CHAPTER 3

Competing with Giants: Who Wins, Who Loses?

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The rapid growth of China and India in recent years has raised many questions about the implications for the world economy. Will most countries gain? Or will the outcome be brutal competition in a narrow range of products and consequent declines in the prices of developing country exports that impoverish not just India and China, but other developing countries? If some countries lose from increased competition, as found by Freund and Ozden (2006) and Hanson and Robertson (2006), which countries and which products will face the most serious competition. And finally, will the industrial countries face ever-more-sophisticated exports from China and India destroying the jobs of skilled workers in today's advanced industrial countries? Or will the benefits of lower prices from China and India allow real incomes in industrial countries to continue to rise strongly?

Are the pessimists right? While it is certainly the case that rapid increases in exports of any given product must be accommodated by a decline in its price, three recent developments have the potential to at least attenuate these stark scenarios of relentless competition. One is the rise of two-way trade in manufactures, which makes the recipient countries the beneficiaries of improvements in efficiency in their trading partners (Martin 1993). Another is the growth of global production sharing, where part of the production process is undertaken in one economy, and subsequent stages are undertaken in another (Ando and Kimura 2003). This process, fuelled by improvements in transport and trade facilitation, and in communications, and frequently involving foreign direct investment linkages, makes participants in this process beneficiaries from, rather than victims of, improvements in the competitiveness of their partners. A third is recognition that trade expansion does not typically involve mere increases in the volumes of exports of products currently exported to existing markets. Rather, developing countries typically expand the range of products they export, improve product quality, and export to additional markets as their exports grow (Evenett and Venables 2002; Hummels and Klenow 2005).

All of these developments have potentially major implications for the growth prospects of China and India, and for the rest of the world. The share of developing-country manufactured exports going to other developing countries has risen in recent years, making developing countries potentially major gainers from improvements in the economic performance of other developing countries. The explosive growth of production sharing in East Asia has meant that many of these economies gained from trade liberalization associated with China's accession to the WTO (Ianchovichina and Martin 2004), despite increased competition in third markets.

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Another factor that is likely to make the implications of export expansion from large developing countries like China and India more favorable for each other, and for other developing countries, is the fact that such export expansion seems to involve sharp increases in the range of products produced and in the quality of those goods. Hummels and Klenow (2005) find that two-thirds of the growth of exports comes from expansion in the number of products produced, rather than from expansion in the volumes of existing products exported. Where consumers prefer variety in the goods that they consume or use as intermediate inputs, this has the effect of lowering the effective price of these goods. Whether these forces are sufficient to attenuate or reverse the price-depressing impacts of increased exports is, however, ultimately an empirical question whose answer depends on the way on which the growth of China and India evolves.

Much can be learned by examining developments in the trading patterns of these countries. While, it turns out, both have been quite successful in expanding their exports and imports, they have done this in *very* different ways. Broadly, China has relied primarily on exports of manufactures, frequently as part of an East Asian production sharing network. By contrast, India has concentrated more heavily on services. Within manufactures, China has relied heavily on exports of finished goods, while India has focused much more on exports of intermediate inputs. India's exports include a number of capital and skill-intensive goods, while China has emphasized exports of labor-intensive goods—although these are increasingly sophisticated and their capital intensity is rising (Rodrik 2006). If, as assumed by Kochhar, Kumar, Rajan, Subramanian and Tokatlidis (2005), the past is a good guide to the pattern of development, the prospect of head-on competition would seem less likely than might be suggested by a simple, aggregate view of competition between labor-intensive exporters of standardized manufactures.

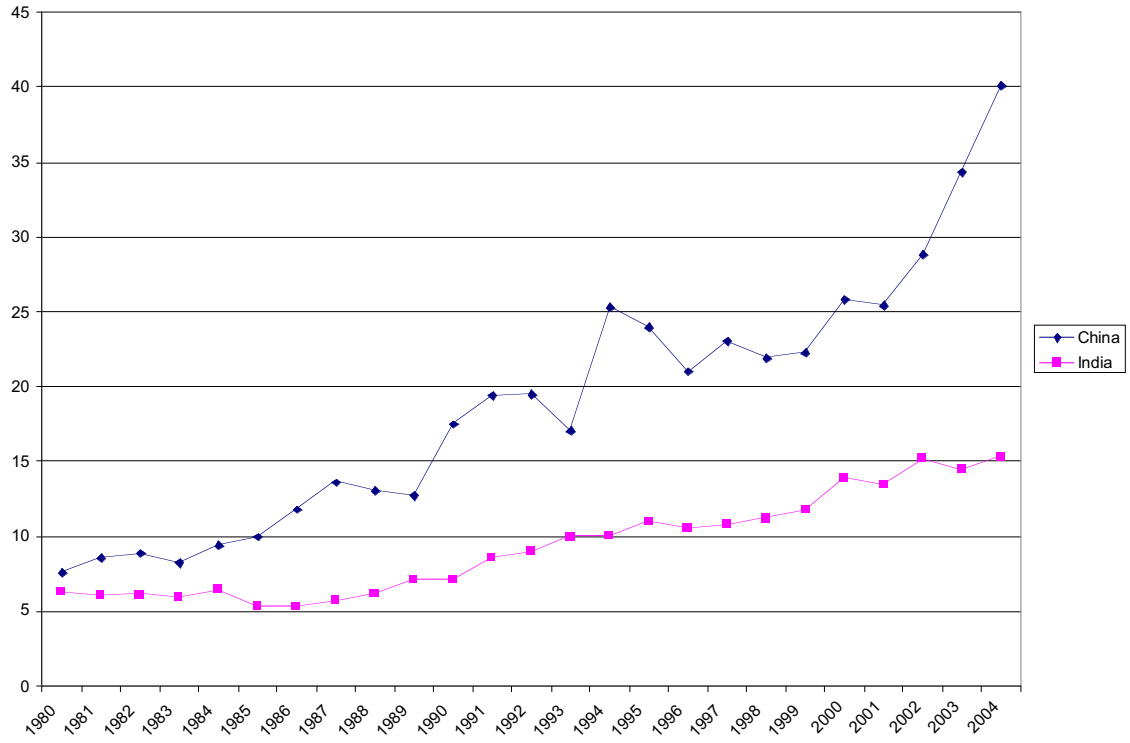
However, there have been major, recent reforms in both China and India whose impact may not have been fully felt yet. India appears to be moving towards much deeper integration into systems of global production sharing—partly by following China's earlier pattern of using duty exemptions and free trade areas for the production of exports, and partly by reducing protection in a manner more consistent with China's broader trade liberalization. It seems important to take into account these changes, which may require adjustments by (as well as creating opportunities for) other developing countries.

No analysis of potential future developments can reliably be undertaken without an examination of the key features of the current situation, and how it arose. Therefore, this chapter first reviews some key features of the trade of China and India, in particular, the recent rapid growth of exports; the changing relative importance of goods and services; and changes in the composition of exports within merchandise and services. With this as background, a global economy-wide modeling approach is then used to take into account all of the potential impacts, and to complement the industry-focused studies presented in Chapter 2. First, the implications of the reforms under way in India are examined to see if they might result in greater competition between China and India. Then, model-based simulations are used to generate a baseline for growth, and to examine the potential implications of higher-than-expected growth rates in these two economies. From this baseline, we consider first the impact of more rapid economy-wide growth in China and India. We then examine the implications of two different types of growth, first growth focused on the relatively sophisticated products discussed in Chapter 2 and subsequently growth driven by increased accumulation of physical and human capital. A brief survey of recent trade policy reforms is provided in the Appendix, which is available at http://econ.worldbank.org/dancingwithgiants.

Developments in Trade

Both China and India have grown relatively rapidly in recent years, and, in both, the importance of trade has risen substantially relative to GDP. As is evident from figure 3.1, both of these

Figure 3.1 Exports of Goods and Nonfactor Services as a Share of GDP
percent



Source: World Bank, *World Development Indicators* database.

large, low-income countries had very low export to GDP ratios around 1980, when the process of reform was beginning in China. From the mid-1990s, as the export processing arrangements were broadened beyond the initial special economic zones in China,[1] the share of exports in China's GDP began to climb sharply. With the sharp devaluation of the official exchange rate in 1994, the share of exports in GDP rose, but then stabilized or declined in the mid-1990s. From 2001 to 2004, China's export share rose dramatically, to around 40 percent, over two and a half times

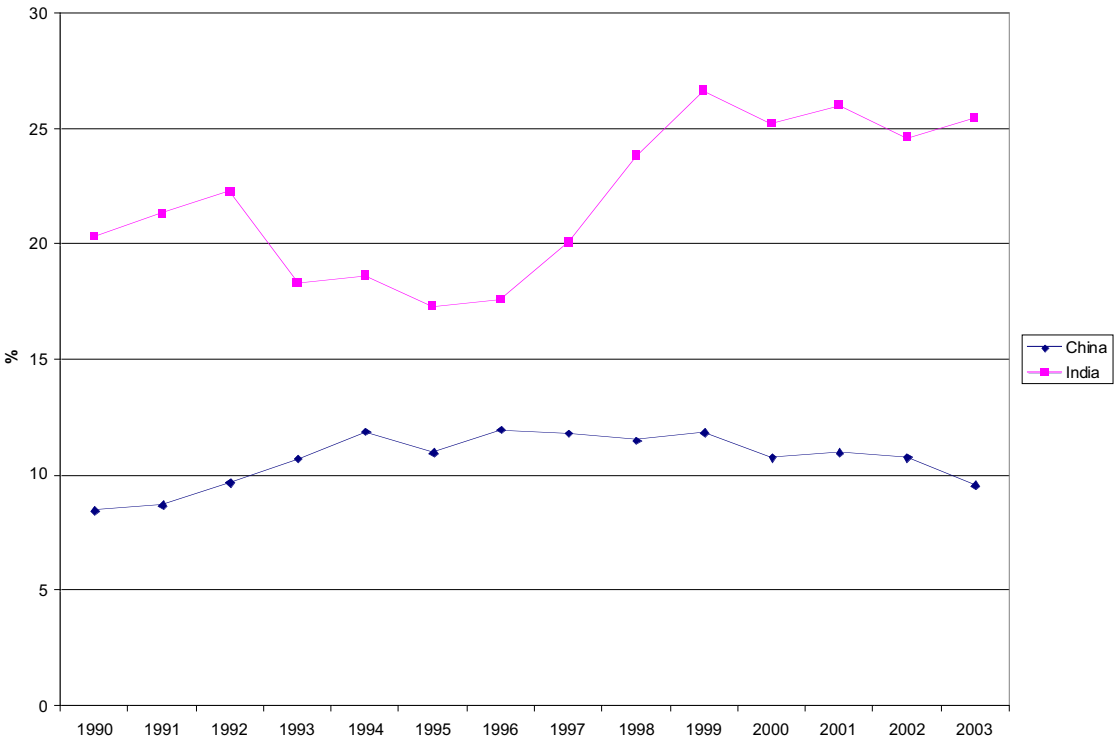
[1] The export processing arrangements included duty exemptions on imports used for the production of exports. These exemptions were offered to foreign invested enterprises that initially were located in special economic zones in the southern coastal regions of China, but were subsequently broadened to a wide range of enterprises (World Bank 1994) which typically did not receive the economically questionable and (now WTO-inconsistent) income-tax concessions traditionally available in the zones.

India's export share. Even the upward revision to GDP of 17 percent in 2004 (see World Bank Office, Beijing 2006) leaves China's export share at 31 percent, more than double India's level.

Exports of Services

A striking difference between China and India is in the relative importance of services relative to merchandise exports. Figure 3.2 shows the share of commercial services in total goods and services exports has been much higher in India than in China, not just since the rapid expansion of exports of computing services around 2000, but for the entire period since 1992 during which comparable estimates are available. The share of services in India's exports began, at around 20 percent, over twice as high as China's. This share declined in India until the late 1990s, when it again began to rise sharply. Since 2000, services have accounted for over a quarter of India's exports, while the share of services in China's exports has declined to under ten percent of total exports—although China's exports of services have been growing rapidly in absolute terms.

Figure 3.2 Share of Commercial Services in Total Exports
percent



There have also been contrasting patterns within exports of services. As is evident from figure 3.3(a), the composition of China's exports of services has changed significantly, with a decline in the relative importance of transport services, and a substantial increase in the importance of travel services (including tourism) to around 50 percent in 2002, although this share appears to have declined in 2003. The importance of communication and computing

Figure 3.3a Composition of Services' Exports, China

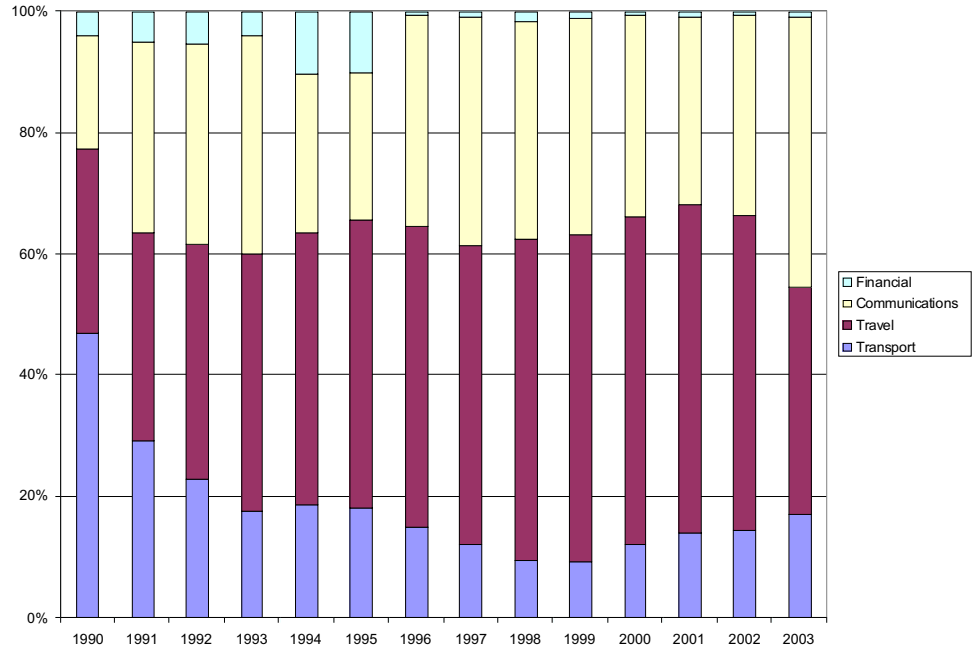
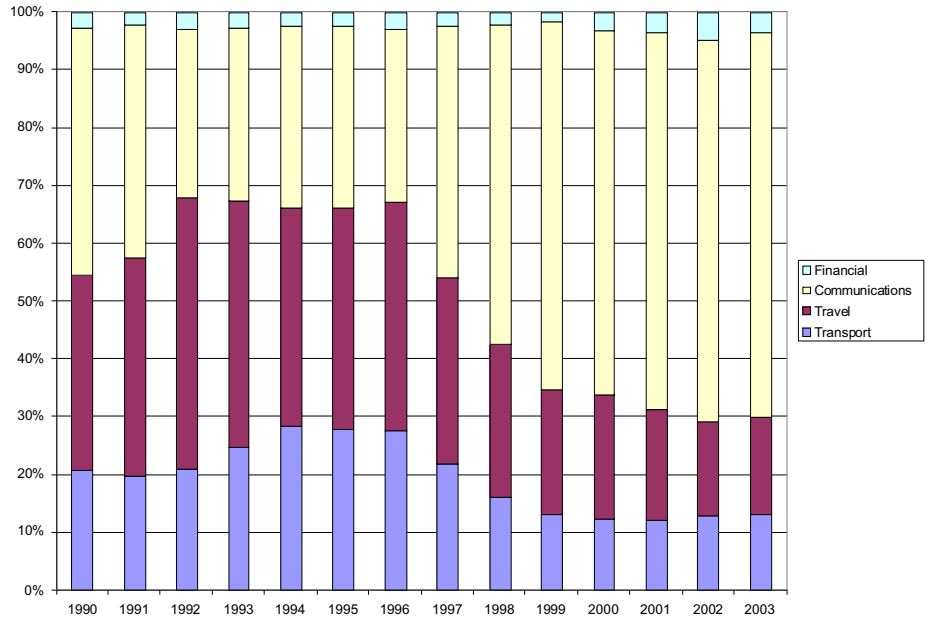


Figure 3.3b Composition of Services' Exports, India



services rose to nearly 45 percent in 2003. Exports of financial services provided only a small, and declining, share of China's total exports of commercial services.

India's services exports have shown remarkable dynamism (Mattoo, Mishra and Shingal 2004). The main development evident in our data was a dramatic increase in the importance of communications and computing services, from around 40 percent in 1990, to roughly two-thirds in recent years. Mattoo, Mishra and Shingal point out that this rise in importance was associated with a rapid increase in activities such as Business Process Outsourcing as well as computing services. However, Nikomborirak (2006) shows an explosive growth rate in software services, with these exports growing twelve-fold between 1997 and 2003. The importance of both transport and travel services declined relative to the extremely dynamic communications and computing services. Figure 3.3(b) shows that financial services were also a small but stable share of services' exports, at around 3 percent of the total.

Merchandise Trade

The merchandise exports of both China and India are now dominated by manufactures (World Bank 2003). However, the composition of these manufactures and the approach to their production appears to differ considerably. Table 3.1 presents information on export and import patterns for each country using data on stage of production from the United Nations' Broad Economic Classification (BEC) system. Because of the very different importance of fuel imports and exports to the two countries, these data are presented only for non-fuel products.

Table 3.1 Composition of Nonfuel Imports and Exports by Broad Economic Classification

	China imports	China Exports	India imports	India Exports
2004				
Fuel Primary				
Fuel Processed				
Nonfuel Primary Inputs	10	1	16	8
Intermediate inputs	63	38	60	52
Final Goods	28	61	25	40
Total	100	100	100	100
Parts/components	*31*	*17*	*12*	*6*
1992				
Fuel Primary				
Fuel Processed				
Nonfuel Primary Inputs	8	6	30	6
Intermediate inputs	61	30	55	47
Final Goods	31	65	15	47
Total	100	100	100	100
Parts/components	*15*	*5*	*15*	*5*

Source: U.N. COMTRADE statistics from the World Bank WITS system.

If we look first at the import data for 2004, we find that sixty-three percent of China's nonfuel imports are of manufactured intermediate inputs, while these account for sixty percent of India's imports. Only when we consider imports of parts and components do we see the sharp distinction between the two countries that might be expected given the discussions on global production sharing. These accounted for 31 percent of China's merchandise imports, as against only 12 percent in India.

On the export side, there is a large difference between the two countries in the importance of final goods in their exports. While 61 percent of China's non-fuel exports are classified as final goods, only 40 percent of India's exports are final goods, with 52 percent intermediate manufactured goods, and 8 percent non-fuel primary products.

Between 1992 and 2004, the major change evident in the table is the dramatic increase of China's trade in parts and components. In 1992, these accounted for only 15 percent of non-fuel imports, but this share rose to 31 percent by 2004. By contrast, in India, this share declined from 15 to 12 percent. While discussions of China's role in production networks tend to focus on China's role as an importer of components, it is notable that there has also been a substantial increase in the importance of parts and components in China's exports, with this share rising from 5 to 15 percent. By contrast, in India, this share rose from 5 to just 6 percent of total non-fuel exports. These data are consistent with the widespread perception that India remains much less integrated than China in global production networks, despite the existence of Indian policies to allow duty-free access to imported components for use in the production of exports (World Bank 2004).

As Hausman and Rodrik (2003) have emphasized, the exports of different countries reflect a wide range of differences in trade regimes, as well as idiosyncratic factors that lead apparently similar countries to have very different product mixes at the finer levels of disaggregation. Table 3.2 presents the top 25 exports for each country at the six-digit level of the original Harmonized System, the so-called 1988–92 version. These exports, which account for 55 percent of India's merchandise exports, and 38.2 percent of China's turn out to be almost mutually exclusive sets. Only one product—refined petroleum—enters both lists, accounting for over 9 percent of India's exports and 0.9 percent of China's. A notable feature of China's list is the prominence of computer and electronic equipment products under Chapters 84 and 85. These two chapters (which also include non-electronic equipment) alone accounted for almost 42 percent of China's exports in 2004, up from 16 percent in 1994. In India, three HS products under Chapter 71 (diamonds and jewelry) and refined petroleum under Chapter 27 likewise accounted for 28 percent of total exports.

Methodology and Simulation Design

The preceding discussion of trade patterns provides valuable background, but does not allow us to assess the implications of higher growth rates in China and India. To do this, we used a modified version of the standard GTAP model to assess the potential implications of rapid growth and structural change in China, India.[2] A global applied general equilibrium model such as GTAP has the important advantage over less formal approaches to projections of ensuring consistency while including important sectoral detail—each region's exports of particular goods equal total imports of these goods into other regions (less shipping costs); global investment equals the sum of regional savings; regional output determines regional income; global supply and demand for individual goods balance; and in each country/region demand for a factor equals its supply. These accounting relationships and the behavioral linkages in the model constrain the outcomes in

[2] This model is documented comprehensively in Hertel (1997) and in the GTAP database documentation (Dimaranan 2006).

Table 3.2 Top 25 Exports for China and India, 2004

China	HS-	Percent	India	HS-	Percent
Product	88/92	Share	Product	88/92	Share
Parts of automatic data processing	847330	4.0	Diamonds non-industrial nes	710239	12.7
Digital auto data processing machinery	847120	4.0	**Petroleum oils, etc, (excl. crude) ;**	**271000**	**9.7**
Input or output units	847192	4.2	Articles of jewelry and parts thereof	711319	4.6
Transmission apparatus	852520	3.1	Non-agglomerated iron ores and conc.	260111	4.5
Parts suitable for use solely or pr	852990	2.3	Semi-milled or wholly milled rice	100630	2.6
Monolithic integrated circuits	854211	1.9	Other organic compounds, nes	294200	2.1
Storage units, whether or not prese	847193	1.5	Flat rolled prod, i/nas, plated or	721049	2.0
Video recording or reproducing appa	852190	1.5	Other medicaments of mixed or unmix	300490	1.9
Optical devices, appliances	901380	1.4	T-shirts, singlets and other vests,	610910	1.4
Video recording or reproducing appa	852110	1.2	Women's or girls' blouses, shirts,	620630	1.4
Television receivers including vide	852810	1.2	Frozen shrimps and prawns	030613	1.5
Cargo containers	860900	1.1	Men's or boys' shirts of cotton	620520	1.3
Static converters, nes	850440	0.9	Imitation jewelry nes of base metal	711719	1.2
Parts and accessories of apparatus	852290	0.9	Furnishing articles, nes, of cotton	630492	1.2
Petroleum oils, etc, (excl. crude) ;	**271000**	**0.9**	Oil-cake and other solid residues,	230400	1.1
Coke and semi-coke of coal, of lign	270400	0.9	Cashew nuts, fresh or dried	080130	1.1
Printed circuits	853400	0.9	Made up articles (incl. dress patterns)	630790	1.1
Footwear with rubber… soles	640399	0.9	Motor vehicle parts nes	870899	1.0
Automatic data processing machines	847199	0.9	Polypropylene, in primary forms	390210	0.9
Bituminous coal, not agglomerated	270112	0.8	Copper cathodes and sections of cat	740311	0.9
Footwear, nes, not covering the ankle	640299	0.8	Agglomerated iron ores and concentr	260112	0.9
Trunks, suit-cases…, etc	420212	0.8	Men's or boys' shirts of cotton, knit	610510	0.9
Digital process units	847191	0.8	Automobiles with reciprocating piston	870321	0.8
Sound reproducing apparatus, not in	851999	0.7	Woven fabrics of high tenacity yarn	540710	0.8
Jerseys, pullovers, etc, of man-made	611030	0.7	Collages and similar decorative	970190	0.8
Total		38.4			58.4

Source: U.N. COMTRADE statistics from the World Bank WITS system.

important ways not found in partial equilibrium analyses—increased exports from one country must be accommodated by increased imports by other countries; broad-based increases in productivity that raise competitiveness also raise factor prices and help offset the original increase in competitiveness.

The model emphasizes the role of intersectoral factor mobility in determining sectoral output supply. Product differentiation between imported and domestic goods, and among imports from different regions, allows for two-way trade in each product category, depending on the ease of substitution between products from different regions. Factor inputs of land, capital, skilled and unskilled labor, and in some sectors a natural resource factor, are included in the analysis. The model includes the explicit treatment of international trade and transport margins, a "global" bank designed to mediate between world savings and investment, and a relatively sophisticated consumer demand system designed to capture differential price and income responsiveness across countries.

The constant returns to scale version of the GTAP model was adjusted to incorporate China's duty exemptions—which have been a key reason for the rapid integration of China into global production networks—and was modified to allow analysis of the impact of an effective system of duty exemptions for inputs used in the production of exports in India. Duty exemptions were incorporated in the GTAP model and data base following the methodology developed by Ianchovichina (2003). This duty exemption model allows for two separate activities in each

industry. Production of exports is represented as an activity for which imported intermediate inputs are available duty-free. Production for the domestic market uses the same technology, but requires payment of duties on intermediate inputs. Firms engaging in production for either the domestic market or the export market purchase both imported and domestic intermediate inputs which are imperfect substitutes following the Armington structure. Ianchovichina (2003) documents the approach used to introduce duty exemptions into the GTAP model and shows that failing to account for duty exemptions introduces bias in trade liberalization outcomes in countries with such a system.

The 57 sectors and 87 regions of the GTAP 6 Data Base were aggregated into 24 regions (table 3.5) and 26 sectors (table 3.6) based on the importance of these regions and sectors as China's and India's trade partners. To start, we used historical and projected growth rates for GDP, skilled labor, unskilled labor, capital, and population to roll the global economy forward to 2005. This pre-simulation essentially updates the database for 2001 to 2005, the starting point of our projection simulations. It also includes the removal of textile and apparel quotas on exports to Canada, USA, and EU under the Agreement of Textiles and Clothing; China's WTO accession commitments following Ianchovichina and Martin (2004); and the remaining commitments of developing countries under the Uruguay Round using tariff data from Jean, Laborde, and Martin (2005). The efficiency gains in China's motor vehicle sector resulting from WTO accession reforms are captured using productivity shocks as in Ianchovichina and Martin (2004).

While the examination of trade data above suggests that there is surprisingly little overlap in the export mix of China and India, this might change in light of India's move to greater integration in the world economy, including the very large reductions in protection that have been undertaken in India since 2001; the further reductions in manufacturing-sector protection that have been foreshadowed by the government; and measures intended to enable Indian manufacturers to fully participate in global production sharing. These measures include more effective duty exemptions for intermediates used in the production of manufactured exports, tariff cuts intended to bring tariffs on manufactured products to around the 7 percent level prevailing in China post-Accession (Ianchovichina and Martin 2004, p11), and reduction in international transport costs to and from India by 20 percent.[3]

As is evident from Table 3.3, the effect of this simulation was to sharply expand India's exports of manufactures, with particularly large increases in exports of machinery and equipment and metals. However, the expansion in India's exports of products such as textiles and apparel was smaller than the average expansion, implying a reduction in their share in India's exports. In figure 3.4, we compare the share of each product represented in the model in China's exports (represented by bars) with the share in India's exports before (B-India) and after the policy reforms (P-India). From this graph it does not appear that these reforms will greatly expand India's exports of products in which China has particularly large export shares. In fact, the correlation for overall exports rises modestly, from 0.36 to 0.41. However, the correlation within manufactures falls, from 0.01 to –0.02.

[3] The tariff reduction is based on continuation of the rapid liberalization undertaken in India's non-agricultural tariffs in recent years. The reduction in transport costs is based on broad estimates by trade-facilitation experts of the potential cost-reducing impacts of trade facilitation measures.

Table 3.3 Impact of India's Integration with the World Economy
Percent changes

Product	Output	Producer prices	Exports	Imports
Rice	1.12	0.50	24.83	15.04
Wheat	0.44	0.23	12.71	2.75
Grains	0.14	0.65	0.98	3.48
Vegetables and Fruits	–0.42	0.49	12.15	6.35
Oils and Fats	–1.75	0.10	11.18	8.23
Sugar	0.31	0.73	11.34	13.73
Plant Fibers	–1.89	–0.07	12.05	1.94
Other Crops	–0.10	0.59	8.46	11.46
Livestock and Meat	–0.03	0.76	5.23	9.66
Dairy	0.34	1.01	–6.57	13.80
Other Processed Foods	0.70	0.55	4.37	5.85
Energy	–0.83	–0.87	42.47	–0.20
Textiles	–1.90	–0.83	35.70	234.58
Wearing Apparel	12.78	–0.81	26.55	257.38
Leather	11.57	–1.34	48.70	241.71
Wood and Paper	–8.85	–0.27	30.17	90.69
Minerals	–3.28	–0.62	38.35	46.31
Chemicals, Rubber, and Plastics	–8.82	–3.42	90.22	128.04
Metals	–11.76	–3.25	108.29	209.06
Motor Vehicles and Parts	1.41	–2.31	59.51	30.91
Machinery and Equipment	20.98	–4.42	167.71	41.11
Electronics	34.97	–3.64	140.28	3.18
Other Manufactures	9.41	–3.19	56.48	82.57
Trade and Transport	–0.21	0.43	–1.81	1.51
Commercial Services	0.29	0.30	–0.62	1.46
Other Services	0.36	0.32	–1.09	1.75
Food	*0.02*	*0.55*	*9.85*	*7.23*
Energy and minerals	*–1.50*	*–0.80*	*39.47*	*6.27*
Manufactures	*–0.49*	*–2.74*	*67.63*	*84.17*
Services	*0.14*	*0.36*	*–0.68*	*1.51*
Total	1.14	–1.08	52.36	50.46
Welfare represented as:	EV in US$ 2001	4989	Per capita utility	0.91
Real returns to:	Capital	3.26	Skilled labor	3.88
	Land	1.70	Unskilled labor	3.28

Source: Authors' simulations with modified GTAP model; see details in text.
Note: The simulation includes introduction of duty drawbacks, a drop in manufacturing tariffs to 7 percent, and a reduction in transport costs to and from India by 20 percent.

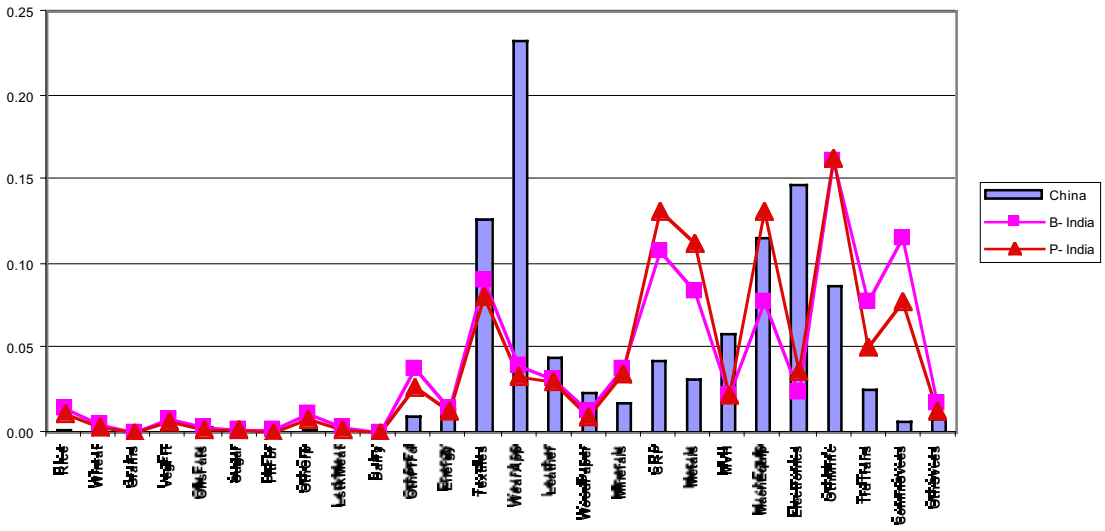
The second simulation explores the strong growth prospects in China and India in the context of world economic expansion over 2005–2020, see table 3.5.[4] This process provides a baseline from which we can assess the impact of an additional 2.1 percentage points annual growth in China, and 1.9 percentage point annual growth in India, in the period 2005–2020. Using the methodology for assessing potential growth impacts of reform presented in Ianchovichina and Kacker (2005) we concluded that these were potentially feasible increases

[4] The forecasts of growth rates for real GDP, skilled and unskilled labor inputs, investment and capital accumulation, and population were based on the 'central projections' for 2005-2015 in the World Bank's Global Economic Prospects database in January 2006. The methodology for construction of the macroeconomic projections to 2020 (known as the "GTAP baseline") is documented in Walmsley, Dimaranan, and McDougall (2002). The growth rates to 2020 are very close to the World Bank's July 2006 "central projections" to 2020 used in Chapter 1, but are preferred to the latter here because they have been decomposed by GTAP into the sources of growth.

relative to the baseline.[5] We implement these growth dividends using favorable, sector-neutral, annual shocks to total factor productivity (TFP) of the same size, focusing purely on productivity increases to isolate these effects from those due to increases in the stock of particular factors. These assessments of upside potential are perhaps conservative in that they do not explicitly take into account the potential benefits from reforms of labor market policies in India that are widely believed to have enormous potential for productivity growth and fuller participation in global production chains (Mitra and Ural 2006). Nor do they fully account for the potential benefits of reforms in services trade (Nikomborirak 2006), which Markusen, Rutherford and Tarr (2005) find to be potentially very large.

We then assess the impact of strong growth on the quality and variety of exports from China and India. Quality improvements in exports have recently been identified as a key influence on the performance of rapidly growing exporters such as China and India (Hummels and Klenow 2004). We follow Hummels and Klenow (2005) who observe that larger economies export more in absolute terms than smaller economies and analyze the extent to which larger economies export higher volumes of each good (intensive margin growth), a wider set of goods (the extensive margin), and improved-quality goods. Their estimates imply that rising quality in existing product lines accounts for increases
of approximately 0.09 percent in export prices for each one percent increase in income levels, despite increases of 0.34 percent in the quantities exported. Further, they find that 66 percent of the export growth resulting from an increase in income arises from export of new products.[6]

Figure 3.4 Export Shares in China and India, 2001



[5] Ianchovichina and Kacker (2005) present growth scenarios for all developing countries using a cross-country growth model estimated by Loayza et al. (2005).
[6] Hummels and Klenow (2005) find that the contribution of the extensive margin varies with the levels of aggregation. At the 6 digit level exports of new varieties account for 66 percent of the country differences in exports. At the 1 digit level the variety effect accounts for 15 percent of the country differences in exports.

In the standard modeling framework in which we work, the number of goods cannot, in fact rise as exports grow. However, both the increase in the number of varieties exported, and the improvements in the quality of goods exported result in increases in the demand for goods contained within each of our standard aggregates. We specify these increases in demand as product-augmenting technical changes that increase the effective quantity of each good in the eyes of the purchaser, and correspondingly lower the effective price of the good to the purchaser. Using the price aggregator dual to Hummels and Klenow's quantity aggregator, we are able to specify the reduction in the effective price associated with their combinations of increases in variety and quality. This price aggregator is:

$$P^* = \left[N \bullet \left(P / \lambda\right)^{(1-\sigma)}\right]^{(1/(1-\sigma))}, \qquad \text{Eq. 3.1}$$

where P is the actual price of individual commodity exports, N is the number of varieties, λ is the quality change index and P^* is the overall effective price of exports. With this, we can calculate the change in the effective price corresponding to a change in real GDP. We show that in the case when the elasticity of substitution σ is 7.5,[7] the effective price declines corresponding to the cumulative increases in China's and India's real GDP growth in the high growth scenario relative to the baseline are 9.2 percent and 8.2 percent, respectively. We implement the impact of this effect as a 9.2 percent and an 8.2 percent product-quality-augmenting technical change on imports by other countries of goods from China and India, respectively.

Finally, because we do not know the exact channels through which China and India will grow in the next fifteen years, we undertake three simulations that are alternatives to the preceding neutral high-TFP scenarios, and which allow us to investigate whether China and India's export growth might create more competition for developing or for industrial countries. We first study the implications of positive productivity shocks of 2 percent per year in the relatively capital and skill-intensive sectors considered in the case studies of Chapter 2: metals; electronics; machinery and equipment; automobiles, and commercial services in China and India. Then, we consider shocks that augment the stocks of human and physical capital, and could be expected to shift the composition of China's exports towards goods more intensive in human and physical capital, and hence more competitive with the exports of the industrial countries. We first assess the impacts of a 2 percentage point annual increase in the stock of physical capital in China and India. Then, we compute the effects of a 2 percentage point annual increase in the stock of human capital in China and India.

The macroeconomic closure of the simulation model assumes a constant level of employment, perfect mobility of skilled and unskilled labor between sectors, and none between regions. Since we look at long run trends, we have doubled the elasticity of substitution between imported goods from different sources and between composite imported and domestic goods from the values used in the GTAP 6 Data Base. In all simulations the trade balances as shares of gross domestic product (GDP) were fixed for our focus countries of China and India to avoid potentially important changes in welfare resulting from changes in financial inflows from abroad when growth rates in these countries change substantially.[8]

[7] This is the mid-range value considered in Hummels and Klenow (2005).

[8] Financial inflows to other countries not experiencing differential growth shocks are much less likely to change substantially and hence create misleading indicators of welfare change.

Trade Effects of Global Growth, 2005–20

The projections for key variables such as output, labor force growth and investment in table 3.4 assume that the world economy will grow in real terms at an average, annual rate of 3.1 percent in the period 2005–2020. The volume of world trade is projected in these standard model projections to grow only slightly faster, at an average annual rate of 3.7 percent per year. The small gap between GDP growth rates and the growth of trade reflects the assumptions that productivity grows equally in all sectors, so that no great imbalances are created, and that there is no expansion in the range or quality of varieties traded in this scenario. Growth in China, India and other developing economies in South and East Asia is much higher than the average for the world which causes their role in the global economy to grow.

Table 3.4 Output, Factor Inputs, and Population Projections, 2005–20
Annual average growth rates, percent

Trading partner	GDP	Unskilled labor	Skilled labor	Physical capital	Population
Australia and New Zealand	3.5	1.6	0.6	3.8	0.7
China	6.6	0.8	3.9	8.5	0.6
Japan	1.6	0.2	–0.7	2.5	–0.2
Korea	4.7	2.0	5.8	4.9	0.3
Hong Kong and Taiwan, China	4.3	0.6	3.0	4.9	0.4
Indonesia	5.2	2.7	6.5	4.7	1.1
Malaysia	5.6	–1.4	3.9	5.8	1.4
Philippines	3.5	1.8	4.6	3.5	1.5
Singapore	4.9	0.6	1.1	5.3	0.8
Thailand	4.6	0.1	3.2	3.9	0.5
Vietnam	5.4	1.4	1.9	6.0	1.1
Rest of South East Asia	3.1	1.3	3.6	3.6	1.0
India	5.5	1.6	4.0	6.1	1.1
Rest of South Asia	5.0	2.1	3.6	5.1	1.7
Canada	2.6	1.6	0.9	3.2	0.4
USA	3.2	1.5	0.8	3.9	0.7
Mexico	3.8	2.7	4.6	3.3	1.4
Argentina and Brazil	3.6	0.9	3.7	3.1	1.0
Rest of Latin America	3.3	1.6	3.8	3.6	1.3
European Union 25 and EFTA	2.3	0.3	0.0	2.6	–0.1
Former Soviet Union	3.2	0.3	0.8	3.6	–0.1
Middle East and North Africa	4.1	1.7	3.3	4.1	1.6
Sub-Saharan Africa	3.5	2.6	3.3	3.2	1.9
Rest of the World	3.7	0.7	1.2	2.6	0.5
Low-income countries	*4.7*	*1.7*	*3.1*	*4.2*	*1.5*
Middle-income countries	*4.5*	*1.0*	*3.1*	*3.9*	*0.8*
High-income countries	*2.7*	*0.9*	*0.4*	*3.0*	*0.2*
World	3.1	0.9	0.8	3.2	0.9

Source: World Bank projections to 2015 extrapolated to 2020.

The rate of unskilled workforce growth in China and India is projected to slightly outpace the growth of the population over the projection period, while skilled labor and physical capital are projected to growth at much higher rates than unskilled labor (table 3.5). Differential rates of

factor accumulation and differences in income elasticities of demand for particular goods lead to structural changes, rather than a balanced growth path for the world. This augmentation of physical and human capital is expected to have important implications for the structure of output—switching it towards capital-intensive products—and for factor rewards. On the demand side, the consumption profile changes to reflect the effects of growing incomes per head coupled with non-homothetic preferences, implying declines in the share of expenditure on necessities such as food and increases in those on luxuries such as services. These pressures for change from the individual regions contribute to changes in relative world commodity prices that also influence the pattern of structural change worldwide.

Table 3.5 Changes in Key Economic Indicators as a Result of Global Growth, 2005–20
percent

	Output	Exports	World price[a]
Rice	49.5	68.7	–2.3
Wheat	50.2	64.3	8.8
Grains	53.3	52.1	9.7
Vegetables and Fruits	38.7	42.0	8.9
Oils and Fats	74.0	80.5	–9.4
Sugar	56.6	60.5	–10.1
Plant Fibers	88.4	118.3	7.9
Other Crops	45.4	53.6	7.6
Livestock and Meat	57.1	123.0	–8.6
Dairy	44.9	76.7	–11.6
Other Processed Foods	43.7	44.9	–12.5
Energy	79.4	110.0	40.6
Textiles	72.6	60.8	–13.7
Wearing Apparel	72.3	58.2	–17.4
Leather	58.6	47.0	–13.7
Wood and Paper	60.4	58.3	–15.5
Minerals	66.2	66.6	–13.6
Chemicals, Rubber, and Plastics	52.2	58.2	–11.5
Metals	65.3	68.4	–14.2
Motor Vehicles and Parts	58.6	62.1	–15.0
Machinery and Equipment	65.2	72.1	–15.8
Electronics	92.2	88.9	–17.4
Other Manufactures	91.3	77.6	–19.2
Trade and Transport	62.1	70.4	–14.1
Commercial Services	64.8	65.1	–19.5
Other Services	61.9	64.2	–15.9
Food	*49.75*	*66.2*	*–5.82*
Energy and minerals	*76.05*	*101.2*	*26.94*
Manufactures	*68.33*	*69.1*	*–15.19*
Services	*62.87*	*64.7*	*–16.10*
Total	66.64	71.7	–11.28

Source: Authors' simulations with modified GTAP model; see details in text.
a. Relative to a numeraire of aggregate factor prices.

Under our initial assumption of sectorally-neutral technical change, strong growth in the developing world implies that demand outpaces supply for energy, natural fibers, and farm products, such as wheat, grain and vegetables and fruits, and other crops. Energy prices rise by 41

percent (or 2 percent per year) over the fifteen year period, in part because of the presence of a fixed resource in the model's representation of this sector, and under the assumption that extraction efficiency improves at the same rate as efficiency in other activities. The prices of mineral products decline reflecting the fact that fixed natural resource factors are a small share of the cost of output in this sector (table 3.5) and the rise in their price is offset by increased productivity in their use. Liberalization of the textile and apparel markets puts downward pressure on these products' prices. With strong growth in China and India competition in the manufacturing sectors intensifies, and the prices of manufacturing goods and services fall relative to food and energy and minerals. World prices, on average, fall relative to the factor price numeraire in the period 2005–2020 (table 3.5) because of the increase in productivity.

Table 3.6 Welfare and Trade Changes as a Result of Global Growth, 2005–20

	Welfare		Output	Exports	Imports
Trading Partner	**(2001 US$, billions)**	**(percent change)**	**(percent change)**	**(percent change)**	**(percent change)**
Australia and New Zealand	285	70.3	66.3	58.2	86.1
China	1965	146.2	161.9	187.8	167.7
Japan	936	24.5	27.6	87.6	65.8
Korea	421	93.3	99.7	122.4	115.9
Hong Kong and Taiwan, China	385	83.0	87.3	94.3	94.3
Indonesia	181	116.5	112.8	127.9	137.4
Malaysia	118	126.8	127.8	132.1	136.3
Philippines	47	61.7	68.2	89.7	77.0
Singapore	76	89.4	105.9	156.5	150.5
Thailand	115	93.4	97.2	109.6	110.2
Vietnam	38	111.9	121.1	103.7	104.8
Rest of South East Asia	45	60.5	58.2	57.0	88.7
India	631	116.5	124.4	189.9	151.4
Rest of South Asia	161	103.2	109.1	139.8	117.3
Canada	334	48.2	46.7	47.4	51.3
USA	5838	58.4	60.8	67.1	65.6
Mexico	450	77.5	75.2	59.7	75.9
Argentina and Brazil	526	71.6	68.8	31.3	86.9
Rest of Latin America	382	66.1	63.6	55.5	68.2
European Union 25 and EFTA	3191	40.2	41.1	38.6	42.4
Former Soviet Union	340	71.6	59.6	74.1	64.0
Middle East and North Africa	1028	97.3	82.9	51.5	89.7
Sub-Saharan Africa	251	78.0	68.2	48.5	79.7
Rest of the World	99	72.9	72.5	61.0	76.3
Low income countries (LICs)	*1126*	*99.6*	*101.4*	*115.1*	*113.8*
Middle income countries (MICs)	*5249*	*98.1*	*97.3*	*104.3*	*107.5*
High income countries	*11466*	*47.8*	*49.8*	*57.8*	*58.7*
World	17841	58.5	60.0	71.7	71.7
LICs (excl. India)	*495*	*84.3*	*80.7*	*70.7*	*90.7*
MICs (excl. China)	*3284*	*81.9*	*75.6*	*73.0*	*87.0*

Source: Authors' simulations with modified GTAP model; see details in text.

The projected implications of global growth at the country level are presented in table 3.6. China and India are expected to increase their volume of trade at much higher rates than those of other economies in East and South Asia, though exports of other middle and low income

countries also grow at rapid rates (above 100 percent). In the baseline both China and India almost triple their export volumes, and more than double their import volumes (table 3.6).[9] However, the implications of strong economic performance for per capita income differ for the two countries significantly as India's population grows at twice the rate in China.

The Impact of Improved Growth and Quality of Exports from China and India

The effects on key variables of higher growth in China and India, and higher growth with and without increased variety and quality of exports are presented in table 3.7. These impacts are presented for real incomes (welfare); for export volumes; and for terms-of-trade effects. For each variable, the effect depends upon whether the income increases in China and India result in growth of merely the same exports ("Growth"), or whether export growth is accompanied by expansion in the range of products exported, and improvements in their quality ("Growth and Quality"). Increases in real income presented are measures of equivalent variation in 2001 dollars. Export expansion is presented using percentage changes in the volume of exports. The terms-of-trade effect is presented in 2001 dollar terms.[10]

A positive efficiency gain in China and India resulting in annual growth that is respectively 2 and 1.9 percentage points higher than the one in the baseline will translate into a welfare gain of US$1.25 trillion for China and $394 billion for India relative to the baseline. The volume of exports increases by 29 percent from both India and China—an increase slightly larger than the corresponding increases in output. However, this export expansion is accompanied by declining export prices and a terms-of-trade loss of about US$48 billion for China and $12 billion for India. Such a terms-of-trade loss is an expected outcome in a model employing the Armington assumption of national product differentiation.

The welfare changes for other countries are relatively small. Gains for most of China and India's trading partners in the Asia-Pacific region are modest. High income countries gain, except for the EU, where existing distortions and structural change lead to an allocative efficiency loss. Many countries will benefit from improved terms-of-trade for their products as China increases its imports from the rest of the world by 23 percent and India by a similar amount. Some middle and low income countries such as Thailand, the Philippines, as well as other countries in South Asia, will lose as competition with China and India in third markets negatively affects their terms-of-trade.

Whereas the aggregate results suggest that competition from China and India would have a small impact on average real incomes, manufacturing industries in many countries are affected negatively,[11] and for industries in some countries these effects could be substantial (table 3.8).[12] Improved growth of exports from China and India implies expansion of their textile industries

[9] The disparity in export and import growth does not imply an increasing trade surplus because prices change.
[10] Since the price of relevance to the importer is the effective price, which may fall when quality and variety increase, and the price relevant to the producer is the actual price, which rises when quality and variety increase, it is possible for the terms-of-trade to improve for both importer and exporter.
[11] Table 9 reports output changes for the manufacturing sectors in the model. While in some countries all manufacturing sectors contract, some other sectors (not reported in the table) expand as factor inputs move out of the shrinking manufacturing industries into the farm and services sectors.
[12] Results in the case of improved growth in China are available upon request and do not differ much from the results in the case of improved growth in China and India, except for India whose apparel industry contracts by 12 percent, while the impact on other industries is negligible.

Table 3.7 Effects of Improved Growth and Quality of Exports in China and India, Relative to Base, 2020

	World				Exports		Terms-of-Trade Effects	
	Growth		Growth and Quality		Growth	Growth and Quality	Growth	Growth and Quality
Regions	2001 $m	percent	2001 $m	percent	percent	percent	2001 $m	2001 $m
Australia and N Zealand	2743	0.45	5568	0.91	–0.06	0.72	2652	5240
China	1145733	39.9	1253425	43.6	29.41	55.34	–48229	38159
Japan	6588	0.16	17276	0.42	2.44	4.80	9186	18946
Korea	829	0.11	7451	1.00	3.45	5.83	–957	4646
Hong Kong (China)/ Taiwan (China)	3811	0.53	12749	1.78	1.94	3.78	4260	13307
Indonesia	791	0.27	1822	0.61	0.18	–0.10	723	1907
Malaysia	1555	0.87	3636	2.03	0.27	0.02	1570	3698
Philippines	–627	–0.57	–994	–0.89	–0.26	–3.19	–559	–583
Singapore	–2280	–1.68	–458	–0.34	4.92	6.50	–159	2019
Thailand	–639	–0.31	492	0.24	1.63	2.33	–857	312
Vietnam	–41	–0.07	166	0.29	–1.10	–2.33	63	468
Rest of S E Asia	424	0.41	603	0.58	–2.85	–2.11	382	541
India	361740	33.7	394490	36.7	28.89	47.05	–12379	10661
Rest of South Asia	–962	–0.35	–159	–0.06	1.60	2.98	–1110	–517
Canada	2767	0.32	5182	0.59	–0.91	–1.43	2634	4736
USA	124	0.00	20262	0.15	0.67	2.87	479	20671
Mexico	535	0.06	1000	0.11	–1.33	–2.37	175	489
Argentina and Brazil	1410	0.13	3134	0.28	–0.06	0.45	1072	2570
Rest of Latin America	3015	0.36	4703	0.56	–0.48	–0.26	2652	4251
EU 25 and EFTA	–4306	–0.04	16893	0.18	–0.14	–0.18	3013	22183
Former Soviet Union	9958	1.37	12914	1.77	1.34	2.34	9750	12039
M East and North Africa	23780	1.31	29108	1.60	–1.50	–1.50	22592	27568
Sub–Saharan Africa	4904	0.96	7676	1.50	–0.24	0.80	4004	6439
Rest of the World	–688	–0.34	–500	–0.24	1.46	2.37	–596	–282
LICs (excl. India)	*366065*	*17.9*	*402775*	*19.7*	*14.04*	*23.44*	*–9039*	*17592*
MICs (excl. China)	*1184823*	*13.1*	*1308743*	*14.5*	*10.70*	*20.39*	*–11707*	*90130*
High-income countries	*10275*	*0.03*	*84923*	*0.28*	*0.79*	*1.73*	*21109*	*91749*
World	1561163	3.8	1796437	4.3	4.4	8.5	363	199472
Low-income countries (excl. India)	*4325*	*0.46*	*8286*	*0.87*	*–0.07*	*0.77*	*3339*	*6931*
Middle-income countries (excl. China)	*39091*	*0.61*	*55315*	*0.87*	*–0.18*	*–0.16*	*36522*	*51971*

Source: Authors' simulations with modified GTAP model; see details in text.

and contraction of the textile industries in other countries relative to the base run. Indonesia and Vietnam experience the largest contractions of 9.2 percent and 8.9 percent, respectively. The projected growth of China's and India's apparel industries means sharp contractions in apparel production elsewhere. The apparel industries of Vietnam and the Middle East and North Africa are expected to be the hardest hit as their output declines by nearly a fifth (19 percent). Similar declines will plague the light manufacturing industry (leather and other manufactures), although the expected declines are much smaller than the ones affecting apparel. With the exception of Singapore and Thailand, competition from India and China leads to contractions of the electronic industries in other countries. Machinery and equipment production will also relocate to China and India, reducing the size of these industries in other countries. The expected expansion of the

automobile production in China and India has a small negative effect on automobile production in other countries, with the exception of Mexico and Thailand.

Table 3.8 Manufacturing: Effects of Improved Growth, Quality, and Variety of Exports in China and India, Relative to Base, 2020
percent

Regions	Textiles	Apparel	Leather	Wood	Minerals	Chemicals	Metals	Auto	Machinery	Electronics	Other
Australia and	–6.9[a]	–8.6	–8.5	–1.3	–1.1	–0.8	–4.1	–2.4	–6.7	–5.9	–8.4
New Zealand	*–15.3*[b]	*–15.5*	*–13.7*	*–1.5*	*0.2*	*–3.4*	*–3.9*	*–6.3*	*–13.9*	*–18.5*	*–15.3*
China	35.5	20.3	39.4	41.6	36.8	42.9	38.5	34.8	37.6	35.8	30.5
	30.0	*20.5*	*45.2*	*34.7*	*36.3*	*39.2*	*34.8*	*40.9*	*40.2*	*58.2*	*33.1*
Japan	–1.6	–6.0	–5.3	–1.1	–1.0	–2.3	–2.7	–3.9	–6.6	–4.8	–4.2
	15.1	*–8.0*	*–8.1*	*–1.0*	*–0.6*	*–1.4*	*–1.9*	*–6.6*	*–9.0*	*–10.7*	*–6.8*
Korea	–1.3	–2.1	–1.6	0.4	–0.6	–1.7	1.7	–3.0	–1.9	0.0	–7.7
	10.0	*–3.7*	*10.6*	*4.1*	*–0.8*	*2.7*	*3.9*	*–9.2*	*–7.0*	*–7.9*	*–11.7*
Hong Kong (China) / Taiwan	–5.9	–7.3	–7.1	–2.2	–1.7	–4.8	–5.0	–3.6	–5.7	–2.9	–15.8
(China)	*1.7*	*–1.0*	*–4.3*	*–2.5*	*–3.9*	*–2.2*	*–8.8*	*–10.0*	*–10.7*	*–10.6*	*–26.3*
Indonesia	–9.2	–11.7	–7.7	4.6	–2.6	0.3	–5.9	–0.5	–1.2	–1.4	–10.6
	–15.6	*–21.4*	*–20.0*	*15.4*	*–3.4*	*0.9*	*–8.9*	*–2.8*	*–4.4*	*–12.0*	*–19.2*
Malaysia	–7.5	–15.8	–5.7	0.6	–1.3	1.9	–1.6	–1.1	–4.6	–0.2	–3.6
	–7.3	*–27.4*	*–4.2*	*5.1*	*0.5*	*4.4*	*1.2*	*–2.4*	*–5.9*	*–3.5*	*–5.5*
Philippines	–7.4	–15.7	–8.7	–0.2	–0.3	3.9	0.1	0.0	–0.2	–4.0	–6.4
	–14.3	*–25.7*	*–17.0*	*1.9*	*1.3*	*5.5*	*2.6*	*0.4*	*4.0*	*–13.9*	*–9.9*
Singapore	–8.0	–8.1	–11.2	–0.6	2.1	0.7	2.0	–3.6	–1.8	3.4	–10.9
	–7.9	*–16.9*	*–21.7*	*1.6*	*3.9*	*0.8*	*5.0*	*–11.4*	*–2.5*	*5.2*	*–20.3*
Thailand	–5.1	–5.0	–6.0	1.5	–0.6	2.0	0.5	0.5	–1.4	4.6	–8.1
	–9.1	*–9.5*	*–13.9*	*6.5*	*0.3*	*3.0*	*2.2*	*0.3*	*–3.7*	*6.2*	*–15.5*
Vietnam	–8.9	–19.3	–5.6	–0.9	0.3	–1.1	–4.9	–4.7	–7.7	–4.8	–6.6
	–15.6	*–35.5*	*–11.9*	*–0.1*	*1.0*	*2.4*	*–8.4*	*–8.0*	*–12.8*	*–12.6*	*–10.4*
Rest of	–6.3	–3.6	–3.4	0.7	0.7	–0.5	–1.2	–0.4	–3.5	–0.5	–0.8
S. East Asia	*–12.4*	*–6.2*	*–5.6*	*9.1*	*1.4*	*–2.4*	*–2.1*	*–1.1*	*–6.0*	*–2.4*	*–1.2*
India	35.1	23.3	41.4	39.8	30.7	30.6	33.9	30.6	29.2	30.7	23.5
	26.2	*11.1*	*45.5*	*32.1*	*33.9*	*33.1*	*34.0*	*30.0*	*41.5*	*36.5*	*15.6*
Rest of	–2.7	–12.4	–1.2	0.7	–1.6	–0.4	3.8	–1.5	–3.2	–0.2	–6.4
South Asia	*–6.4*	*–25.5*	*–6.3*	*2.3*	*–1.9*	*–1.2*	*10.5*	*–3.8*	*–8.1*	*–8.9*	*–11.6*
Canada	–4.4	–8.3	–3.7	–1.4	–2.4	–4.0	–2.1	0.0	–4.1	–2.2	–12.7
	–5.8	*–14.9*	*–3.7*	*–1.1*	*–2.6*	*–3.8*	*–4.3*	*–1.0*	*–8.5*	*–11.0*	*–20.5*
USA	–5.4	–8.7	–4.3	–0.2	0.1	0.9	–0.7	–0.2	–2.5	–3.5	–10.5
	–10.5	*–15.3*	*–6.4*	*0.3*	*0.2*	*1.4*	*–1.0*	*–0.4*	*–4.2*	*–11.0*	*–16.7*
Mexico	–2.1	–2.2	–0.8	0.2	0.1	0.9	–0.3	0.7	–4.1	–3.8	–6.5
	–3.9	*–3.6*	*–1.3*	*1.2*	*0.8*	*1.6*	*0.4*	*2.0*	*–5.7*	*–13.2*	*–10.1*
Argentina and	–2.0	–1.1	–6.6	–1.0	–1.0	–2.0	–3.2	–1.8	–4.5	–3.1	–2.9
Brazil	*–3.4*	*–1.8*	*–8.4*	*–0.9*	*0.0*	*–2.8*	*–4.5*	*–2.5*	*–7.4*	*–8.0*	*–4.9*
Rest of Latin	–4.5	–4.2	–3.4	–0.5	–0.2	–0.3	–2.8	–1.3	–5.5	–5.3	–8.8
America	*–9.5*	*–7.9*	*–6.1*	*0.4*	*1.1*	*–1.4*	*–2.6*	*–2.5*	*–9.9*	*–15.1*	*–14.4*
EU 25 and	–5.6	–9.7	–5.0	0.0	–0.4	–1.8	–0.7	–0.4	–2.4	–2.5	–3.9
EFTA	*–9.9*	*–16.8*	*–8.5*	*0.8*	*–0.5*	*–3.0*	*–1.3*	*–1.3*	*–5.0*	*–11.7*	*–6.6*
Former	–2.6	–4.7	–1.4	–0.5	–1.9	–1.1	–3.3	–0.3	–4.4	–3.1	–3.2
Soviet Union	*–5.8*	*–9.4*	*–4.2*	*0.8*	*–2.2*	*–1.6*	*–2.9*	*0.1*	*–7.9*	*–6.6*	*–5.7*
Middle East	–8.6	–18.6	–2.6	–0.7	–0.5	–5.8	–6.6	–3.2	–8.3	–7.2	–9.1
and N. Africa	*–14.8*	*–29.4*	*–3.7*	*–0.7*	*0.3*	*–5.9*	*–6.5*	*–4.9*	*–12.9*	*–15.9*	*–13.4*
Sub-Saharan	–4.6	–5.5	–4.1	0.0	–0.1	0.3	–2.3	–3.8	–8.4	–7.4	–7.6
Africa	*–10.4*	*–10.3*	*–7.7*	*0.6*	*1.2*	*–2.0*	*1.4*	*–8.5*	*–16.1*	*–24.9*	*–13.3*
Rest of	–2.9	–7.7	–1.7	1.1	–0.1	0.0	–1.2	–0.3	–1.9	–1.8	–14.3
the World	*–5.3*	*–12.9*	*–4.1*	*2.5*	*–0.1*	*–1.4*	*–2.6*	*–0.7*	*–4.7*	*–7.0*	*–24.0*

Source: Authors' simulations with modified GTAP model; see details in text.
a. For each partner, numbers in the first row are results for the case of improved growth in China and India.
b. For each partner, numbers in the second row are results for the case of improved growth and quality exports in China and India.

Table 3.9 Export Volume Changes under Various Scenarios
percent

Region	Improved sector productivity in China and India	Improved capital growth in China and India	Improved skilled labor growth in China and India
Australia and New Zealand	–0.01	0.14	0.02
China	96.42	23.93	5.39
Japan	4.40	2.97	0.66
Korea	4.05	3.25	0.82
Hong Kong and Taiwan, China	–3.88	1.15	0.32
Indonesia	–0.73	0.12	0.05
Malaysia	–6.60	–0.36	–0.04
Philippines	–18.34	–0.82	–0.06
Singapore	–8.56	3.87	1.03
Thailand	–9.77	0.46	0.15
Vietnam	3.23	–0.49	–0.07
Rest of South East Asia	14.02	–0.27	–0.16
India	72.90	35.06	6.92
Rest of South Asia	13.40	2.60	0.56
Canada	–6.96	–1.21	–0.27
USA	5.07	1.82	0.38
Mexico	–8.74	–1.39	–0.31
Argentina and Brazil	1.33	0.50	0.08
Rest of Latin America	0.00	–0.23	–0.07
European Union 25 and EFTA	–2.45	0.00	0.01
Former Soviet Union	4.44	2.27	0.52
Middle East and North Africa	–0.62	–1.40	–0.33
Sub–Saharan Africa	–2.24	–0.59	–0.16
Rest of the World	12.42	3.19	0.75
Low-income countries (LICs)	*35.50*	*16.51*	*3.25*
Middle-income countries (MICs)	*32.42*	*8.33*	*1.88*
High-income countries	*-0.43*	*1.01*	*0.24*
World	11.13	3.94	0.88
LICs (excl. India)	*2.61*	*0.13*	*0.01*
MICs (excl. China)	*–2.24*	*–0.11*	*–0.02*

Source: Authors' simulations with modified GTAP model; see details in text.

But not all will be bad news. The boost in China's and India's wood processing industries has positive spillover effects via increased demand for intermediate wood products from Korea, Indonesia, Malaysia, Thailand, and other countries in East and South Asia. Similarly, growth in China and India will fuel demand for chemicals from the Philippines, Malaysia, and Thailand, mineral products from Vietnam and other South East Asian Countries, and metals from some countries in East Asia and South Asia (table 3.8).

Adding improvements in the variety and quality of exports from China and India to the growth scenario increases the benefits to the world economy from $1.6 trillion to $1.8 trillion (table 3.7). In this case, the volumes of exports from China and India grow by 55 and 47 percent respectively with positive terms-of-trade effects in all regions other than the Philippines. Most countries benefit since they can import higher volumes from these two countries at lower effective prices and also experience greater demand for their exports from China and India. The biggest beneficiaries are, of course, China and India, whose welfare increases by US$1.3 trillion and US$0.4 trillion, respectively. The volume of trade between China and India increases more than does either's trade with the rest of the world, deepening the trade links between the two Asian giants.

Pressure on middle-income developing countries to raise the quality of their exports will increase as a result of improved-quality Chinese and Indian exports. Without efforts to keep up with China and India, some countries—most notably the Philippines, Mexico, Vietnam and others in South East Asia—may see their export shares eroded.[13] Improved quality exports from fast growing China and India intensify competition in the markets for different manufactured goods and lead to further contractions of the electronics industry in all regions except Singapore and Thailand, the machinery and equipment industries in all countries except the Philippines, the textile, apparel and other light manufacturing sectors in the most regions. As China starts producing more sophisticated and new varieties of electronics, machinery and equipment, it reduces the rate of expansion of its processing industries (wood, mineral, chemical and metals) leaving space for other countries to expand these industries (table 3.8).

Alternative Paths to Improved Growth in China and India

A positive productivity shock of 2 percent per year in the five Chinese and Indian sectors considered in Chapter 2—metals, electronics, machinery and equipment, motor vehicles and commercial services—is beneficial to the world and all developing countries except the Philippines (table 3.9). However, this efficiency improvement in China and India entails substantial structural change (table 3.10). China and India become much more powerful players in these sectors and world trade grows much faster than envisaged under the scenario of neutral total factor productivity (TFP) growth of 2 percent. Exports from China double and exports from India jump by more than 72 percent. World trade expands by 11 percent, as regional trade between China and developed economies in the Asia Pacific region (Japan, Korea, and US), and India and its closest partners in South Asia will grow as well. The huge effects on trade arises because the assumed stimulus is to existing export sectors, so it exacerbates imbalances between local supply and demand and hence requires increased trade to restore equilibrium.

Under this scenario China and India expand their heavy industry and high-tech manufacturing sectors, leaving space for other countries to increase production of light manufactures, chemicals, and minerals (table 3.10). Still, exports from many developing economies that compete with China and India decline as a result of the improved efficiency of China's and India's heavy industry, and high-tech manufacturing sectors. Most notable is the decline of exports from the Philippines (18 percent) and Thailand (10 percent), whose electronics sectors decline by 65 percent and 53 percent, respectively. All economies experience structural change of a similar magnitude. China and India shift out of textiles and light manufactures, whereas the rest of the economies shift out of heavy and high-tech manufactures.

Improved growth through accelerated accumulation of capital (2 percentage points faster than the baseline) benefits China and India, and modestly affects real incomes in other regions (table 3.9). China and India increase their production of all manufactured goods, but the expansion of the capital-intensive sectors is larger than that of other sectors. Since the capital-intensive sectors are the sectors experiencing efficiency gains in the previous scenario, the export and sector specific changes are similar but smaller in absolute value than the ones presented for

[13] In only one case—the Philippines—the welfare loss from improved growth in China and India worsens as China and India improve the quality of their exports and expand output of electronics, machinery and equipment (Table 3.8). Such an outcome can be explained by the high share of electronics in the Philippines' total exports. Indeed, this share is higher than that of any other country/region in the model.

the case of improved efficiency of China's and India's metals, electronics, machinery and equipment, motor vehicles and commercial services in table 3.10.

Finally, improved growth through accelerated accumulation of human capital (2 percentage points per year higher than the baseline) has a much smaller effect on welfare, exports, and sector outputs than improved growth through accelerated accumulation of physical capital (table 3.9). This is the case because the share of skilled labor is much lower than the share of capital in total factor endowment.

Table 3.10 Industry Effects of Improved Sectoral Productivity Growth in China and India
percent

Regions	Textiles	Apparel	Leather	Wood	Minerals	Chemicals	Metals	Auto	Machinery	Electronics	Other
Australia and New Zealand	10.4	38.7	9.4	3.1	15.8	–0.9	–42.7	–28.5	–44.0	–61.8	25.6
China	–79.6	–72.8	–63.6	–52.3	–0.6	–45.6	42.7	195.8	95.4	252.1	–58.0
Japan	48.3	36.5	30.5	9.1	16.8	22.5	–19.3	–23.1	–31.6	–43.9	28.2
Korea	61.4	40.5	125.8	51.2	27.4	47.0	–32.2	–29.5	–36.2	–54.5	104.2
Hong Kong (China) and Taiwan (China)	1.6	107.2	28.1	9.6	2.6	8.0	–51.6	–40.0	–56.0	–66.3	94.9
Indonesia	38.7	96.2	–2.0	37.0	–7.5	–1.1	–45.7	–26.8	–38.1	–77.9	37.6
Malaysia	99.2	290.7	63.1	88.9	44.1	53.8	–19.2	–12.4	–23.0	–53.2	44.4
Philippines	71.9	266.3	44.2	22.3	4.2	16.1	–40.6	–25.0	–23.9	–64.7	81.3
Singapore	70.4	36.6	29.4	29.9	51.3	30.6	–31.5	–39.0	–42.0	–35.0	48.5
Thailand	54.2	59.4	26.6	35.6	16.4	8.9	–34.4	–14.8	–39.5	–53.3	69.7
Vietnam	48.9	203.1	–5.1	–0.3	6.0	13.5	–41.7	–39.0	–53.2	–57.9	14.9
Rest of S. East Asia	20.8	26.4	–5.6	21.1	3.4	–3.0	–23.4	–12.7	–29.1	–28.2	2.9
India	–40.5	–67.5	–88.7	–43.8	–37.8	–41.7	117.5	26.2	156.2	8.7	–71.4
Rest of South Asia	23.3	156.1	5.3	5.0	2.4	2.5	–39.2	–40.0	–48.2	–64.8	20.0
Canada	54.7	94.6	49.7	12.0	3.5	12.4	–30.2	–27.5	–37.6	–60.4	100.6
USA	36.6	81.0	33.7	5.8	6.8	14.8	–14.7	–13.7	–24.2	–56.6	77.3
Mexico	57.0	75.0	20.6	8.0	5.0	13.8	–13.6	–16.0	–33.0	–65.0	70.8
Argentina and Brazil	6.0	4.3	28.6	2.3	13.4	–0.9	–20.6	–20.8	–27.8	–36.3	8.5
Rest of Latin America	22.3	43.8	11.7	4.6	10.7	0.2	–34.7	–27.5	–40.3	–61.6	34.9
EU 25 and EFTA	72.1	111.4	38.1	9.1	4.9	6.4	–24.5	–28.0	–37.1	–62.2	44.2
Former Soviet Union	16.5	50.2	8.2	17.2	–10.6	5.9	–26.3	–9.9	–26.0	–30.4	10.1
Middle East and N. Africa	30.2	173.0	2.9	–1.6	7.1	–2.6	–38.2	–32.8	–47.8	–63.9	38.7
Sub-Saharan Africa	17.0	32.2	12.4	6.6	13.2	7.1	–45.8	–41.1	–50.0	–70.4	30.1
Rest of World	45.1	155.0	15.2	4.3	–7.0	–3.8	–30.1	–25.3	–31.7	–45.7	125.4

Source: Authors' simulations with modified GTAP model; see details in text.

Concluding Remarks

This study highlights the very sharp differences in the trade patterns of India and China and assesses the implications of rapid growth and structural change on the trade patterns of China, India and the rest of the world. The paper shows that services exports are roughly twice as important for India as for China. Within merchandise trade, both are dependent on manufactures, with China much more strongly integrated into production networks through trade in parts and components. However, their product mixes are radically different, with only one product—refined petroleum—appearing in the top 25 products for both. Each country has undergone quite radical trade reform.

Our baseline projections suggest that there is scope for China and India to expand their exports and imports significantly without hurting each other's development prospects or those of other economies. However, improved growth in China and India will intensify competition in global markets for manufactures, and the manufacturing industries in many countries will be affected negatively. Improvement in the range and quality of exports from both countries has the potential to create substantial welfare benefits to the world, and to each other, and to act as a powerful offset to the terms-of-trade losses otherwise associated with rapid export growth. Without efforts to keep up with China and India, some countries may see further erosion of their export shares and high-tech manufacturing sectors. As China starts producing more sophisticated and new variety manufacturing products, there will be opportunities for other countries to expand their processing industries.

Efficiency improvements in China's and India's high-tech and heavy industries have much stronger trade effects than a uniform efficiency improvement of the same magnitude. This scenario will lead to severe competition in the high-tech sectors and entail substantial structural change with China and India displacing other countries in markets for high-tech products, but leaving space for other countries to increase production of light manufactures.

Some caveats are important. First, these are thought experiments not precise predictions. While they show that China and India's growth could be beneficial to nearly all other countries, and that the impact on particular countries will depend on those countries' own trade, production and consumption profiles and on the patterns of growth in China and India, they offer only the broadest indications of likely effects. Likewise, our results strongly suggest that benefiting will depend on adapting to the new opportunities and challenges. But by themselves these results cannot dictate the necessary adjustment. They must be supplemented with sector-specific case studies both to identify the emerging patterns in general and to consider particular products. Our aggregation hides important information on intra-industry trade in components as part of the global production sharing arrangements.

Moreover, note that the adjustment costs of this economic transformation could be substantial, but are not estimated in this paper. Finally, recall also that the paper focuses on the static trade aspects of growth in China and India; it ignores important investment-growth linkages that may amplify the effects discussed here and affect the welfare results.

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