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, which will impoverish not just China and India but also other developing economies? 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? Will the industrial countries face ever-more-sophisticated Chinese and Indian exports that destroy the jobs of skilled workers in today's advanced economies? 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? Although 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 at least to attenuate these stark scenarios of relentless competition. One development 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 development is the growth of global production sharing, where part of the production process is undertaken in one economy, and subsequent stages are performed in another (Ando and Kimura 2003). This process, fueled by improvements in transport and trade facilitation and in communications, and frequently involving foreign direct investment links,

makes participants beneficiaries rather than victims of improvements in their partners' competitiveness. The third development is recognition that trade expansion by developing countries typically involves expansion in the range of products they export, improvements in product quality, and exporting 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 World Trade Organization (WTO) (Ianchovichina and Martin 2004), despite increased competition in third markets.

Another factor that is likely to make the implications of export expansion from large developing countries, like the Giants, more favorable for each other and for other developing countries is that such export expansion seems to involve sharp increases in the range of products made and in the quality of those goods. Hummels and Klenow (2005) found that two-thirds of the growth of exports comes from expansion in the number of products made, 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 factor lowers the effective price of these goods. Whether these forces are sufficient to reverse the price-depressing impact of increased exports, however, is ultimately an empirical question whose answer depends on the way in which the growth of China and India evolves.

Much can be learned by examining developments in the trading patterns of these countries. Although both economies 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, whereas India has focused much more on exports of intermediate inputs. India's exports are frequently of capital and skill-intensive goods, whereas China has emphasized exports of labor-intensive goods—although these goods are increasingly sophisticated (Rodrik 2006b). If the past is a good guide to the pattern of development (as assumed

by Kochhar et al. [2005]), 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.

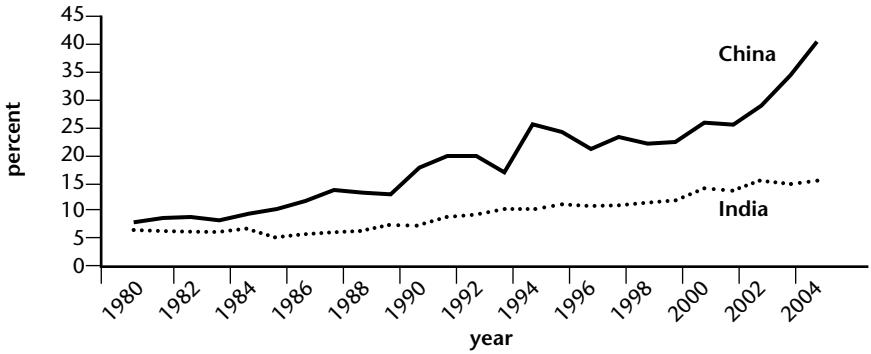
However, there have been major recent reforms in both Giants, whose impact may not have been fully felt. As noted in chapter 2, India now appears to be moving toward deeper integration into systems of global production sharing—partly by following China's earlier pattern of using duty exemptions and free 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 these changes into account, and doing so may require adjustments by (as well as creating opportunities for) other developing countries.

No analysis of potential future developments can be undertaken reliably without an examination of the current situation, and how that situation came to be. Therefore, this chapter first reviews some key features of China's and India's trade, particularly the recent rapid growth of exports; the changing relative importance of goods and services; and changes in the composition of exports within the broad groups of merchandise and services. With that overview as background, we then use a global economywide modeling approach to take into account all of the potential effects and to complement the industry-focused studies presented in chapter 2. First we will examine the implications of the reforms under way in India to see if they might result in greater competition between China and India. Then we use model-based simulations to generate a baseline for growth and to examine the potential implications of higher-than-expected growth rates in these two economies. From that baseline, we consider first the impact of more rapid economywide growth in China and India. Finally, we examine the implications of two different types of growth—that is, growth focused on the relatively sophisticated products discussed in chapter 2 and growth driven by increased accumulation of physical and human capital.

Developments in Trade

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

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



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

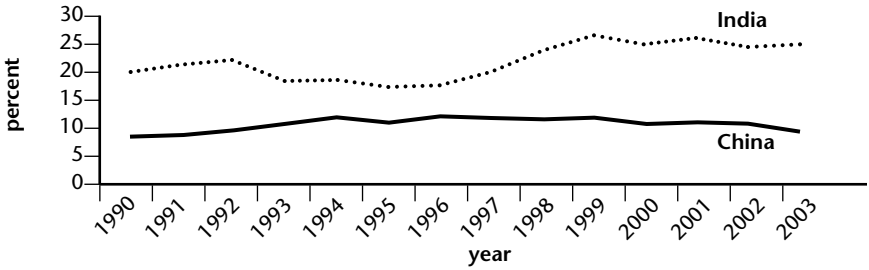
processing arrangements were broadened beyond the initial special economic zones in China, the share of exports in China's GDP began to climb sharply.[1] With the sharp devaluation of the official exchange rate in 1994, the share of exports in GDP rose and then stabilized or declined in the mid-1990s. From 2001 to 2004, China's export share rose dramatically (to approximately 40 percent— more than two and a half times India's export share). Even the upward GDP revision by 17 percent in 2004, which raised the importance of services relative to goods (see World Bank Office 2006), left 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 importance of services relative to merchandise exports (Panagariya 2006). Figure 3.2 shows that the share of commercial services in total exports of goods and services has been much higher in India than in China, not only since the rapid expansion on the export of computing services around 2000 but for the entire period

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 subsequently were broadened to a wide range of enterprises (World Bank 1994) that typically did not receive the economically questionable and (now WTO-inconsistent) income tax concessions traditionally available in the zones.

Figure 3.2 Share of Commercial Services in Total Exports



Source: World Bank Development Data Platform.

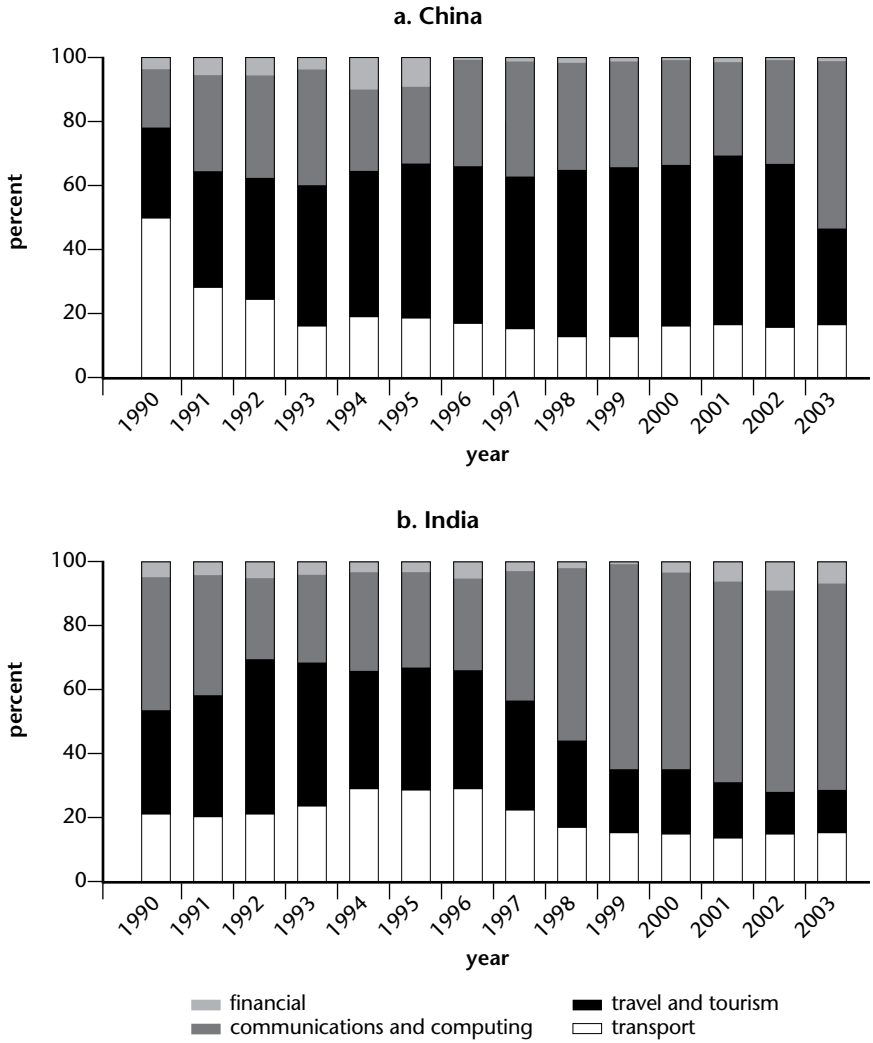
since 1990 during which comparable estimates are available. The share of services in India's exports began around 20 percent, more than twice as high as China's share. India's share declined until the late 1990s when again it began to rise sharply. Since 2000, services have accounted for more than a quarter of India's exports, whereas the share of services in China's exports has declined to less than 10 percent of total exports (although China's exports of services have been growing rapidly in absolute terms).

There also have been contrasting patterns within exports of services. As is evident in figure 3.3a, the composition of China's exports of services has changed significantly, with the relative importance of transport services declining and the importance of travel services (including tourism) increasing substantially. Travel and tourism services rose to approximately 50 percent in 2002, although they appear to have declined in 2003. The share of communication and computing 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 approximately 40 percent in 1990 to roughly two-thirds in recent years. Mattoo, Mishra, and Shingal pointed out that this rise was associated with a rapid increase in such activities as business process outsourcing and computing services. However, Nikomborirak (2006) showed an explosive growth rate in software services, with these exports growing twelvefold between 1997 and 2003. The importance of both transport and travel services declined, relative to the extremely dynamic communications and computing

services. Figure 3.3b shows that financial services also were a small but stable share of services exports (approximately 3 percent of the total).

Figure 3.3 Composition of Services Exports



Source: International Monetary Fund balance of payments statistics extracted from the World Bank's Development Data Platform.

Merchandise Trade

The merchandise exports of both China and India are dominated by manufactures (World Bank 2003a). The composition of these manufactures and the approach to their production, however, appear 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 Categories classification system. Because of the very different importance of fuel imports and exports to the two countries, these data are presented only for nonfuel products.

If we look first at the import data for 2004, we find that 63 percent of China's nonfuel imports are of manufactured intermediate inputs, whereas these account for 60 percent of India's imports. Only when we consider imports of parts and components do we see the sharp distinction that we might expect between the two countries, given the discussions on global production sharing. These imports accounted for 31 percent of China's merchandise imports, compared with only 12 percent in India.

On the export side, the importance of final goods in their exports differs greatly between the two Giants. Although 61 percent of China's nonfuel exports are classified as final goods, only 40 percent of India's exports are so clas-

Table 3.1 Composition of Nonfuel Imports and Exports by Broad Economic Classification, 1992 and 2004

	China		India	
	Imports	Exports	Imports	Exports
1992				
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
2004				
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

Source: United Nations Commodity Trade Statistics database, accessed via the World Bank's World Integrated Trade Solution (WITS) software.

sified, with 52 percent being intermediate manufactured goods, and 8 percent nonfuel primary products.

Between 1992 and 2004, the major change evident in the data in table 3.1 is the dramatic increase of China's trade in parts and components. In 1992, these items accounted for only 15 percent of nonfuel imports; by 2004, this share rose to 31 percent. In contrast, this share in India declined from 15 to 12 percent over the same period. Although discussions of China's role in production networks tend to focus on its imports of components, there also has been a substantial increase in the importance of parts and components in China's exports, with this share rising from 5 to 17 percent. By contrast, in India this share rose only from 5 percent to 6 percent of total nonfuel exports. These data are consistent with the widespread perception that India remains much less integrated in global production networks than is China, despite the existence of Indian policies to allow duty-free access to imported components for use in the production of exports (World Bank 2004b).

As Hausmann 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 China and for India at the six-digit level of the original Harmonized System (HS), the so-called 1988–92 version. These exports, which account for 38.4 percent of China's and 58.4 percent of India's merchandise exports, are almost mutually exclusive sets. Only one product—refined petroleum—appears on both lists, accounting for 0.9 percent of China's exports and almost 10 percent of India's exports. 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 nonelectronic 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 enable us to assess the implications of higher growth rates in China and India. To do that, we used a modified version of the standard Global

Table 3.2 Top 25 Exports for China and India, 2004

China			India		
Product	**HS code**	**Share (%)**	**Product**	**HS code**	**Share (%)**
Computer parts and accessories	847330	4.0	Diamonds, nonindustrial	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	Iron ores and concentrates	260111	4.5
Parts for radio-telephony equipment	852990	2.3	Semi-milled or wholly milled rice	100630	2.6
Monolithic integrated circuits	854211	1.9	Other organic compounds	294200	2.1
Storage units for computers	847193	1.5	Flat-rolled products, zinc-plated	721049	2.0
Video recording equipment (non-tape)	852190	1.5	Medicaments, packed for retail sale	300490	1.9
Optical devices, appliances	901380	1.4	T-shirts, singlets, and other vests	610910	1.4
Video tape recorders	852110	1.2	Women's or girls' blouses or shirts, cotton	620630	1.4
Color television receivers	852810	1.2	Frozen shrimp and prawns	030613	1.5
Cargo containers	860900	1.1	Men's or boys' shirts of cotton	620520	1.3
Electric converters, static	850440	0.9	Imitation jewelry of base metal	711719	1.2
Parts and accessories of apparatus	852290	0.9	Furnishing articles, non-knitted	630492	1.2
Petroleum oils, etc. (excl. crude)	**271000**	**0.9**	Oil-cake and solid soybean residues	230400	1.1
Coke and semi-coke of coal	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 and accessories	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	740311	0.9
Rubber footwear	640299	0.8	Agglomerated iron ores and concentrate	260112	0.9
Travel goods of plastic or textiles	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, such as CDs	851999	0.7	Woven fabrics of high-tenacity yarn	540710	0.8
Jerseys, pullovers of manmade fiber	611030	0.7	Collages and similar decorative plaques	970190	0.8
Total	n.a.	38.3	Total	n.a.	58.4

Source: United Nations Commodity Trade Statistics database, accessed via the World Bank's World Integrated Trade Solution (WITS) software.
Note: CD = compact disc; HS = Harmonized System. Harmonized System codes align with the 1988–92 version; n.a. = not applicable.

Trade Analysis Project (GTAP) model to assess the potential implications of rapid growth and structural change in China and India.[2] Unlike less formal approaches to projection, a global applied general equilibrium model such as GTAP has the advantage 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 demand for a factor in each country/region equals its supply. These accounting relationships and the behavioral links in the model constrain the outcomes in 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 a natural resource factor in some sectors are included in the analysis. The model incorporates 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 database following the methodology developed by Ianchovichina (2004). 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

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

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 (2004) documented the approach used to introduce duty exemptions into the GTAP model and showed 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 database were aggregated into 26 sectors and 24 regions, based on the importance of these sectors and regions as China's and India's trade partners—the sectors and regions are shown in various tables below. 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 presimulation essentially updates the database for 2001 to 2005, the starting point of our projection simulations. It also includes the removal of textiles and apparel quotas on exports to Canada, the European Union, and the United States under the WTO's Agreement on 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 that resulted from WTO accession reforms are captured using productivity shocks, as in Ianchovichina and Martin (2004).

Although the examination of trade data above suggests that there is surprisingly little overlap in the export mix of China and India, this situation might change with 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 participate fully 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 after accession (Ianchovichina and Martin 2004, p. 11), and 20 percent reduction in international transport costs to and from India.[3]

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

As is evident in table 3.3, this simulation sharply expanded India's exports of manufactures, with particularly large increases in exports of machinery and equipment and of electronics. The expansion in India's exports of products such as textiles and apparel, however, was smaller than the average expansion, thus 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 with the share in India's exports before and after the policy reforms. In the graph it does not appear that these reforms will expand greatly 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.

The second simulation explores the strong growth prospects in China and India in the context of world economic expansion over the period 2005–20.[4] This process provides a baseline from which we can assess the impact of an additional annual growth of 2.1 percentage points in China and 1.9 percentage points in India in the period 2005–20. Using the methodology for assessing potential growth effects of reform presented in Ianchovichina and Kacker (2005), we concluded that these were potentially feasible increases 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 resulting from increases in the stock of particular factors. These assessments of upside potential may be 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 account fully for the potential benefits of reforms in services trade (Nikomborirak 2006), which Markusen, Rutherford, and Tarr (2005) found to be potentially very large.

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 2005–15 in the World Bank's Global Economic Prospects database at the time the analysis was undertaken. The methodology for constructing 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 central projections to 2020, used in chapter 1 of this volume.

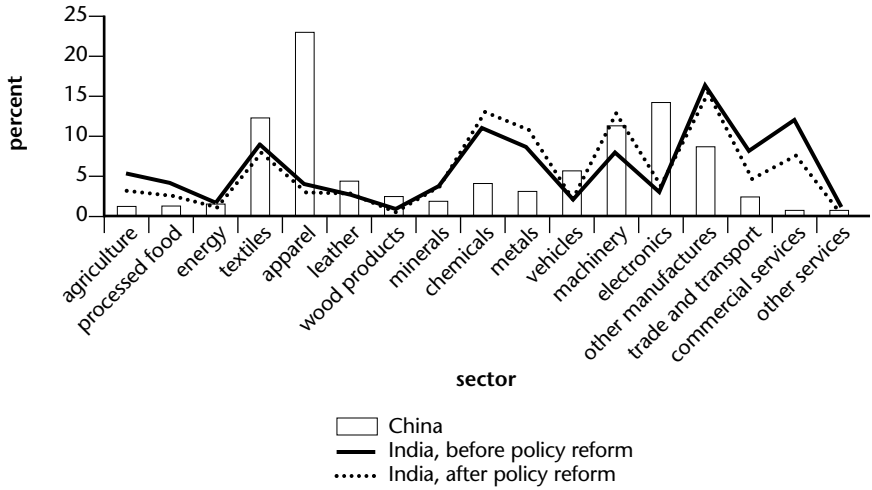
5. Ianchovichina and Kacker (2005) presented growth scenarios for all developing countries using a cross-country growth model estimated by Loayza, Fajnzylber, and Calderon (2005).

Table 3.3 Impact of India's Integration with the World Economy, 2020
Percent change

Product	Output	Producer price	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 (EV in $ 2001)		4,989	Per capita utility	0.91
Real returns to	Capital	3.26	Skilled labor	3.88
Real returns to	Land	1.70	Unskilled labor	3.28

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

Figure 3.4 Export Shares in China and India, 2001



Source: GTAP-6 database and authors' simulation.

We then assess the impact of strong growth on the quality and variety of exports from China and India. Quality improvements in exports recently have been identified as a key influence on the performance of rapidly growing exporters, such as China and India (Hummels and Klenow 2005). We follow Hummels and Klenow (2005), who observed that larger economies export more in absolute terms than do smaller economies and analyzed 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 1.00 percent increase in income levels, despite increases of 0.34 percent in the quantities exported. Furthermore, they found that 66 percent of the export growth resulting from an increase in income arises from exports of new products.[6] This specification provides smaller benefits to trading partners from in-

6. Hummels and Klenow (2005) found that the contribution of the extensive margin varies with the levels of aggregation. At the six-digit level, exports of new varieties account for 66 percent of the country differences in exports. At the one-digit level, the variety effect accounts for 15 percent of the country differences in exports.

creased variety than Krugman-style new economic geography models (see Puga and Venables 1999), but provides additional gains from improved quality.

In the standard modeling framework in which we operate, the number of goods cannot 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 (2005) 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

$$P^* = \left[N \cdot \left(P/\lambda\right)^{(1-\sigma)}\right]^{(1/(1-\sigma))}, \tag{3.1}$$

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 formula we can calculate the change in the effective price corresponding to a change in real GDP. We show that 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 15 years, we undertake three simulations that are alternatives to the preceding neutral high-TFP scenarios and that enable us to investigate whether China's and India's export growth might create more competition for developing or 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 presented in 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 that could be expected to shift the composition of China's exports toward goods more intensive in human

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

and physical capital and so more competitive with the exports of the industrial countries. We first assess the effects of a 2 percent annual increase in the stock of physical capital in China and India. Then we compute the effects of a 2 percent 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, with perfect mobility of skilled and unskilled labor between sectors and none between regions. Because 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 database. In all simulations the trade balances as shares of GDP were fixed for our focus countries (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]

Trade Effects of Global Growth, 2005–20

The projections for such key variables 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 2005–20. 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). 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 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.

The rate of unskilled workforce growth in China and India is projected to slightly outpace population growth rates over the projection period, whereas skilled labor and physical capital are projected to grow at much higher rates than is unskilled labor (table 3.4). 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

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.

implications for the structure of output—switching it toward capital-intensive products—and for factor rewards. On the demand side, the consumption profile changes to reflect the effects of growing per capita incomes coupled with nonhomothetic preferences, implying declines in the share of expendi-

Table 3.4 Output, Factor Inputs, and Population Projections, 2005–20
Average annual 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, Rep. of	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 Southeast 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
United States	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
EU25 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
LICs	*4.7*	*1.7*	*3.1*	*4.2*	*1.5*
MICs	*4.5*	*1.0*	*3.1*	*3.9*	*0.8*
HICs	*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.
Note: EFTA = European Free Trade Association; EU = European Union; HIC = high-income country; LIC = low-income country; MIC = middle-income country.

ture 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.

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, vegetables, fruits, and other crops). Energy prices rise by 41 percent (or 2 percent per year) over the 15 year period considered, 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 no faster than efficiency in other activities. The prices of mineral products decline, indicating that fixed natural resource factors are a small share of the cost of output in this sector (table 3.5) and the rise in its price is offset by increased productivity in their use. Liberalization of the textiles 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 manufactured goods and services fall relative to those of food, energy, and minerals. World prices, on average, fall relative to the factor price numeraire in the period 2005–20 (table 3.5) because of increased productivity.

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, although 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 significantly for the two countries because India's population grows at twice China's rate.

Impact of Improvement in Growth and Quality of the Giants' Exports

The effects on key variables of higher growth in China and India and of higher growth with and without increased variety and quality of exports are pre-

9. The disparity in export and import growth does not imply an increasing trade surplus because prices change, including declines in the price of the Giants' manufactured exports.

sented 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 on whether the income increases in China and India result in growth of the same exports ("growth"), or whether export growth is accompanied by

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

percent

Sector	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*
All sectors	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.

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

Trading partner	Welfare		Output (% change)	Exports (% change)	Imports (% change)
	2001 US$ billions	% change			
Australia and New Zealand	285	70.3	66.3	58.2	86.1
China	1,965	146.2	161.9	187.8	167.7
Japan	936	24.5	27.6	87.6	65.8
Korea, Rep. of	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 Southeast 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
United States	5,838	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
EU25 and EFTA	3,191	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	1,028	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
LICs	*1,126*	*99.6*	*101.4*	*115.1*	*113.8*
MICs	*5,249*	*98.1*	*97.3*	*104.3*	*107.5*
HICs	*11,466*	*47.8*	*49.8*	*57.8*	*58.7*
World	17,841	58.5	60.0	71.7	71.7
LICs (excl. India)	*495*	*84.3*	*80.7*	*70.7*	*90.7*
MICs (excl. China)	*3,284*	*81.9*	*75.6*	*73.0*	*87.0*

Source: Authors' simulations with modified GTAP model; see details in text.
Note: EFTA = European Free Trade Association; EU = European Union; HIC = high-income country; LIC = low-income country; MIC = middle-income country.

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

Region	Welfare				Exports		Terms-of-trade effects	
	Growth		Growth and quality					
	2001 $ millions	Percent	2001 $ millions	Percent	Growth (%)	Growth and quality (%)	Growth (2001 $ millions)	Growth and quality (2001 $ millions)
Australia and New Zealand	2,743	0.45	5,568	0.91	–0.06	0.72	2,652	5,240
China	1,145,733	39.9	1,253,425	43.6	29.41	55.34	–48,229	38,159
Japan	6,588	0.16	17,276	0.42	2.44	4.80	9,186	18,946
Korea, Rep. of	829	0.11	7,451	1.00	3.45	5.83	–957	4,646
Hong Kong and Taiwan (China)	3,811	0.53	12,749	1.78	1.94	3.78	4,260	13,307
Indonesia	791	0.27	1,822	0.61	0.18	–0.10	723	1,907
Malaysia	1,555	0.87	3,636	2.03	0.27	0.02	1,570	3,698
Philippines	–627	–0.57	–994	–0.89	–0.26	–3.19	–559	–583
Singapore	–2,280	–1.68	–458	–0.34	4.92	6.50	–159	2,019
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 Southeast Asia	424	0.41	603	0.58	–2.85	–2.11	382	541
India	361,740	33.7	394,490	36.7	28.89	47.05	–12,379	10,661
Rest of South Asia	–962	–0.35	–159	–0.06	1.60	2.98	–1,110	–517
Canada	2,767	0.32	5,182	0.59	–0.91	–1.43	2,634	4,736
United States	124	0.00	20,262	0.15	0.67	2.87	479	20,671
Mexico	535	0.06	1,000	0.11	–1.33	–2.37	175	489
Argentina and Brazil	1,410	0.13	3,134	0.28	–0.06	0.45	1,072	2,570
Rest of Latin America	3,015	0.36	4,703	0.56	–0.48	–0.26	2,652	4,251
EU25 and EFTA	–4,306	–0.04	16,893	0.18	–0.14	–0.18	3,013	22,183
Former Soviet Union	9,958	1.37	12,914	1.77	1.34	2.34	9,750	12,039
Middle East and North Africa	23,780	1.31	29,108	1.60	–1.50	–1.50	22,592	27,568

continued on next page

Table 3.7, *continued*

Region	Welfare				Exports		Terms-of-trade effects	
	Growth		Growth and quality					
	2001 $ millions	Percent	2001 $ millions	Percent	Growth (%)	Growth and quality (%)	Growth (2001 $ millions)	Growth and quality (2001 $ millions)
Sub-Saharan Africa	4,904	0.96	7,676	1.50	–0.24	0.80	4,004	6,439
Rest of the world	–688	–0.34	–500	–0.24	1.46	2.37	–596	–282
LICs	*366,065*	*17.9*	*402,775*	*19.7*	*14.04*	*23.44*	*–9,039*	17,592
MICs	*1,184,823*	*13.1*	*1,308,743*	*14.5*	*10.70*	*20.39*	*–11,707*	90,130
HICs	*10,275*	*0.03*	*84,923*	*0.28*	*0.79*	*1.73*	*21,109*	91,749
World	1,561,163	3.8	1,796,437	4.3	4.4	8.5	363	199,472
LICs (excl. India)	*4,325*	*0.46*	*8,286*	*0.87*	*–0.07*	*0.77*	*3,339*	*6,931*
MICs (excl. China)	*39,091*	*0.61*	*55,315*	*0.87*	*–0.18*	*–0.16*	*36,522*	*51,971*

Source: Authors' simulations with modified GTAP model; see details in text..
Note: EFTA = European Free Trade Association; EU = European Union; HIC = high-income country; LIC = low-income country; MIC = middle-income country.

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 dollars.[10]

A positive efficiency gain in China and India resulting in annual growth that is, respectively, 2.1 and 1.9 percentage points higher than in the baseline will translate into a welfare gain in 2020 of $1.15 trillion (40 percent) for China and $362 billion (34 percent) for India, relative to the baseline. The volume of exports increases by 29 percent from both China and India—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 approximately $48 billion for China and $12 billion for India. Such a loss is expected in a model using the Armington assumption of national product differentiation.

The welfare changes for other countries are relatively small. Gains for most of China's and India's trading partners in the Asia-Pacific region are modest. High-income countries gain, except for those in the European Union 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 increases imports by a similar amount. Some middle- and low-income countries (such as the Philippines, Thailand, and some other countries in South Asia) will lose as competition with China and India negatively affects their terms of trade in third markets.

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

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. Results of improved growth in China alone are available from the authors on request; they do not differ much from the results of improved growth in China and India, except that India's apparel industry contracts by 12 percent whereas the impact on other industries is negligible.

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

percent

Region	Textiles	Apparel	Leather	Wood	Minerals	Chemicals	Metals	Auto	Machinery	Electronics	Other
Australia and	–6.9	–8.6	–8.5	–1.3	–1.1	–0.8	–4.1	–2.4	–6.7	–5.9	–8.4
New Zealand	–15.3	–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, Rep. of	–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	–5.9	–7.3	–7.1	–2.2	–1.7	–4.8	–5.0	–3.6	–5.7	–2.9	–15.8
and Taiwan	1.7	–1.0	–4.3	–2.5	–3.9	–2.2	–8.8	–10.0	–10.7	–10.6	–26.3
(China)											
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 South-	–6.3	–3.6	–3.4	0.7	0.7	–0.5	–1.2	–0.4	–3.5	–0.5	–0.8
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 South	–2.7	–12.4	–1.2	0.7	–1.6	–0.4	3.8	–1.5	–3.2	–0.2	–6.4
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
United States	–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
EU25 and EFTA	–5.6	–9.7	–5.0	0.0	–0.4	–1.8	–0.7	–0.4	–2.4	–2.5	–3.9
	–9.9	–16.8	–8.5	0.8	–0.5	–3.0	–1.3	–1.3	–5.0	–11.7	–6.6
Former Soviet	–2.6	–4.7	–1.4	–0.5	–1.9	–1.1	–3.3	–0.3	–4.4	–3.1	–3.2
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 and	–8.6	–18.6	–2.6	–0.7	–0.5	–5.8	–6.6	–3.2	–8.3	–7.2	–9.1
North 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 the	–2.9	–7.7	–1.7	1.1	–0.1	0.0	–1.2	–0.3	–1.9	–1.8	–14.3
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.
Note: EFTA = European Free Trade Association; EU = European Union. For each region, numbers in the first row are results for the case of improved growth in China and India; numbers in the second row are results for the case of improved growth and quality exports in China and India.

and a contraction of the textile industries in other countries, relative to the baseline. Indonesia and Vietnam experience the largest contractions—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 hit hardest as their output declines by nearly a fifth (19 percent). Similar declines will affect the light manufacturing industry (leather and other manufactures), although the expected declines are much smaller than the declines in apparel. With the exception of the electronics industry in Singapore and Thailand, competition from China and India leads to contractions of the electronics industries in other countries. Machinery and equipment production also will relocate to China and India, thereby reducing the size of these industries in other countries. The expected expansion of automobile production in China and India has a small negative effect on automobile production in other countries, except in Mexico and Thailand.

But not all news will be bad. The boost in China's and India's wood processing industries has positive spillover effects via increased demand for intermediate wood products from Indonesia, the Republic of Korea, Malaysia, Thailand, and other countries in East and South Asia. Similarly, growth in China and India will fuel demand for chemicals from Malaysia, the Philippines, and Thailand; for mineral products from Vietnam and other Southeast Asian countries; and for metals from some countries in East Asia and South Asia (table 3.8). Moreover, in all countries losing manufacturing output, other sectors (not reported in the table) expand as factors move into the farm and services sectors.

Adding to the growth scenario improvements in the variety and quality of exports from China and India 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 because they can import higher volumes from these two countries at lower effective prices and they can experience greater demand for their exports from China and India. The biggest beneficiaries are China and India, of course, because their welfare gains are increased by 3.7 percent and 5.0 percent of initial income levels by the quality and variety effects, raising their overall gains to 44 percent and 37 percent, respectively. In one case—the Philippines—the welfare loss from higher growth in China and India worsens as the Giants improve the quality of their exports and expand output

of electronics, machinery, and equipment. 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 volume of trade between China and India increases more than does either country's trade with the rest of the world, thereby deepening the trade links between the two Asian Giants. Most countries have increases in exports as a result of the Giants' growth and quality improvements, but some suffer losses (most notably, Mexico, the Philippines, Vietnam, and others in Southeast Asia). Middle-income countries other than China suffer an absolute loss of exports.

Pressure on middle-income developing countries to raise the quality of their manufactures will increase as a result of improved-quality Chinese and Indian exports. 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; in the machinery and equipment industries in all countries except the Philippines; and in the textiles, apparel, and other light manufacturing sectors in 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, minerals, chemicals, and metals), thus leaving space for other countries to expand these industries (table 3.8).

Impact of Variety

Our simulations of growth and quality improvement include most of the broad features of new economic geography models, such as Puga and Venables (1999). Improved variety and quality of exports from China and India raise welfare, and lower production costs in their trading partners, in the same way that increased variety does in the Puga-Venables model—that is, through a reduction in the effective price of imports from the Giants. In our formulation, trading partners also face increased competition in third markets, reducing welfare in their competitors. Induced increases in import demand from China and India improve the terms of trade of their trading partners in our formulation, as in Puga and Venables. One difference is that increases in exports from trading partners do not increase the number of varieties supplied by these countries, and hence do not generate benefits from the preference for

variety assumed in the new economic geography models. For trading partners where welfare declines but exports increase (Singapore, the rest of South Asia, and the rest of the world), our formulation omits a positive effect that may reverse the very small estimated overall negative impact. For the Philippines, however, exports decline, so this channel would be unlikely to reverse the adverse welfare impact arising from greater competition in third markets.

Alternative Paths to Improved Growth

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. This efficiency improvement in China and India, however, entails substantial structural change (table 3.9). The Giants become much more powerful players in the favored sectors, and world trade grows much faster than envisaged under the scenario of neutral 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 the United States), and India and its closest partners in South Asia grow as well. The huge effects on trade arise 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.

In 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 3.9). 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 sectors; exports from high-income countries decline marginally. Most notable is the decline of exports from the Philippines (18 percent) and Thailand (10 percent), including declines of 65 percent and 53 percent, respectively, in the electronics sector. All economies experience structural change of a similar magnitude. In the simulation with neutral productivity increases across sectors, the growth and quality scenario created increased competition in a number of sectors, and reduced other countries' output levels relative to the baseline in many cases. In almost all cases, however,

Table 3.9 Industry Effects of Improved Sectoral Productivity Growth in China and India, Relative to Base, 2020
percent

Region	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, Rep. of	61.4	40.5	125.8	51.2	27.4	47.0	–32.2	–29.5	–36.2	–54.5	104.2
Hong Kong and 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 South-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
United States	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

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Table 3.9, *continued*
percent

Region	Textiles	Apparel	Leather	Wood	Minerals	Chemicals	Metals	Auto	Machinery	Electronics	Other
EU25 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 North 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 the 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.
Note: EFTA = European Free Trade Association; EU = European Union.

output continues to rise strongly, relative to its level in 2005. When technological progress is focused in a few key, trade-oriented sectors, on the other hand, the impacts on output are much more variable, relative to the baseline projection. The electronics sector is the most likely to contract, relative to 2005 levels, with declines in most countries associated with extremely rapid expansion in China and India. Outputs of metals and automobiles are projected to increase in absolute terms in most regions, with noticeable declines, relative to 2005 levels, only in Australia/New Zealand (17 percent) and Hong Kong and Taiwan (China). Output of other machinery is projected to come under downward pressure in sub-Saharan Africa and in the high-income countries, where a decline in output of 21 percent is projected for the European Union, relative to 2005 levels. The results from this experiment show just how strongly the impacts at a sectoral level depend on the sectoral pattern of productivity growth in the Giants.

Improved growth through accelerated accumulation of capital (2 percentage points faster than the baseline in China and India) modestly affects real incomes in other regions. 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. Because the capital-intensive sectors are experiencing efficiency gains in the previous scenario, the export and sector-specific changes are broadly similar but smaller in absolute value than the ones presented for the case of improved efficiency of China's and India's metals, electronics, machinery and equipment, motor vehicles, and commercial services. In terms of total exports, capital accumulation impinges relatively more heavily on other low-income countries than on other middle-income countries in this exercise than it does in the previous exercise, and high-income countries record gains rather than losses (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 does improved growth through accelerated accumulation of physical capital (table 3.10). This occurs because the share of skilled labor is much lower than the share of capital in total factor endowment. The patterns over countries are similar to those of physical capital accumulation, but they impinge relatively more heavily on middle-income countries.

Table 3.10 Export Volume Changes under Various Scenarios, Relative to Base, 2020

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, Rep. of	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 Southeast 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
United States	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
EU25 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
LICs	*35.50*	*16.51*	*3.25*
MICs	*32.42*	*8.33*	*1.88*
HICs	*-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.
Note: EFTA = European Free Trade Association; EU = European Union; HIC = high-income country; LIC = low-income country; MIC = middle-income country.

Summary and Conclusions

This study highlights the very sharp differences in the trade patterns of China and India, and assesses the implications of rapid growth and structural change on the trade patterns of those economies and of the rest of the world. The chapter explains that services exports are roughly twice as important for India as for China. Within merchandise trade, both countries are dependent on manufactures, with China much more strongly integrated into production networks through trade in parts and components. However, the Giants' 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 most other economies. Improved growth in China and India will intensify competition in global markets for manufactures, however, and the manufacturing industries in many countries will be affected negatively. Improvement in the range and quality of exports from both countries may create substantial welfare benefits to the world and to the Giants, and may act as a powerful offset to the terms-of-trade losses otherwise associated with rapid export growth. Lacking 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 manufacturing products, there will be opportunities for other countries to expand their processing industries. We take into account increases in the variety and quality of exports from China and India, but, based on the most recent evidence (see Hummels and Klenow 2005), we specify export growth as arising only partially at the extensive margin (that is, through increases in the number of varieties exported). However, we augment these gains with the important Hummels-Klenow finding that the quality of existing exports rises with economic growth. One feature of the new economic geography that we do not take into account is potential gains from increases in output variety in the additional partner exports induced by the growth of these high-growth economies (see, for example, Puga and Venables 1999).

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 In-

dia 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, what we have presented here are thought experiments, not predictions. Although they show that China's 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 probable effects. Likewise, our results strongly suggest that benefiting will depend on adapting to the new opportunities and challenges. 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 intraindustry trade in components as part of the global production sharing arrangements.

Moreover, note that we have not estimated the adjustment costs of this economic transformation—and these costs could be substantial. Finally, recall that the chapter focuses on the static trade aspects of growth in China and India; it ignores important investment–growth links that may amplify the effects discussed here and may affect the welfare results.