manufacturing shifted further towards land-scarce countries and why comparative advantage in less-skill-intensive manufacturing shifted further towards skill-scarce countries.

Also consistent with such a technology transfer is the rise in the manufacturing-to-primary-sector labor productivity (*i.e.*, output per worker) ratio in land-scarce countries relative to land-abundant countries.¹³ Since output is measured by value added, this shift reflects a relative increase in some combination of skill per worker, capital per worker, and returns to skill and capital in manufacturing, as expected from the introduction of better technology. The technology-transfer hypothesis also fits with [Rodrik's \(2013\)](#) finding of unconditional convergence in formal-sector manufacturing labor productivity.

The driver of this technology transfer can be summarized as a reduction of “co-operation costs”.¹⁴ Falls in the cost of business travel and communication and improved management systems, assisted by new information technology (Baldwin 2016), have enabled highly-skilled workers in developed countries to co-operate more extensively and effectively with workers in developing countries. Some of the increase in co-operation was within growing multinational companies, but much was in the form of contractual relationships among independent firms linked together in an ever-expanding network of global value chains and by a large increase in trade in parts and components (WTO 2014).

Exactly what happened varied among countries and regions, depending on the initial levels of their trade costs and co-operation costs and on how much each of these sorts of costs declined (possible combinations of levels and changes are analyzed in Wood 2002). Some skill-scarce and land-scarce countries were excluded from the technology transfer by, for example, a lack of infrastructure, weak institutions, political instability, or civil war. Structural change also varied for reasons unrelated to trade costs or co-operation costs, which would need to be taken into account in analyzing the experiences of particular countries or regions.

How much of the “worldwide” pattern is attributable to China? This one country accounted for 70% of the rise in the developing-country share of global manufacturing output and for 60% of the rise in the developing-country share of formal manufacturing employment. Omitting China also significantly affects the changes in the sectoral structure of developing countries in aggregate (table 4, bottom two rows): the share of manufacturing in GDP falls by 3 percentage points during 1985–2015, rather than staying constant; and the share of formal manufacturing in employment remains constant, rather than rising by 2 points. The cross-country regression results, however, are almost unaffected by the omission of China.

China’s contribution did not merely add to global totals: structural change in other countries over this period would have been different if it had remained a closed non-market economy. Because of its vast size, China’s opening to trade effectively lowered the global land/labor ratio and raised the share of workers with a basic education in the global labor force, shifting the comparative advantage of other developing countries from manufacturing to primary production, though in most cases not by much (Wood and Mayer 2011). Had China remained closed, in short, other developing countries would have become more industrialized.

What Happened to Factor Prices?

Heckscher-Ohlin theory makes predictions about the effects of globalization not only on sectoral structure but also on factor (or resource) prices. A proper analysis lies beyond the scope of this article, but a brief look at factor price movements is worthwhile, partly as a check on the preceding explanation of structural change (since, in

theory, quantity and price movements are related) and partly because of their social and political significance.

The standard Heckscher-Ohlin prediction is that a reduction of barriers to trade benefits a country's abundant factors and hurts its scarce factors. Thus, land rents should have risen relative to wages in land-abundant countries and fallen in land-scarce ones, while skilled workers should have gained relative to unskilled workers in skill-abundant countries and lost in skill-scarce ones. A lack of data on land rents makes it impossible to assess the accuracy of the first of these predictions. Comparable data on wages across countries and periods are also scarce, but there are enough for an assessment of the second prediction.

In the skill-abundant OECD countries between 1985 and 2015, as predicted, skilled workers usually gained relative to unskilled workers, though there is dispute over the size of the contribution of globalization (Wood 2018). In other regions, outcomes varied among countries and periods, but again the skilled usually gained relative to the unskilled (Helpman 2017; Pavcnik 2017; Silva and Messina 2017), counter to the standard prediction, though not necessarily counter to Heckscher-Ohlin theory. For some developing (as well as FSS) countries, a rise in the relative skilled wage could be explained in Heckscher-Ohlin terms by their above-world-average skill abundance, which put them in the same situation as the OECD countries.

In land-scarce developing countries, a rise in the relative skilled wage could also be explained in Heckscher-Ohlin terms by the fact that manufacturing is more skill-intensive than primary production, so that the rise in manufacturing relative to primary output as a result of a reduction of trade barriers tended to increase the relative demand for skilled workers.¹⁵ This effect was probably largest for the wages of workers with a basic education, who are the core of the labor force in formal labor-intensive manufacturing, relative to less-educated workers in peasant agriculture.

Within the manufacturing sectors of land-scarce developing countries, however, it was the less skill-intensive segments that grew most because of the greater specialization resulting from lower trade barriers and because the transfer of know-how was concentrated on these segments. This structural shift within manufacturing tended to lower the relative wage of skilled workers (the standard Heckscher-Ohlin prediction), though this tendency was offset by the know-how transfer often apparently increasing the skill intensity of these less skill-intensive segments. The transfer also generated huge gains for workers and firms with the relevant know-how, especially in OECD countries (Anderson, Tang, and Wood 2006; Wood 2018).

Globalization thus pulled the relative wages of skilled and unskilled workers different ways in different developing countries (Wood 2002), with the outcome depending on other forces as well, including labor market institutions. Of most practical significance, however, was the relative wage change most clearly consistent with Heckscher-Ohlin theory: the worsening economic situation of less-skilled workers in developed countries was neglected by their governments and eventually contributed to a political backlash against globalization (Wood 2018).

Prospects and Policy Options

Between 1985 and 2015, endowment-related sectoral specialization was intensified by globalization—reduction of international trade and co-operation costs. Developed-country manufacturing became more skill-intensive. Developing countries in total became more industrialized and increased their share of world manufacturing, but this progress was concentrated in land-scarce East Asia and above all China. In land-abundant developing regions, industrialization stagnated or declined, and in land-scarce South Asia industrialization was held back by low literacy and weak infrastructure.

Will this Pattern of Structural Change Continue?

In Heckscher-Ohlin theory, a change in the height of trade barriers should shift the world economy from one structural equilibrium to another. The halt since 2011 in the upward trend of the world ratio of trade to GDP after 1985 (following a decade of stagnation: [WTO 2015, 2017](#)) might thus mean that global adjustment to the falls in barriers during this period has been completed.

The political backlash against globalization could even reverse the falls in policy barriers (as happened after the first wave of globalization in the 19th century: [Williamson 1998](#)). Non-policy barriers, however, will continue to fall as a result of improved infrastructure, especially in developing countries, and of transport and communications innovations, which will also make more services tradable ([Baldwin 2019](#)). Sectoral structures will continue to be related to endowments, and on balance are likely to move further in this direction, though perhaps not soon.

The sectoral and product details of endowment-based specialization will inevitably change, due not least to robotization ([Mayer 2018](#)). Like most other machines, robots will be available to all countries at much the same price and in themselves cannot give a country an advantage over any other country. Robots could, however, alter the global pattern of comparative advantage by altering the relative immobile-resource intensities of goods. For example, if skilled workers with robots could make shoes more efficiently than unskilled workers, shoe production would shift from skill-scarce to skill-abundant countries.

The global pattern of comparative advantage will also evolve because of changes in relative resource endowments, slowly for regions but faster for countries. Of particular importance over the next decade will be a rise in the relative skill abundance of China, following the upward move of South Korea and Taiwan province over the past couple of decades. The composition of China's manufacturing will thus shift away from labor-intensive goods and activities and into more skill-intensive ones, as has already started to happen.

This structural shift will bring China into competition with the OECD countries (which are already specialized in skill-intensive manufacturing) and tend to

lower the world prices of skill-intensive manufactures relative to labor-intensive manufactures—a reversal of the 1985–2015 trend (Fu, Kaplinsky, and Zhang 2012). Such a change in relative prices would lower the wages of the mainly skilled OECD workforce (and the wages of skilled workers relative to unskilled workers in all countries). This price shift and the associated shrinkage of manufacturing output in OECD countries, however, will be mitigated or perhaps even reversed by increased demand for skill-intensive goods as incomes rise (Caron, Fally, and Markusen 2014).

Other land-scarce developing countries will occupy the labor-intensive manufacturing space vacated by China (Wood and Mayer 2011). Their sectoral shares of manufacturing will rise, relative to those of primary activities, for both output and employment, particularly formal employment (and if the relative world price of labor-intensive manufactures rises, so will the relative wages of their unskilled workers). It remains to be seen whether India's push to make up for lost time in basic education, infrastructure, and other policies (Wood and Calandrino 2000) will enable it to take over most of China's former manufacturing, or whether most will go to other countries, probably mainly in South Asia and East Asia, but also in some land-scarce parts of Sub-Saharan Africa (Gelb et al. 2017).

Slower population growth in richer than in poorer countries will continue to bring their land-to-labor ratios closer together (figure 2), and by 2100 the huge gap in this ratio between Africa and Asia is projected to fall by two-thirds (see table 1 in UN 2015). Nonetheless, variation among countries in land/labor ratios will remain a basic feature of the world economy, as it has been for the past millennium (see table 2 in Wood 2003), and so too will the consequent differences in sectoral structure between land-scarce and land-abundant countries documented in this article.

Land-scarce and land-abundant countries tend to follow different development paths as they accumulate skills and capital (Chenery and Syrquin 1975; Wood 2003). In particular, a land-scarce country that is open to trade will go through a phase of specialization in labor-intensive manufactures, while a land-abundant one will remain an exporter mainly of primary products until its skill-per-worker endowment ratio has risen to a level where its comparative advantage within manufacturing is in skill-intensive goods. Before then, it may export processed primary products, but only if the processing is of low skill intensity (Owens and Wood 1997).

Does This Pattern of Structural Change Matter?

The accepted view since Kuznets (1966) of a strong association in the course of economic development between growth of per capita income and changes in sectoral structure recognizes that causation can occur in both directions—or in neither direction (Chenery and Syrquin 1975). Rising per capita income, for example, shifts the composition of domestic demand away from agriculture and later towards services, while a rising share of investment in GDP both alters the sectoral composition of demand and raises per capita income.

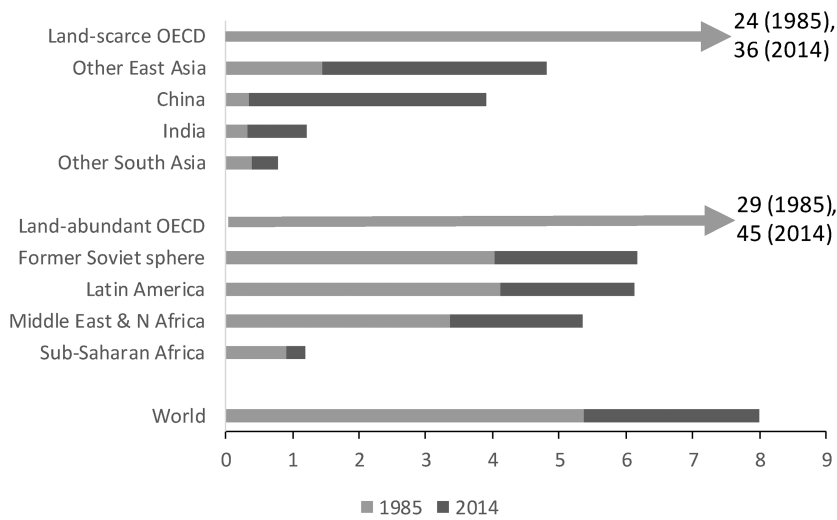
From [Singer \(1950\)](#) and [Lewis \(1954\)](#) to [Lin \(2013\)](#), however, most attention has been given to the causal contribution of structural change to growth. This contribution might occur through the transfer of labor from low-productivity agriculture to higher-productivity manufacturing and services (though the effect on total output may be limited because agricultural workers are less skilled: [Herrendorf and Schoellman 2018](#)), or through transfers within these broad sectors (though changes in employment structure do not always add to growth: [McMillan, Rodrik, and Verduzco-Gallo 2014](#), [McMillan, Rodrik, and Sepulveda 2017](#); [Diao, McMillan, and Rodrik 2017](#)). Manufacturing is also argued (especially by Kaldor and his followers, e.g., [Haraguchi, Cheng, and Smeets 2017](#)) to be a particularly powerful engine of growth because of its economies of scale, inter-sectoral linkages, rapid technical progress, and potential for learning.

An overlapping concern is that land-abundant countries are developmentally disadvantaged by a “resource curse”. Various mechanisms have been proposed ([Smith 2015](#); [Venables 2016](#)), some of them limited to the adverse effects of high-value minerals on the quality of governance. But as originally identified empirically by [Sachs and Warner \(1995\)](#), the curse is associated with high dependence on all primary sectors, including agriculture, and connects directly with the literature on structural change and growth. Of particular relevance are theoretical models (including [Matsuyama 1992](#) and [Redding 1999](#)) that show how exposure to trade might cause countries with a comparative advantage in primary sectors (a) to produce fewer manufactures, and thus (b) to grow less rapidly.

The evidence in this article strongly supports causal link (a): land-abundant countries tend to produce fewer manufactures than land-scarce countries, and this difference in sectoral structure has been amplified by globalization and the associated increase in trade. What does the evidence suggest about causal link (b)? Are land-abundant countries really poorer, and was their growth slowed by the effects of globalization on their sectoral structures?

The per capita GDP averages in [figure 7](#) conflict with the resource curse hypothesis inasmuch as they show that both in 1985 and in 2014 the world’s richest region was a land-abundant one and that the land-abundant Latin American and Middle Eastern developing regions were richer than all the land-scarce developing regions. The figure also shows, however, that between 1985 and 2014, faster per capita GDP growth in land-scarce than in land-abundant developing regions narrowed the gap between the two groups (and brought all the land-scarce ones proportionally closer to the world’s richest region, the land-abundant OECD, which did not happen for any land-abundant developing region). Pulling the other way, rapid growth in Asia contributed to a rise in the relative world price of primary products, which benefited land-abundant regions through an improvement in their terms of trade not reflected in these data.

Figure 7. GDP Per Capita, 1985 and 2014 (Thousands of 2005 U.S. Dollars at Official Exchange Rates)



Source: Derived from data from UN National Accounts Main Aggregates database.
Note: Horizontal axis measures GDP per capita (in thousands of dollars), scaled for clear comparisons among developing regions. GDP per capita levels in OECD regions are way off the scale and are indicated by the numbers at the ends of the arrows.

Cross-country regressions confirm that per capita GDP growth rates in developing countries between 1985 and 2014 were inversely related to land abundance. These regressions also show that land-abundant countries tend to be poorer than land-scarce countries: the simple cross-country elasticity of per capita GDP with respect to land area per adult is about -0.2 , and statistically significant, in both 1985 and 2014.¹⁶ This relationship between income level and land abundance disappears, however, after controlling for average years of schooling, which suggests that land-abundant countries are poorer simply because they are less well educated (Gylfason 2001). A likely cause is that their specialization in primary sectors, which are less skill-intensive than manufacturing, reduces the demand for education (Blanchard and Olney 2017). This link may help to explain why the quality of governance—which includes the supply of schooling—seems to matter more for successful development in land-abundant countries than in land-scarce ones (Mehlum, Moene, and Torvik 2006; Cabrales and Hauk 2011).

It is not easy to disentangle what caused land-scarce developing countries to grow faster than land-abundant ones during the 1985 to 2015 period of globalization. There is no evidence in the cross-country data of faster growth of schooling in land-scarce than in land-abundant countries in this period. Part of the explanation

may have been more movement of workers from lower-productivity agriculture to higher-productivity manufacturing, but the evidence reviewed above suggests that a more important contributor was the transfer of manufacturing technology from developed to land-scarce developing countries, which increased productivity and stimulated investment.

It is also hard to assess the long-term implications of this phase of faster growth in land-scarce developing countries. For example, the transfer of manufacturing technology to them may have been a much-delayed but one-shot equivalent to the colonial transfer of mining and agricultural technology to land-abundant countries (of which the ones with climates suitable for European settlement also acquired manufacturing technology: [Wood and Jordan 2000](#)). Perhaps land-abundant developing countries will finish up, like today's land-abundant developed countries, mostly richer than their land-scarce contemporaries, especially if robotization has made labor a less valuable resource, but some could finish up much less rich if their governance continues to be corrupted by high-value minerals.¹⁷

There is more than one road to successful development, and most developing countries are still at relatively early points on their respective roads. As [figure 7](#) shows, the average incomes of both land-abundant and land-scarce developing countries remain far below the incomes of their OECD counterparts, and attaining developed-country income levels would require both groups to improve in many of the same respects. Even in the field of trade policy, best practice is much the same: reduce infrastructural and other non-policy barriers, assist exporters, avoid grossly distorting policy barriers, use sectoral industrial policies with extreme caution, and be alert to distributional effects, especially on poor people.

Some of the specifics of development policy, however, do differ between these two groups of countries ([Wood 2003](#)). Land-abundant countries need to make more supply-side efforts to increase schooling than land-scarce countries. They also need more infrastructure per person because of their lower population density. Their training and research should be more natural-resource-oriented, and they need to pay greater attention to reducing inequalities in the ownership of land and other assets. In all these respects, as well as in the areas where their priorities overlap, intelligent support from the international community can help both groups of countries.

Notes

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1. This idea was later formalized in ways that some people find implausible and failed some early econometric tests. More recent and better-specified tests, however, have confirmed its empirical relevance. For a review, see [Wood \(2009\)](#), as well as [Romalis \(2004\)](#) and [Chor \(2010\)](#).

2. The results are similar if processed primary products are put in the primary rather than the manufactured category, as in SITC trade statistics, except that the coefficient on the land variable is (absolutely) larger.

3. That manufacturing uses less land than primary production is obvious for agriculture. Mines usually occupy small areas of land, but they depend on the existence of large mineral reserves; the land area of the country concerned is a proxy for the probability of having such reserves.

4. The statistical appendix of [Wood \(2017\)](#) shows that by 2000 in 14 European countries the educational level of “skill-intensive” manufacturing sectors was equal to or lower than that of “labor-intensive” sectors. [Table 3](#) of [Wood \(2017\)](#) also shows that between 1985 and 2014 the “skill-intensive” share of SITC manufactured exports rose in every region except “Other South Asia”.

5. These statements are based on roughly comparable regional averages from World Development Indicators and the UN National Accounts Main Aggregates database.

6. Consistent with [Diao, McMillan, and Wangwe \(2018\)](#), but questionable because the direction of the change depends on which source of data is used ([Wood 2017](#); see note 24).

7. Mexico’s share of Latin America’s manufactured exports increased between 1985 and 2014 by 16 percentage points, to 52%. Mexico’s formal manufacturing employment rose, too, as a share both of the Latin American total and of all employment in Mexico.

8. This statement is based on the de jure trade globalization index in [Gygli, Haelg, and Sturm \(2018\)](#), available in 1985 and 2014 for all but five of the countries in this article’s dataset, with regional averages weighted by 1985 country populations. The unweighted mean value of this index for the world as a whole rose from 0.43 to 0.57, though its standard deviation across countries hardly altered.

9. [McCaig and Pavcnik \(2018\)](#) summarize earlier evidence of limited response of sectoral structure to reductions in import tariffs and find a similarly limited response to the reduction of tariffs in export markets, though with a larger response in the formal enterprise sector.

10. The policy barrier measure is the de jure trade globalization index in [Gygli, Haelg, and Sturm \(2018\)](#). The difference between 1985 and 2014 values of this index for each country is added to the regressions in [table 1](#), both on its own and interacted with the skill, land, and country size variables. The land-per-worker coefficient, which then refers to the outcome in a country with no change in policy barriers, changes from -0.27 to -0.20 in the export regression (third row of panel A) and from -0.23 to -0.18 in the output regression (third row of panel C).

11. The policy barrier control experiment is as described in the previous note: the coefficient on average years of schooling in the third row of panel C changes from 0.68 to 0.72.

12. The outcomes are consistent with Northern know-how having simply been transferred unchanged, though [Acemoglu, Gancia, and Zilibotti \(2015\)](#) argue that offshoring may have induced changes in the technology.

13. This change in relative productivity (output/employment) is implied by the positive coefficient on land per worker in the labor intensity (employment/output) regressions in panels D1 and D2 of [table 1](#).

14. The phrase “co-operation costs” was coined by [Anderson, Tang, and Wood \(2006\)](#). [Baldwin and Robert-Nicoud \(2014\)](#) equivalently use the phrase “coordination costs”.

15. “More skill-intensive” here means a higher skill-to-labor ratio, as implied by the positive coefficients on years of schooling in the relevant regressions in [table 1](#). Manufacturing also has a higher skill-to-land ratio, as implied by the upward slopes in [figures 3](#) and [5](#).

16. This relationship explains very little of the variance of per capita income, but it is robust to the exclusion of countries with unusually high and unusually low land area per adult. The regional weighted

averages in figure 7 suggest the opposite relationship partly because richer land-scarce countries tend to be smaller, while richer land-abundant countries tend to be bigger.

17. I owe the point about robotization to Doug Gollin.

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