India's Trade Policy Choices

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Overview of the Report

India is a country of contrasts, marrying huge potential with profound and chronic challenges. Its recent high economic growth rates have improved the prospects that the world's second most populous country will be able to raise incomes broadly for its 1.1 billion people and contribute to global economic stability and growth. And yet India remains the largest reservoir of poverty in the world, with 300 million poor people, according to the national poverty line, and more than 800 million people surviving on less than $2 per day, an international measure of poverty. Almost two-thirds of Indians still live in rural areas and well over half of the population works in the agricultural sector, where growth has stagnated at less than 3 percent for the last decade. By contrast, India's world-renowned high-technology service sector has grown strongly in recent years but still employs less than 1 percent of the workforce.

Trade Policy Challenges

As India engages more deeply with the global economy, its policy makers face the challenge of devising trade policies that take into account the stunning diversity of its economy and people. While taking advantage of opportunities offered by increased economic integration, they must manage the challenges that a more open economy will pose for the majority of Indian workers and farmers. The country's current commitments on trade policy through institutions such as the World Trade Organization (WTO) are modest and leave broad policy discretion over tariffs and other trade measures in the hands of national policy makers. As India pursues a new multilateral trade agreement and numerous bilateral and regional trade pacts, it is moving into uncharted territory, where the decisions it makes will constrain its existing policy space and have a significant impact on the evolution of its economy.

This study seeks to contribute to the knowledge base upon which the Indian government and public and the country's international trading partners can

evaluate the difficult policy choices the country faces in the realm of trade. The study uses a global trade model and a national model of the Indian economy to explore the effects of a range of possible trade choices on the economy, its sectors, its workforce, and its households.

The study simulates potential outcomes of the Doha Round at the WTO and several possible bilateral free trade agreements (FTAs), including a trade deal with the European Union (EU) that is currently under negotiation and possible trade pacts with the United States and China. It also considers other potential effects of closer integration with the global economy by simulating changes in the global prices for rice and wheat, the two most important food grains in India. World agricultural price changes would affect India differently if it binds its tariffs at lower levels.

The Main Results of the Study

Of the potential trade pacts simulated in the study, a multilateral agreement at the WTO has a much larger impact on the Indian economy than bilateral trade agreements with the EU, the United States, or China. Overall, India's real income would increase by about six times as much under a Doha agreement compared with the gain from the most beneficial bilateral agreement. Still, the gain would amount to only about $1.2 billion, or one-quarter of one percent of the current economy. Exports would increase by about 4 percent, while imports would grow by about 3 percent. Domestic production would increase by about $4.5 billion, or one-half of one percent. A Doha agreement along the lines of the study's simulation would be positive, albeit quite modest, for India.

The simulations of changes in the world prices of rice and wheat show potentially significant effects on the country if it binds its agricultural tariffs at levels that would prevent it from offsetting global price shocks. For example, a 50 percent decrease in the world price of rice could have a negative impact on India's real income as large as the positive impact of the entire Doha agreement as simulated in the study. Even a 25 percent decrease in the price of rice has negative effects on all major components of the Indian economy, including private consumption, investment, exports, and imports. Seventy-eight percent of households would experience real income losses from such a price change, and the distributional impact would be regressive, with the poorest households losing the most. These results suggest that the Indian government's concern over the potential negative effects of a Doha agreement on poverty and rural development is well founded and that it has been correct to seek provisions such as a "special product" designation for agricultural products that are important to livelihoods and a "special safeguard mechanism" to allow it to shield domestic producers from sharp negative price shocks to key commodities.

The simulation of a free trade agreement with India's largest trading partner, the European Union, shows that Indian exports would increase by about 5.5 percent and its imports by 3.4 percent, more than under a Doha agreement. However the overall impact on India would be slightly negative, with overall real income and private household consumption showing small declines.

An India-U.S. free trade agreement has smaller effects on India than an agreement with the EU, which is not surprising given that the existing trade relationship is smaller. Exports and imports increase by roughly one-third as much as under a pact with Europe. The overall impact on the economy is slightly positive, while households lose slightly.

An India-China FTA, which is the subject of a feasibility study by the two governments, would produce even smaller gains for the Indian economy than would an agreement with the United States, along with smaller losses for households. Exports and imports would each increase, but by smaller amounts than under the other bilateral agreements.

Creating employment is an important goal of the Indian government, both to absorb unemployed workers, currently estimated at about 40.4 million, and also to generate opportunities for the large numbers of underemployed workers in rural areas and the estimated 7 to 8.5 million annual new entrants into the labor force. All the trade pacts simulated in this study would induce small increases in demand for unskilled labor, with a Doha agreement increasing demand by 0.9 percent (about 4 million jobs based on current employment levels). An India-EU FTA would increase demand by 0.5 percent (about 2.3 million jobs), an India-U.S. FTA by 0.3 percent (1.4 million jobs), and an India-China FTA by 0.2 percent (900,000 jobs). Although these additional positions would be welcome, they represent a very modest contribution to India's employment needs. Clearly, employment creation will depend much more on Indian domestic demand than on export-led growth for the foreseeable future.

The results of the study indicate that continued trade liberalization, particularly at the multilateral level, can contribute to India's growth and development. However it must be recognized that the potential gains are modest and the risks are not insignificant. Balancing the defensive interests of India's poor households with the quest for improved efficiency and market opportunities will require careful trade negotiations and appropriate complementary measures.

—Sandra Polaski

CHAPTER 1

Introduction

India's economic growth has accelerated in recent years, and its share of world trade has expanded. These are welcome developments for the country and, given India's large share of the world's population, for the global economy. Yet, despite these recent positive trends, India faces daunting challenges and policy decisions if it is to maintain high economic growth rates, employ its burgeoning population, and raise incomes across the full range of households, skill levels, sectors, and regions. India remains the largest reservoir of poverty in the world. Its recent high growth has been driven mainly by its modern services sector, which accounts for only a small proportion of overall employment and household incomes. Its agricultural sector is in a deep crisis, whether measured by slow growth rates, persistent rural poverty, or widespread farmer suicides.

Despite the recent expansion of India's trade with the world, its share of global trade is disproportionately small given its size. India's bound tariffs are still relatively high, although applied tariffs are much lower. Because of this gap, the government currently retains significant policy space with respect to trade, including the ability to raise and lower tariffs in response to prevailing conditions. Thus the decisions it makes in trade negotiations to bind tariffs at lower levels or otherwise change the rules governing its engagement with its trading partners will constrain its existing policy space and potentially have significant impacts on the evolution of the economy.

It is evident that Indian economic policy makers carry a heavy burden in trying to achieve the full potential of the economy and the Indian people. Sound analyses of the potential effects of different trade policy choices on the overall economy and its sectors, as well as the distributional effects among households, labor, land, and capital, can provide valuable guidance. This study seeks to contribute to the knowledge base upon which the Indian government, its international partners, and the public can evaluate the difficult policy choices India confronts in the realm of international trade.

The study uses a global trade model and a national model of the Indian economy to explore the impact of a range of trade policy choices. It uses these computable general equilibrium models to simulate potential outcomes of the Doha development round negotiations of the World Trade Organization and several potential bilateral free trade agreements involving India that are currently under negotiation or may be considered in the future, including potential trade deals with the European Union, the United States, and China. The study also simulates other potential shocks from the global economy, namely changes in global agricultural prices, which would interact with India's trade policy. By using both global and country-level models, we are able to trace the impact of a variety of trade policy choices and other changes that occur beyond India's borders back to its agricultural, industrial, and service sectors, to its factors of production, and to its households. This allows us to probe both the overall effects and the distributional consequences.

The study is organized as follows. Chapter 2 provides on overview of India's recent economic evolution, its place in the global economy, and its domestic challenges in order to set the context for the study's simulations and the trade policy choices that the Indian government confronts. Chapter 3 describes the models, the social accounting matrix (SAM) and data used in the national model of India, and the simulations that were undertaken. Chapter 4 presents the results of a simulation of a multilateral agreement in the Doha Round negotiations. It also explores the impact of global agricultural price changes, because the Doha Round will determine the amount of flexibility that India retains to respond to price changes through "special product" and "special safeguard" mechanisms. Chapter 5 presents the results from a simulation of an India-EU free trade agreement, and chapters 6 and 7, respectively, analyze the results from simulations of India-U.S. and India-China FTAs. Chapter 8 presents a comparative overview of the results of the simulations and the relative impact of each on India's economy and households. The section also briefly reviews the results from other studies of Indian trade. Chapter 9 suggests policy implications of the simulation exercises and concludes.

CHAPTER 2

The Context of Indian Trade

In April 2007 the gross domestic product (GDP) of India reached $1 trillion, measured at the official exchange rate with the U.S. dollar, making it the twelfth-largest economy in the world.[1] This threshold was crossed due to the strong growth in the economy over several years and also in part because of the appreciation of the Indian currency, the rupee. Measured at purchasing power parity (PPP)—a conversion system that attempts to eliminate the differences in price levels between countries—India's GDP stood at $4.2 trillion in 2006.[2] The Asian Development Bank (ADB), however, recently released new purchasing power parity estimates that suggest India's economy is significantly smaller than previously believed.[3] Using the ADB estimates, India's GDP measured at purchasing power parity is about $2.3 trillion.

Although India's aggregate economy is large, when divided by its 1.1 billion people, the resulting per capita income places it in the ranks of low-income countries. Its GDP per capita stood at $785 in the most recent measure by the International Monetary Fund, ranking it 134th of 185 member countries.[4] Using the traditional purchasing power parity conversion, its GDP per capita stands at about $3,800, similar to the levels of Nicaragua, Angola, and Vietnam.[5] Using the new ADB estimates, GDP per capita is significantly lower, at about $2,100.

The structure of India's economy as represented in the global model used in this study (based on the most current global database, which uses 2001 data) is divided between private consumption, which accounts for 67 percent of the economy, government consumption, which accounts for 13 percent, and investment, which accounts for 23 percent.[6] India's trade deficit of –2 percent completes the national account. Total Indian exports and imports of goods and services amounted to 30 percent of GDP in the model base year. Of course, the Indian economy has evolved since 2001. Private consumption now accounts for a smaller share of the economy, at 58 percent, and government consumption has also declined slightly, to 11 percent. Investment has

increased to 34 percent of the economy, while the trade deficit has increased to 3 percent.[7] Total exports and imports of goods and services now amount to 49 percent of GDP, due in large part to a significant increase in India's services exports.[8]

The relative size of the agricultural, manufacturing, and services sectors in India underscores the development challenges facing the country. Fully one-quarter of economic activity in India took place in the agricultural sector in the model base year of 2001. (For comparison, in the United States, agriculture represents only 1 percent of economic output.) Manufacturing accounts for 29 percent of Indian economic activity in the model, with services accounting for the remaining 46 percent. Since 2001 the importance of the agricultural sector has decreased slightly, to 19 percent of economic activity, while manufacturing has also declined, to 27 percent. Services now account for 55 percent of GDP.[9]

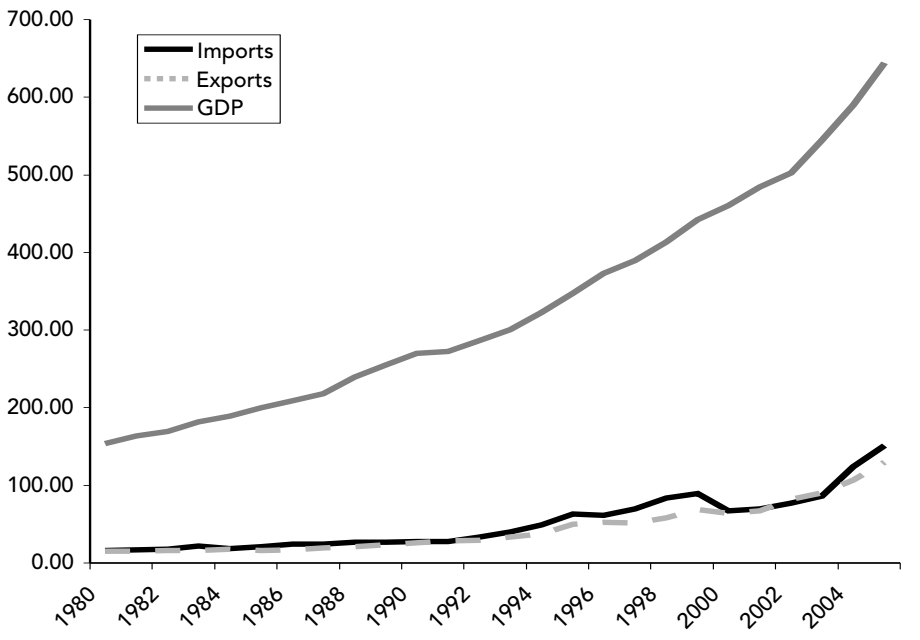
Agricultural production in India intensively uses land and unskilled labor, with only small amounts of capital involved. In contrast, the vast majority of manufacturing production uses capital and unskilled labor intensively. The services sector is the main source of employment for skilled labor. However, the heterogeneity of services produced in India is illustrated by the fact that skilled labor represents only 28 percent of the factor inputs in the sector, with unskilled labor representing an almost equal share, at 24 percent. The country boasts some of the world's leading information technology firms, but the sector also includes much lower value-added activity and a large informal service sector. Across all sectors in India, skilled labor absorbs only 11 percent of total income.

India in the Global Economy

India's economy was largely closed until the 1980s. In recent decades, a series of policy reforms have gradually opened it to international trade; exports and imports have both grown (figure 2.1). Nonetheless, India's share in world trade is small, whether measured by exports or imports (table 2.1). The country remains one of the less open economies among large developing countries, with average applied tariffs of 12.1 percent (14.1 percent including ad valorem equivalents) on nonagricultural products and 40.8 percent on agricultural products.[10]

India's current trade is dominated by trade with three partners: the European Union, the United States, and China (table 2.2). India's largest trading partner is the EU, with total trade of $55 billion in 2006, made up of $26 billion in exports and $29 billion in imports, reflecting a small bilateral trade deficit for India. In second place was trade with the United States, totaling $30 billion, with India running a surplus composed of $19 billion in exports, compared with $11 billion in imports. Indian trade with China ranked third, with total

Figure 2.1 Indian Exports, Imports, and GDP, 1980–2005



Source: World Bank, World Development Indicators 2007 CD-ROM.

trade of $23 billion comprising $8 billion in exports and $16 billion in imports. Other significant trading partners included the United Arab Emirates ($19 billion total trade), Saudi Arabia ($13 billion total trade), Singapore ($11 billion total trade), Japan ($8 billion total trade), and Iran ($7 billion total trade). India ran a trade surplus with the United Arab Emirates and Singapore, significant deficits with Saudi Arabia and Iran (due to India's petroleum imports), and a slight deficit with Japan.

India is currently engaged in several trade negotiations, including the Doha Round at the WTO, recently launched negotiations with the European Union for a bilateral free trade agreement, and several rounds of ongoing negotiations with partners such as other South Asian countries, the Association of Southeast Asian Nations (ASEAN), and Japan, among others.

India's Key Policy Challenges

India's recent economic growth has been impressive, and some sectors, such as information technology and business services, show great dynamism. However the vast majority of the population suffers from very low incomes. For most Indians, the only employment opportunities are in low-productivity agriculture or informal services. The country is still at an early stage of the

Table 2.1 India's Share in World Trade, 2006

Measure	Exports	Imports	Total
India's trade (billion dollars)	193	244	437
World trade (billion dollars)	14,472	14,700	29,172
India's share in world trade (percent)	1.33	1.66	1.50

Note: The figures for India differ somewhat from those given in Reserve Bank of India *Annual Report 2006–2007*.

Source: World Trade Organization, "Risks Lie Ahead Following Stronger Trade in 2006, WTO Reports."

rural-urban transition, with insufficient jobs, housing, infrastructure, and transportation to facilitate the movement of those who are underemployed in the countryside to more productive employment and better livelihoods in urban areas. The overall literacy rate was 64 percent in 2004–2005, with 55 percent literacy in rural areas and 75 percent literacy in urban areas.[11] In about 26 percent of the households in rural areas and about 8 percent of those in urban areas, there was not a single member age fifteen years or above who could read and write a simple message with understanding. The government faces the formidable challenge of addressing these critical social and economic needs while maintaining the momentum of growth, achieving better balance in the sectoral pattern of growth, and further developing the leading sectors.

Table 2.2 India's Top Trade Partners, 2006

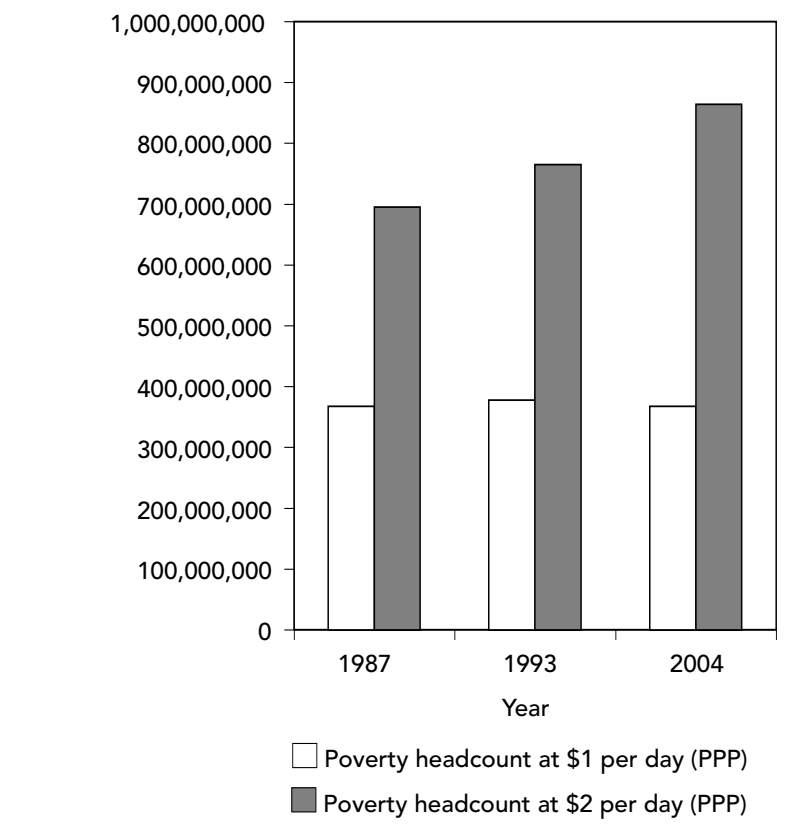
BILLIONS OF DOLLARS

Country or group	Exports (from India to partner)	Imports (from partner to India)	Total
European Union	26	29	55
United States	19	11	30
China	8	16	23
United Arab Emirates	12	7	19
Saudi Arabia	2	11	13
Singapore	6	5	11
Japan	3	5	8
Iran	2	6	8

Note: The figures are for calendar year 2006 and only include merchandise trade, because detailed statistics on the direction of services exports and imports are not available.

Source: Department of Commerce, India, System on Foreign Trade Performance Analysis.

Figure 2.2 Poverty in India by Number of Persons, 1987–2004

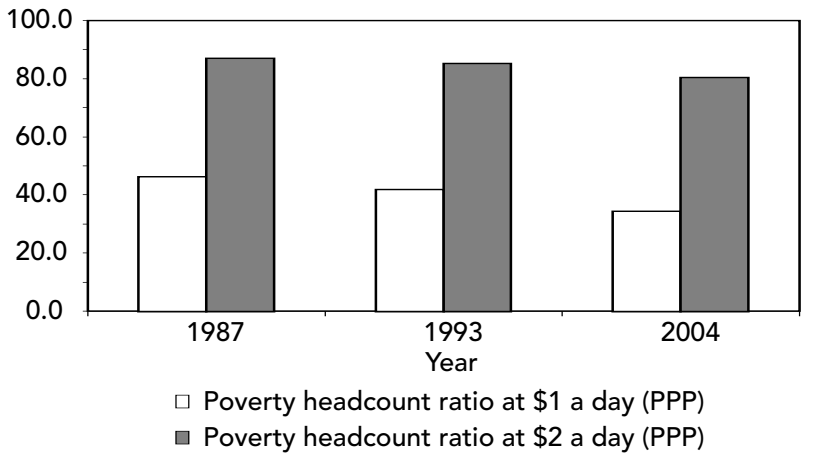


Source: World Bank, World Development Indicators 2007 CD-ROM.

Poverty

India has the largest number of poor people of any country in the world. Reducing poverty must be counted as one of the main challenges for the country and its policy makers. Although the share of the Indian population living in extreme poverty (defined as $1 per day at PPP), and in poverty (defined as less than $2 per day PPP) has declined in recent years, a high population growth rate in recent decades means that the number of people living in poverty has remained stubbornly high (figures 2.2 and 2.3). The proportion of Indians living in extreme poverty (below $1 per day) declined from 46 percent in 1987 to 34 percent in 2004; however the actual number of extremely poor people remained almost unchanged, at about 370 million. (It should be noted that the revised PPP estimates of the ADB would suggest that 792 million people, or 73 percent of the population, live on less than $1 per day.)[12] With respect to the $2-per-day poverty line, there was only modest progress in reducing the share of the population below this threshold, from 87 percent in 1987 to 80 percent in 2004. The number of

Figure 2.3 Poverty in India by Percentage of the Population, 1987–2004



Source: World Bank, World Development Indicators 2007 CD-ROM.

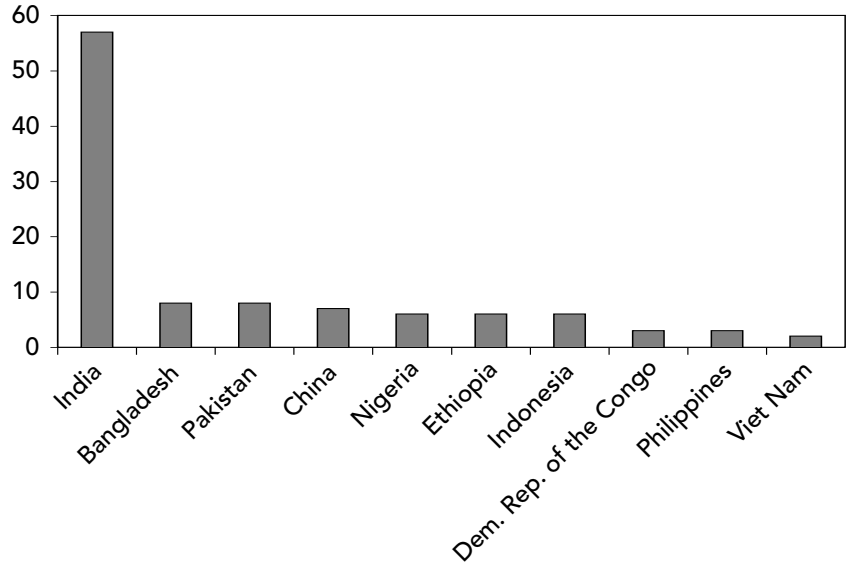
poor people by this definition actually rose, from 694 million in 1987 to 863 million in 2004. (Again the figure is considerably larger using the ADB's revised PPP estimates, which suggest that slightly over a billion people, or 94 percent of the population, live on less than $2 per day.)[13] As measured by the national poverty line, the story is much the same; while the percentage of the population living below the poverty line has fallen in recent years, the number of poor people has barely decreased, and remains above 300 million. In 2004–2005, 77 percent of the population, totaling 836 million people, had an income below 20 rupees per day (twice the official poverty line), which is approximately 50 cents at the current exchange rate.[14]

Poverty in India is concentrated in rural areas, as it is in most of the developing world. Nearly three-quarters of India's poor live in the countryside, where the proportion of the population living at or below the national poverty line is 28.3 percent, compared with 25.7 percent in urban areas.[15] This is driven in large part by deeply rooted problems and slow growth in the agricultural sector, which is discussed below.

Indian poverty is also characterized by an element of ethnicity and caste. Historically, disadvantaged castes, tribes, and some other classes suffered discrimination and exclusion from many economic opportunities. The Indian Constitution recognizes the groups that have been disadvantaged and the government has accorded compensatory advantages to try to redress the effects. The Constitution and laws establish specific opportunities for groups officially identified as "scheduled tribes" (ST), "scheduled castes" (SC), and "other backward classes" (OBC). Nonetheless, these groups continue to suffer considerably higher levels of poverty and more exclusion than other

Figure 2.4 Countries with the Greatest Number of Underweight Children

UNDERWEIGHT CHILDREN (MILLIONS)



Source: UNICEF, "Progress for Children: A Report Card on Nutrition."

groups. In the government's 1999–2000 survey, the proportions of people below the official poverty line were 45.8 percent for "scheduled tribes," 35.9 percent for "scheduled castes," and 27 percent for "other backward classes," compared with 15 percent for the rest of the population.[16]

Poverty is accompanied by widespread child malnutrition. According to a 2006 UNICEF study, 47 percent of children under the age of five years were underweight, among the highest rates in the world (Bangladesh and Nepal have rates of 48 percent). In absolute numbers, India has 57 million underweight young children, the largest concentration in the world (figure 2.4).

Malnutrition at such levels is a humanitarian tragedy. In economic terms, it also has dire consequences for the country's future, because it is likely to constrain growth and productivity for the foreseeable future. Malnourished children are more likely to die, to suffer recurring illness later in life, and to have learning impairment. What happens to Indian children today will affect the economy for the next six decades.

It is commonplace to speak of India's demographic dividend. Countries with high population growth rates that subsequently bring their reproductive rates to more sustainable levels may enjoy an economically advantageous period in which the earlier high population growth expands the labor force, while the proportion of the very young and very old, who consume resources

Table 2.3 India's Average Annual Real Growth Rates, 1951–2007

PERCENT

Sector or measure	1951–52 to 1980–81	1981–82 to 1990–91	1991–92 to 1999–2000	2000–1 to 2006–7
Agriculture	2.6	3.8	3.0	2.5
Industry	5.3	7.0	5.7	7.8
Service	4.6	6.7	7.9	8.5
GDP (total)	3.6	5.6	5.8	6.9
Per capita GDP	1.4	3.4	3.6	5.2

Note: The last column of data is from a new 1999–2000 base. Agriculture includes other primary sectors, such as livestock, forestry, fishing, and mining and quarrying.

Source: Manoj Panda 2007b.

while not contributing to economic activity, are relatively low. This demographic transitional period can in theory lead to high growth rates. However if India's children are not properly nourished today, the demographic dividend will be attenuated.

Agriculture and Rural Development

India produces about 210 million tons of food grains, mainly rice and wheat, which make up the staple food supply of the country. It was a large importer of food grains until the mid-1970s, but it has been self-sufficient and even a net exporter in most years during the last two decades. This turnaround was the result of the adoption of high-yielding varieties of seeds and chemical fertilizers, along with large public investments in irrigation. These measures made up what has come to be called the "green revolution" and also involved government procurement operations and guaranteed minimum support prices to farmers for food grains in some parts of the country. The increase in agricultural output since 1980–1981 has been mostly due to a rise in yield per hectare attributable to the green revolution, rather than expansion of total area under cultivation.

As a result of a combination of domestic and trade policies, Indian farm prices have been lower than international prices. To partly redress this disadvantage to the agricultural sector, the government provides subsidies on several farm inputs, particularly fertilizer, power, and irrigation. Despite these input subsidies, Indian agriculture remains "disprotected" overall, meaning that it suffers from government policies more than it benefits from them (Gulati and Narayanan 2003; Mullen, Orden, and Gulati 2005; Pursell, Gulati, and Gupta 2006).

The agricultural sector has grown more slowly than other sectors for these

and other reasons. Table 2.3 presents sectoral growth rates for the last half century. The slow growth of the agricultural sector is an important reason for continuing high poverty levels in the country. About 55 percent of the workforce continues to depend on agriculture as the major source of livelihood, although it contributes only 19 percent to overall GDP. The income of a typical worker in agriculture is one-fifth of a counterpart in nonagricultural sectors. The bulk of the rural poor consists of landless laborers and marginal farmers owning less than 1 hectare of land.

Farmers' allocation decisions have been partly distorted by the bias in agricultural price support policy in favor of rice and wheat in the green revolution areas. Nonetheless, agricultural land allocation at the national level has shifted away from food grains in favor of crops such as cotton, edible oils, and sugarcane. Livestock has recently emerged as an important subsector of agriculture and accounts for about a quarter of agricultural GDP. India has also witnessed a "white revolution" in the dairy sector and has emerged as the largest producer of milk in the world. The climate and soil conditions in the country are suitable for producing a wide range of horticultural crops, which are generally labor intensive and add more value than food grains. Commercial horticulture, particularly for export, and agroprocessing sectors are seen as having potential as sources of growth for the overall economy and for generating employment and livelihoods in rural areas, an attractive prospect given the deficits of infrastructure, housing, and jobs in urban areas. However substantial investment in rural infrastructure—including basic transport, cold storage, and quality control—will be required to realize this potential.

Trade policy changes can have important effects on the agricultural sector—both positive, through improvements in export opportunities, and negative, if cheaper imports reduce the already low incomes of farmers or eliminate employment opportunities in agriculture without creating sufficient jobs in other sectors. Because such a high proportion of India's labor force is still engaged in agriculture, and the sector is still the main reservoir of poverty in the country, the risks posed by agricultural trade liberalization are high and must be carefully managed.

Employment

India has the second-largest potential labor force in the world, after China. However participation rates are relatively low and unemployment is high. Roughly 450 million people participate in the workforce. According to the most recent employment survey (2004–2005), about 42 percent of the country's working-age population (44 percent in rural areas and 37 percent in urban areas) were "usually employed."[17]

There is a very strong gender differential in workforce participation; the worker population ratio was 55 percent for males in both rural and urban

areas, whereas for females it was 33 percent in rural areas and 17 percent in urban areas. Participation rates for both men and women have been rising slowly in recent years. The labor force participation rate was highest among "scheduled tribes" (51 percent), followed by "scheduled castes" (44 percent) and "other backward classes" (43 percent). For other groups, the participation rate was 40 percent.

The proportion of rural male workers engaged in agricultural activities declined gradually from 81 percent in 1977–1978 to 67 percent in 2004–2005, whereas for rural female workers, the decline was less, from 88 percent in 1977–1978 to 83 percent in 2004–2005. Among urban workers, the largest source of employment for males was the "trade, hotel, and restaurant" sectoral grouping, which employed 28 percent of urban male workers, followed by manufacturing at 24 percent and "other services" at 21 percent. Between the 1999–2000 and 2004–2005 surveys, the proportion of urban females employed in the manufacturing sector increased from 24 to 28 percent, while the share employed in the trade, hotel, and restaurant sector fell by 5 percent.

The unemployment rate—which is defined in Indian statistics as the number of person unemployed per 1,000 persons in the labor force—was 17 in the rural areas and 45 in the urban areas. The unemployment rate is higher for females and highest among urban females. There was little change in overall unemployment between the 1999–2000 and 2004–2005 surveys, with the rural male unemployment rate unchanged, a 1 percent decrease for urban males, and a 1 percent increase for females in both rural and urban areas. In both rural and urban areas, the unemployment rate was higher among the educated (secondary school and above) than the less educated, particularly among educated females, and it was likewise higher among youth (age fifteen to twenty-nine years) than the general working-age population.

According to projections prepared by the Government of India's Planning Commission (2004), India's labor force is expected to increase by about 160–170 million by 2020, a growth of about 2 percent a year. The report estimates that to absorb this growing workforce as well as to offer employment to the 35 million persons unemployed or underemployed as of 2002, the country will need to generate about 200 million additional employment opportunities by 2020.

Notes

1. The $1 trillion figure is calculated using the current exchange rate; using the average exchange rate between April 1, 2006, and March 31, 2007, GDP for the fiscal year was approximately $908 billion.
2. U.S. Central Intelligence Agency (2007).

3. Asian Development Bank (2007). All figures in the report are for 2005. Figures given in Hong Kong PPP dollars are converted to international PPP dollars using the 2005 exchange rate provided in World Bank (2007d).
4. International Monetary Fund (2007b). These figures are unconfirmed IMF staff estimates.
5. Ibid.
6. The most reliable global trade database, the Global Trade Analysis Project, uses data from 2001, described by Dimaranan (2006).
7. Reserve Bank of India (2007). Trade deficit includes trade in services.
8. Ibid. Total trade in services is calculated using given figures for services exports and net services surplus.
9. Ibid. In order to present data comparable to that of the GTAP 2001 data, construction is included in industry rather than services.
10. World Trade Organization (2007c).
11. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India (2005).
12. Authors' calculations using the World Bank's PovcalNet software, http://iresearch.worldbank.org/PovcalNet.
13. Authors' calculations using the World Bank's PovcalNet software, http://iresearch.worldbank.org/PovcalNet.
14. NCEUS (2007).
15. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India (2005). All data in this section are from this survey.
16. Panda (2007a).
17. Ibid.

CHAPTER 3

Description of the Models, Data, and Simulations

The global model used in this study was developed by Scott McDonald, Sherman Robinson, and Karen Thierfelder.[1] The model, called "GLOBE," is a member of the class of multi-country, computable general equilibrium (CGE) models that are descendants of the approach described by Dervis, de Melo, and Robinson (1982).[2] It uses data derived from the Global Trade Analysis Project (GTAP) database.[3] A short description of the model is presented in appendix B. The countries/regions as aggregated in the model and the commodity/sectoral aggregations are presented in tables A.3.1 and A.3.2 in appendix A.

In the simulations conducted for this study, we explored the implications of two alternative labor market conditions. In the first, it was assumed that there was full employment and full mobility in all labor markets. This can be viewed as an archetypal free market model; but the presumption of full employment in all economies is questionable. Hence we considered a second alternative in which there are excess supplies of unskilled labor in developing countries and regions. (In the model this applies to: India; China; the countries grouped as the rest of East Asia, the rest of South Asia, Mercosur, and the rest of Latin America; all of the African country groupings; and a residual group designated rest of the world.) Where there is unemployment in unskilled labor markets, the real wage is held constant and the supply of unskilled labor adjusts following a policy shock. The results reported are for this alternative.

The national model of the Indian economy used in this study is the "STAGE" (Static Applied General Equilibrium) model developed by Scott McDonald. It is a member of the class of single-country CGE models that are descendants of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982) and models reported by Robinson, Kilkenny, and Hanson (1990) and Kilkenny (1991). The model is a social accounting matrix–based CGE model, and the modeling approach has been influenced by Pyatt's

"SAM Approach to Modeling" (Pyatt 1987). As in the global model, we vary the standard modeling assumption of full employment of all labor with an alternative labor market closure that reflects the reality of unemployment and underemployment among unskilled laborers in India. The results we report are for this alternative. A short description of the model is presented in appendix C.

Social Accounting Matrix and Data for the India Model

A social accounting matrix is an assemblage of data that reports all the economic transactions (flows of receipts and expenditures) incurred by all the agents in the economy for a particular year. These agents are the production sectors, social groups (households), firms, government, and foreign agents. These flows take place due to commodity transactions (buying and selling) between the agents for purposes of consumption, intermediate use, investment, and the like, and by way of interagent transfers.

The SAM used in this study was constructed by Scott McDonald, Manoj Panda, and A. Ganesh-Kumar. It improves upon earlier SAMs for the Indian economy by incorporating detailed information on sources of incomes at the household level. Previous SAMs included extensive information on consumption expenditures but were less satisfactory regarding sources of household income. A description of the SAM is presented in appendix D, and table A.3.4 in appendix A provides an overview of the Indian economy as represented in the SAM and model.

The distribution of Indian households by income, location (rural or urban), and social group as reflected in the model are presented in tables 3.1.A (countrywide distribution), 3.1.B (rural distribution), and 3.1.C (urban distribution).

Simulations

We simulate the impact on India of a possible Doha Round agreement at the WTO and of possible free trade agreements with India's three largest trading partners, the EU, United States, and China. We model the effects of such agreements on the overall economy and on the main sectors, as well as on households, labor, land, and capital.

Doha Round Simulation

The Doha simulation reflects a scenario in which a multilateral agreement is reached at the WTO covering agriculture and nonagricultural sectors. (We do not simulate services trade liberalization, for reasons discussed below.) Specifically, we simulate agricultural and nonagricultural tariff reductions of

Table 3.1.A Distribution of Households in the Indian Population, Total

Household group	Number	Share
Rural		
Rural "scheduled tribes," income 0-30 percent	8,070,164	4.28
Rural "scheduled tribes," income 31-60 percent	4,119,474	2.19
Rural "scheduled tribes," income 61-90 percent	2,378,644	1.26
Rural "scheduled tribes," income >90 percent	372,694	0.20
Rural "scheduled castes," income 0-30 percent	13,393,888	7.11
Rural "scheduled castes," income 31-60 percent	9,300,193	4.94
Rural "scheduled castes," income 61-90 percent	5,545,583	2.94
Rural "scheduled castes," income >90 percent	923,481	0.49
Rural "other backward classes," income 0-30 percent	17,932,008	9.52
Rural "other backward classes," income 31-60 percent	16,982,923	9.01
Rural "other backward classes," income 61-90 percent	13,312,988	7.07
Rural "other backward classes," income >90 percent	2,697,944	1.43
Other rural, income 0-30 percent	9,042,016	4.80
Other rural, income 31-60 percent	13,205,395	7.01
Other rural, income 61-90 percent	14,608,818	7.75
Other rural, income >90 percent	5,278,772	2.80
Urban		
Urban "scheduled tribes," income 0-30 percent	860,491	0.46
Urban "scheduled tribes," income 31-60 percent	515,517	0.27
Urban "scheduled tribes," income 61-90 percent	341,136	0.18
Urban "scheduled tribes," income >90 percent	77,309	0.04
Urban "scheduled castes," income 0-30 percent	3,736,578	1.98
Urban "scheduled castes," income 31-60 percent	2,110,141	1.12
Urban "scheduled castes," income 61-90 percent	1,110,004	0.59
Urban "scheduled castes," income >90 percent	160,863	0.09
Urban "other backward classes," income 0-30 percent	6,256,092	3.32
Urban "other backward classes," income 31-60 percent	4,850,576	2.57
Urban "other backward classes," income 61-90 percent	3,604,215	1.91
Urban "other backward classes," income >90 percent	730,890	0.39
Other urban, income 0-30 percent	6,114,311	3.24
Other urban, income 31-60 percent	7,802,559	4.14
Other urban, income 61-90 percent	9,314,989	4.94
Other urban, income >90 percent	3,680,458	1.95
All households	188,431,114	100.00

36 percent by developed countries and 24 percent by developing countries. We also reduce domestic agricultural subsidies by one-third in the simulation and eliminate agricultural export subsidies entirely. In our simulation, tariffs and subsidies are reduced from *applied* tariff and subsidy rates, rather

Table 3.1.B Distribution of Rural Households

Household group	Number	Share
Rural "scheduled tribes," income 0-30 percent	8,070,164	5.88
Rural "scheduled tribes," income 31-60 percent	4,119,474	3.00
Rural "scheduled tribes," income 61-90 percent	2,378,644	1.73
Rural "scheduled tribes," income >90 percent	372,694	0.27
Rural "scheduled castes," income 0-30 percent	13,393,888	9.76
Rural "scheduled castes," income 31-60 percent	9,300,193	6.78
Rural "scheduled castes," income 61-90 percent	5,545,583	4.04
Rural "scheduled castes," income >90 percent	923,481	0.67
Rural "other backward classes," income 0-30 percent	17,932,008	13.07
Rural "other backward classes," income 31-60 percent	16,982,923	12.38
Rural "other backward classes," income 61-90 percent	13,312,988	9.71
Rural "other backward classes," income >90 percent	2,697,944	1.97
Other rural, income 0-30 percent	9,042,016	6.59
Other rural, income 31-60 percent	13,205,395	9.63
Other rural, income 61-90 percent	14,608,818	10.65
Other rural, income >90 percent	5,278,772	3.85
All rural households	137,164,985	100.00

Table 3.1.C Distribution of Urban Households

Household group	Number	Share
Urban "scheduled tribes," income 0-30 percent	860,491	1.68
Urban "scheduled tribes," income 31-60 percent	515,517	1.01
Urban "scheduled tribes," income 61-90 percent	341,136	0.67
Urban "scheduled tribes," income >90 percent	77,309	0.15
Urban "scheduled castes," income 0-30 percent	3,736,578	7.29
Urban "scheduled castes," income 31-60 percent	2,110,141	4.12
Urban "scheduled castes," income 61-90 percent	1,110,004	2.17
Urban "scheduled castes," income >90 percent	160,863	0.31
Urban "other backward classes," income 0-30 percent	6,256,092	12.20
Urban "other backward classes," income 31-60 percent	4,850,576	9.46
Urban "other backward classes," income 61-90 percent	3,604,215	7.03
Urban "other backward classes," income >90 percent	730,890	1.43
Other urban, income 0-30 percent	6,114,311	11.93
Other urban, income 31-60 percent	7,802,559	15.22
Other urban, income 61-90 percent	9,314,989	18.17
Other urban, income >90 percent	3,680,458	7.18
All urban households	51,266,129	100.00

Note: Data are from the "Household Schedule: Consumer Expenditure" in National Sample Survey Organisation, National Sample Survey (55th Round), July 1999–June 2000. The number of households in each category are scaled from the sample to the population level using the multipliers given in the survey.

than from the bound rates that countries negotiate and adopt as binding commitments at the WTO, which may be higher than actual applied rates. We chose to reduce applied tariffs and subsidies rather than bound rates in order to probe the impact on India and other countries of actual changes in tariffs (and therefore domestic prices) and subsidies (and therefore global prices and supplies). Reductions of bound rates that did not reduce applied tariffs and subsidies would not lead to any change in trading patterns and world prices and therefore would not allow us to probe the effects of trade changes on the economy, sectors, and households. From the perspective of negotiators, it is fairly easy to translate reductions in applied rates to the equivalent reductions in bound rates.

We also simulate the impact of changes in world agricultural prices for some key crops using the detailed national model of India. These changes could arise as the result of trade or agricultural policy changes elsewhere in the world, behavior by private actors, weather, or other causes. Because a Doha agreement would require India to bind its tariffs at lower levels, it would have less flexibility to offset such external price shocks. Specifically, we simulate the impact on the Indian economy of a 25 percent decrease, a 50 percent decrease, a 25 percent increase, and a 50 percent increase in the world prices for rice and wheat, which are the most important food grains in India. These price changes would have the strongest effects under a Doha agreement, compared to bilateral free trade agreements, because Indian tariffs would be lowered toward all trading partners, including the lowest-cost producers. (Under bilateral FTAs, price changes could also have an impact if the trading partner was a competitive producer able to export at lower world prices.) Using the national model, we probe the differential effects on different types of labor and on households at different income levels in rural and urban areas in order to explore the consequences for income distribution and poverty.

Bilateral Free Trade Simulations

The three bilateral free trade agreement simulations (between India and the EU, United States, and China) test the effects of full free trade between the relevant parties in agriculture, processed foods, and manufactured goods. The simulations completely eliminate tariffs and export taxes for those commodities. Unlike the Doha simulation, the bilateral simulations do not include reductions in domestic agricultural subsidies. This reflects the practical reality that countries have not been willing to address their subsidy programs in the context of bilateral FTAs.

Trade in Services

We do not include liberalization of services trade in the simulations for two reasons. First, we have little confidence in the available data on protection in service sectors. Second, it is very difficult to simulate the myriad policies that

constrain trade in services—such as visa and temporary entry restrictions or regulations on investments or financial services—using computable general equilibrium models. CGE models are well-suited to simulate changes in tariffs and quotas that can be represented as changes in price and quantity. However most barriers to services trade are not easily quantified in these types of measures. These limitations convince us that service sector liberalization cannot be simulated with economic models in a way that inspires confidence.

Notwithstanding the difficulty of modeling services trade liberalization, we recognize that the potential gains could be significant. The size of the gains will depend on the level of ambition, the sectors affected, and the modes of services trade that are covered in any potential agreement. Additional gains could accrue to India under bilateral or multilateral trade agreements if services were included, and this potential added benefit should be kept in mind when reviewing the following results.

Pre-Experiment

Before conducting each of these simulations we undertook a pre-experiment that eliminated the quotas on textiles and apparels that had been codified in the Agreement on Textiles and Clothing of the WTO. These quotas were terminated on January 1, 2005, under the terms of that agreement. However this is not reflected in the GTAP trade data used in the model. (GTAP is the most extensive source of trade data and is used by most modelers. The most current version available reflects 2001 data and thus does not capture the quota termination.) Given the importance of textile and apparel trade to India's economy, we thought it important to capture the change in our baseline before simulating additional changes through new trade agreements.

Other changes occurred in the global trading system between 2001 and 2007, such as the accession of China to the WTO and the expansion of the European Union. These are not included in the pre-experiment because we did not consider that they would appreciably change the results. By way of illustration, the GTAP database captures the tariffs applied by the rest of the world toward China reasonably well.

Notes

1. Karen Thierfelder is professor of economics at the U.S. Naval Academy.
2. The GLOBE model is described in more detail in McDonald et al. (2007). For examples of earlier models, see Robinson et al. (1993), and Lewis, Robinson, and Wang (1995). The World Bank global CGE model described in van der Mensbrugghe (2006b) has a common heritage.
3. Dimaranan (2006).

CHAPTER 4

Results from the Simulation of a Doha Round Agreement

India has taken a keen interest in the Doha Round and has become one of the key actors in the WTO negotiations. A multilateral trade agreement would affect India's trade relationships with all trading partners, and thus it is likely to have a larger impact on the Indian economy than any single bilateral free trade agreement. At the same time, the depth of liberalization in the Doha Round would be less than in an FTA in which tariffs (and perhaps other barriers to trade) were entirely eliminated.

We simulate a plausible Doha outcome that is moderately ambitious in liberalizing agricultural and manufactures trade. As noted in Chapter 3, we simulate agricultural and nonagricultural tariff reductions of 36 percent by developed countries and 24 percent by developing countries including India, a one-third reduction in domestic agricultural subsidies, and complete elimination of agricultural export subsidies. These reductions are taken to applied rates, producing changes in actual tariffs of that magnitude.

We separately simulate the effects of increases or decreases in the world prices of rice and wheat, which are the most important food grains in Indian production and consumption. As a result of Doha Round tariff reductions, the government would have less scope for offsetting world price swings through tariffs. Because the majority of Indians depend on agriculture for their livelihoods, sharp changes in world prices could have potentially strong effects on household income and poverty. We use the detailed national model of India to explore the impact on households and labor at disaggregated levels.

We do not attempt to simulate services trade liberalization because of the limitations of data and the difficulty of modeling nontariff barriers to trade discussed in Chapter 3, while noting that an ambitious outcome for services trade could be significant for India and should be kept in mind when reviewing the following results.

Table 4.1 Macroeconomic Results for India of a Doha Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	0.53	0.17
Government consumption	–0.01	–0.01
Investment consumption	0.68	0.65
Absorption	1.21	0.25
Import demand	2.18	2.87
Export supply	2.43	3.84
Total domestic production	4.54	0.52

Main Results for India

Table 4.1 presents the main macroeconomic results for India of the Doha simulation. India's overall real income increases by $1.2 billion, about one-quarter of one percent (0.25 percent).[1] Of this overall gain, real income for households increases by about $530 million and investment increases by $680 million. Imports increase by $2.2 billion, while exports increase by $2.4 billion. Because both net exports and domestic consumption increase, production increases in India, with a potential positive impact on employment of labor and other resources. Total domestic production increases by $4.5 billion (0.52 percent). According to these macroeconomic measures, except for a very slight reduction in government expenditures, the results of a Doha agreement along the lines of this simulation would be positive, albeit quite modest, for India.

Of the $2.4 billion increase in exports, the largest gains are in exports of apparel, textiles, leather, and footwear (table 4.2). (Leather and footwear are included in the category "other manufacturing.") Exports of chemicals, minerals, and metals also increase modestly. Overall import penetration increases by $2.2 billion, and is concentrated in capital goods and other manufactures and intermediate inputs, including chemicals, minerals, metals, vegetable oils, and oil and gas. Vehicle imports increase by $100 million, while vehicle exports increase by $50 million.

These changes result from the implementation of the total Doha package as represented in the simulation, including reduction of both agricultural and manufacturing tariffs and of agricultural subsidies. The separate elements of this package produce results that can be quite different from the overall simulation. For example, Indian domestic production decreases as a result of a Doha reduction of agricultural tariffs, processed food tariffs, and domestic agricultural subsidies, while it increases as a result of reduction of manufacturing tariffs (table 4.3). Exports also decline as a result of agricultural and food liberalization, whereas they increase as a result of manufacturing liber-

Table 4.2.A Major Changes in Indian Exports under a Doha Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS)

Commodity	Change in exports
Wearing apparel	0.55
Other manufacturing	0.52
Textiles	0.40
Chemicals	0.24
Minerals and metals	0.19
Trade and transportation	0.12
Services	0.11

Table 4.2.B Major Changes in Indian Imports under a Doha Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS)

Commodity	Change in imports
Other manufacturing	0.60
Minerals and metals	0.39
Chemicals	0.39
Vegetable oils and fats	0.32
Oil and gas	0.18
Vehicles and transport equipment	0.10

alization. Increases in imports are also driven primarily by a reduction of manufacturing tariffs.

The Distribution of India's Gains and Losses

Under the Doha simulation, Indian skilled and unskilled labor and owners of capital and land would all gain about equally in percentage terms, while owners of natural resources would lose (table 4.4). This may seem surprising, because trade theory suggests that trade liberalization will result in the greatest relative increase in returns to the most abundant factor, which in India's case is unskilled labor. In fact, many studies of recent episodes of trade liberalization have found that unskilled labor was not the relative winner, even in countries where it was the most abundant factor. A number of new hypotheses have been advanced to explain this puzzle, including the proposition that under current conditions of production, unskilled labor now competes in a global labor market. In this view, the integration of India, China, and other formerly socialist economies into the capitalist production system has increased the effective supply of unskilled labor more than demand has increased, putting downward pressure on wages everywhere.[2] More generally, multilateral trade liberalization, such as that which is agreed

Table 4.3 Impact on India of a Doha Liberalization by Sector

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	Agricultural export subsidies removal		Agricultural domestic subsidies reduction		Agricultural tariff reduction		Food tariff reduction		Manufactures tariff reduction		Full Doha	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
Private consumption	–0.02	0.00	0.07	0.02	0.22	0.07	0.48	0.15	–0.06	–0.02	0.53	0.17
Government consumption	0.00	0.00	0.02	0.04	0.01	0.01	0.01	0.01	0.02	0.03	–0.01	–0.01
Investment consumption	0.00	0.00	0.01	0.01	–0.01	–0.01	–0.01	–0.01	0.72	0.67	0.68	0.65
Absorption	–0.01	0.00	0.10	0.02	0.22	0.05	0.47	0.10	0.67	0.14	1.21	0.25
Import demand	0.00	0.00	–0.20	–0.26	–0.11	–0.14	0.09	0.12	1.73	2.28	2.18	2.87
Export supply	–0.01	–0.01	–0.57	–0.90	–0.45	–0.71	–0.36	–0.56	2.08	3.29	2.43	3.84
Total domestic production	–0.03	0.00	–0.90	–0.10	–0.57	–0.07	–0.42	–0.05	3.70	0.43	4.54	0.52

Table 4.4 Impact of Doha on the Income to Factors in India

(PERCENT CHANGE)

Factor	Agricultural export subsidies removal	Agricultural domestic subsidies reduction	Agricultural tariff reduction	Food tariff reduction	Manufactures tariff reduction	Full Doha
Land	0.05	–0.25	–0.48	–0.34	1.12	0.92
Unskilled labor	–0.01	–0.16	–0.07	0.03	0.61	0.88
Skilled labor	–0.01	–0.06	0.05	0.15	0.48	0.80
Capital	–0.01	–0.05	0.06	0.15	0.46	0.76
Natural resources	0.00	0.45	0.80	1.11	–2.39	–1.43

through the WTO, exposes a country to increased trade with a wide variety of other countries, whose relative factor endowments vary. India may have abundant unskilled labor, but the relative abundance of this factor may be even greater in other countries. The same may be true of other factors of production.

The separate sectoral components of the Doha scenario have different effects on capital, land, and different types of labor, as would be expected. Unskilled labor loses from reduction of agricultural tariffs and domestic subsidies, while it gains from reduction of manufacturing tariffs. Skilled labor and owners of capital both benefit from all liberalization measures except a reduction of agricultural subsidies. Owners of land lose from all agricultural liberalization measures and gain from liberalization of manufactures trade. As noted above, owners of natural resources lose overall. They gain from agricultural liberalization, but the gains are more than offset by losses from manufacturing liberalization.

Creating employment is an important goal of the Indian government—to absorb unemployed workers, currently estimated at about 40.4 million, to generate better opportunities for the large numbers of underemployed laborers in rural areas, and to absorb new entrants to the labor force, who number between 7 and 8.5 million each year.[3] The Doha simulation results in an increase in demand for unskilled labor of 0.9 percent, which would translate into about 4 million jobs, based on current employment figures. More than half the increase would occur in construction, transport, and various service activities that would be stimulated indirectly by the pact, rather than through the direct channel of increased exports. Direct trade-generated job creation would be very modest, primarily in apparel and textile manufacturing, with additional smaller increases in other manufacturing sectors and some agricultural crops, notably cotton and horticulture. These effects are consistent with results reported elsewhere, which find that even in the presence of significant unemployment and underemployment, trade pacts have modest effects on job creation.[4] A recent study using the World Bank

Linkage model of trade found that *full* global free trade (a scenario much more ambitious than any plausible Doha outcome) would generate an increase in demand for unskilled labor in India of about 2 percent, or 9.1 million jobs.[5]

Most of the increase in unskilled labor demand arises from the reduction in manufacturing tariffs. Much smaller increases in demand arise from agricultural liberalization, but only if tariff reductions are accompanied by reductions in global agricultural subsidies; otherwise, unskilled labor demand would decrease.

For skilled labor, the model assumes full employment. Therefore, the demand for such workers shifts but does not increase or decrease overall. Very small increases in demand for skilled labor in the apparel and textile sectors are offset by decreases in demand for skilled labor in construction and services.

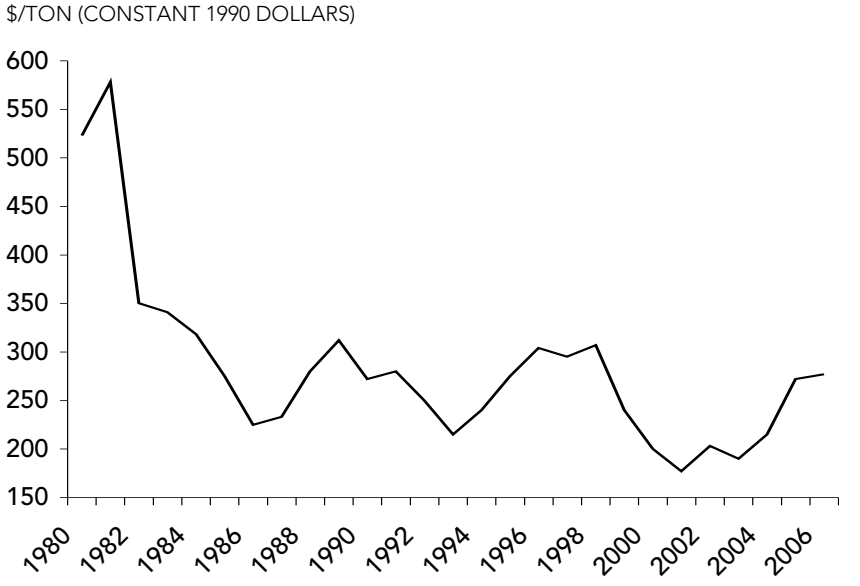
Agricultural Price Shocks, "Special Products," and a "Special Safeguard Mechanism"

An agreement in the Doha round negotiations would require India and other countries to bind their agricultural tariffs at lower levels. As a result, the government would have less scope for raising tariffs to offset negative global price changes that could disrupt domestic farm incomes, the source of livelihood for a majority of Indian households. Depending on the depth of India's cuts in bound tariffs, it might be unable to raise applied tariffs enough to offset the lower prices while its agricultural sector and households adjusted to the changes. Agricultural price changes would have the strongest effects on India under a Doha agreement, as compared with bilateral trade agreements, because Indian tariffs would be lowered toward all trading partners, including the lowest-cost producer of each agricultural product.

Sharp short-term swings in global agricultural prices are not uncommon, as seen in figures 4.1.A and 4.1.B. These changes can be caused by an array of factors, including weather, agricultural subsidies, and changes in agricultural policy elsewhere in the world, dumping, anticompetitive behavior by private firms with market power, and other causes. In recent years, some agricultural prices have been increasing and may continue to do so due to short- or medium-term changes in demand. In the long term, agricultural prices have followed a declining trend, and most economists believe that this long-term decline will continue.

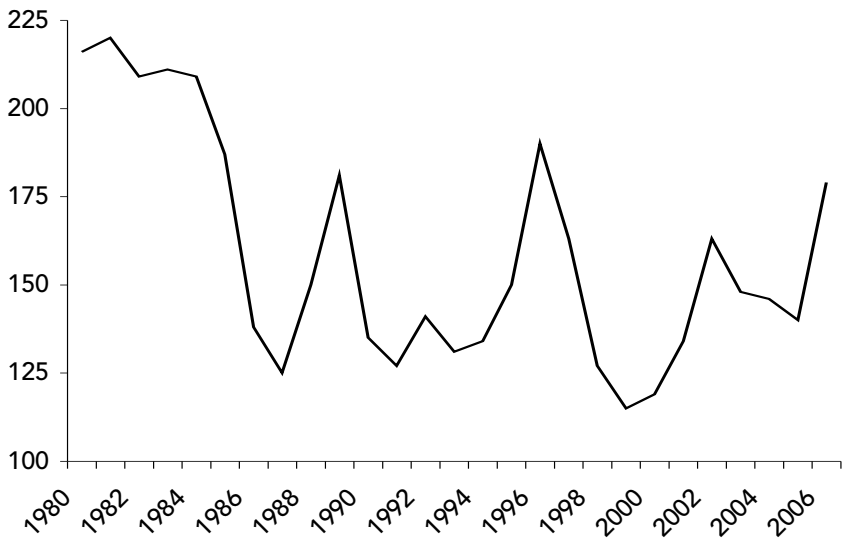
Because of their concerns about the impact of negative price shocks, India and other developing countries for which agriculture is a major source of employment and livelihoods have proposed that they be allowed special treatment in the Doha Round to address this vulnerability. Specifically, India

Figure 4.1.A The World Price of Rice, 1980–2006



Note: Figures given are for Thai 5 percent broken milled rice.
Source: World Bank, "Commodity Markets Briefs: Rice."

Figure 4.1.B The World Price of Wheat, 1980–2006



Note: Figures given are for U.S. hard red winter wheat varieties.
Source: World Bank, "Commodity Markets Briefs: Wheat."

and a coalition of developing countries known as the Group of Thirty-Three (G33) have proposed that they be allowed to designate a certain number of agricultural products as "special products" that could be shielded from tariff reductions or subject to smaller tariff cuts because of their importance for livelihood security, food security, or rural development.[6] They have also proposed that a "special safeguard mechanism" be created whereby they could temporarily raise tariffs to counter a sharp change in the price or volume of imports that could threaten local livelihoods.

To explore the need for such measures, we simulate the impact on the Indian economy of a 25 percent decrease, a 50 percent decrease, a 25 percent increase, and a 50 percent increase in the world prices for rice and wheat, which are the most important food grains in India and important commodities in Indian production and household consumption. We use the country model to probe the differential effects on urban and rural households at different income levels and on different types of labor. Although world prices may not be transmitted perfectly to all households, price data for India show a considerable degree of linkage with world prices for rice and wheat.[7] In the case of rice, import prices move with world prices and within the domestic market prices are transmitted fairly completely between wholesale and retail and between producer and export prices.[8]

Changes in the world price of rice have strong effects on India. Both a 25 percent and a 50 percent decrease in the price have negative effects on all major components of the economy, including private consumption, government spending, investment, exports, and imports (table 4.5). Interestingly, a 25 percent decrease in price has a negative impact that is more than half as large as a decrease of 50 percent; for most of the macroeconomic measures, the impact is two-thirds or more of the larger decrease. By contrast, *increases* of 25 percent or 50 percent in rice prices have positive effects on all macroeconomic measures. The positive effects of price increases are larger than the negative effects of corresponding decreases, except for exports, where a price decline leads to a sharper drop in exports than the increase elicited by a price rise. The relative impact of the two price increases also follows a different pattern from that of price decreases; a 50 percent increase has an impact that is up to three times as large as that of a 25 percent increase.

It is worth noting that the effect of these increases or decreases in the price of rice on private consumption, government expenditures, and total absorption are larger in most cases than the corresponding impact of the entire Doha agreement as simulated in this study (table 4.1).

For the population as a whole, 78 percent of households experience real income losses from a decrease of either 25 or 50 percent in world rice prices (tables 4.6, 3.1.A). The distributional impact is regressive. Real income falls for all rural households except the richest 10 percent as a result of either

Table 4.5 Impact of a Change in the World Price of Rice on India's Economy

(PERCENT CHANGE FROM BASELINE)

Macroeconomic indicator	World price of rice decreases by 25 percent	World price of rice decreases by 50 percent	World price of rice increases by 25 percent	World price of rice increases by 50 percent
Private consumption	–0.16	–0.24	0.30	0.84
Government consumption	–0.09	–0.12	0.17	0.52
Investment consumption	–0.19	–0.28	0.39	1.20
Absorption	–0.16	–0.24	0.31	0.89
Import demand	–0.88	–1.28	1.82	5.62
Export supply	–0.64	–1.24	0.60	1.08
Total domestic production	–0.12	–0.17	0.23	0.70

price decrease, with the poorest households losing the most. The losses are most pronounced for disadvantaged groups in rural areas, including "scheduled tribes," "scheduled castes," and "other backward classes." Rice cultivation is an important source of income for most poor and middle-income rural Indian households, and these results suggest that even moderate declines in the world price of rice would increase rural poverty and have negative effects on income distribution.

In urban areas, where most households are net consumers of rice, the lowest income brackets of disadvantaged groups also experience small income losses. Most urban households feel little impact from the price declines. Only middle- and upper-income households realize gains of 0.1 percent or more.

The likely channel through which the decrease in the price of rice affects poor urban households is the labor market.[9] The drop in rice prices reduces demand for labor in rice production sharply, by almost 12 percent in the case of a 50 percent decline, and reduces overall demand for labor in the agricultural sector (table 4.7). Displaced rural laborers spill over into urban unskilled labor markets. Although demand for labor increases slightly in manufacturing and services in response to capital and other factors leaving rice for other sectors, the combined demand in those sectors grows less than the decrease in demand in agriculture. (It is worth recalling that the overall increase in demand for unskilled labor from the full Doha Round agreement as simulated in the global model is 0.9 percent.) The incomes of illiterate workers in urban areas, typically the least skilled, decline, as is seen in table 4.8.

The distributional impact of an *increase* in world rice prices on Indian households is progressive and is larger than that induced by price declines. The poorest rural households see real income gains of 1.4 to 2.2 percent from a 25 percent price increase and gains of 4 to 6.4 percent from an increase of

Table 4.6 Impact of a Change in the World Price of Rice on the Real Incomes of Indian Households

(PERCENT CHANGE IN REAL INCOME RELATIVE TO BASELINE NOMINAL INCOME OF HOUSEHOLDS)

Household group	World price of rice decreases by 25 percent	World price of rice decreases by 50 percent	World price of rice increases by 25 percent	World price of rice increases by 50 percent
Rural				
Rural "scheduled tribes," income 0–30 percent	–1.13	–1.65	2.20	6.40
Rural "scheduled tribes," income 31–60 percent	–0.60	–0.89	1.16	3.32
Rural "scheduled tribes," income 61–90 percent	–0.20	–0.29	0.36	0.98
Rural "scheduled tribes," income >90 percent	0.01	0.02	–0.04	–0.17
Rural "scheduled castes," income 0–30 percent	–0.95	–1.40	1.85	5.36
Rural "scheduled castes," income 31–60 percent	–0.76	–1.12	1.49	4.35
Rural "scheduled castes," income 61–90 percent	–0.31	–0.46	0.59	1.69
Rural "scheduled castes," income >90 percent	0.02	0.03	–0.05	–0.19
Rural "other backward classes," income 0–30 percent	–0.78	–1.14	1.50	4.33
Rural "other backward classes," income 31–60 percent	–0.70	–1.03	1.38	4.02
Rural "other backward classes," income 61–90 percent	–0.46	–0.67	0.90	2.64
Rural "other backward classes," income >90 percent	0.00	0.00	–0.01	–0.06
Other rural, income 0–30 percent	–0.73	–1.08	1.41	4.05
Other rural, income 31–60 percent	–0.62	–0.91	1.21	3.49
Other rural, income 61–90 percent	–0.46	–0.67	0.89	2.60
Other rural, income >90 percent	–0.07	–0.10	0.12	0.34
Urban				
Urban "scheduled tribes," income 0–30 percent	–0.12	–0.18	0.20	0.50
Urban "scheduled tribes," income 31–60 percent	–0.04	–0.06	0.05	0.09
Urban "scheduled tribes," income 61–90 percent	0.01	0.01	–0.03	–0.11
Urban "scheduled tribes," income >90 percent	0.02	0.03	–0.05	–0.18
Urban "scheduled castes," income 0–30 percent	–0.10	–0.15	0.17	0.43
Urban "scheduled castes," income 31–60 percent	–0.02	–0.03	0.01	–0.02
Urban "scheduled castes," income 61–90 percent	0.01	0.01	–0.03	–0.13
Urban "scheduled castes," income >90 percent	0.02	0.03	–0.05	–0.17
Urban "other backward classes," income 0–30 percent	–0.02	–0.03	0.01	–0.04
Urban "other backward classes," income 31–60 percent	0.05	0.07	–0.13	–0.42
Urban "other backward classes," income 61–90 percent	0.07	0.10	–0.16	–0.50
Urban "other backward classes," income >90 percent	0.04	0.06	–0.10	–0.31
Other urban, income 0–30 percent	0.03	0.05	–0.10	–0.37
Other urban, income 31–60 percent	0.09	0.13	–0.20	–0.63
Other urban, income 61–90 percent	0.11	0.16	–0.23	–0.72
Other urban, income >90 percent	0.09	0.13	–0.19	–0.58
Total	–0.13	–0.19	0.23	0.64

Table 4.7 Impact of a Decrease in the World Price of Rice on the Demand for Labor in India

(CHANGE FROM BASELINE IN BILLION RUPEES AND PERCENT)

	World price of rice decreases by 25 percent		World price of rice decreases by 50 percent	
Sector	Billion rupees	Percent	Billion rupees	Percent
Rice sector	–22.11	–8.06	–32.25	–11.76
Agricultural sector	–16.67	–0.86	–24.33	–1.26
Manufacturing sector	6.03	0.43	8.81	0.64
Services sector	1.85	0.07	2.68	0.10

50 percent, with the disadvantaged groups gaining most. All rural households except the richest 10 percent would gain. Similarly, labor income increases for rural workers at all education levels and for both men and women, with illiterate workers and disadvantaged groups the largest gainers. The impact of a price increase on the incomes of urban households is more varied. Some poor households gain while others lose. The richest households are net losers. Illiterate urban workers from all disadvantaged groups see their incomes rise, while the results for other urban workers show a mix of small gains and small losses with no consistent pattern.

The impact of increases or decreases in the world price of wheat on the Indian economy is more muted (table 4.9). Most macroeconomic variables are almost unchanged, except for imports, which increase by 1 percent in the case of a 50 percent price decline. The negative impact of a decrease in world wheat prices on rural households is much smaller than that of a decline in the price of rice, although the pattern is fairly similar. Urban households experience small gains at all income levels (table 4.10). Although the gains and losses are very small, the overall effect could be to increase poverty, as 92 million rural households in the bottom six deciles of income experience some real income loss, while only 32 million urban households in the same deciles experience income gains (tables 4.10, 3.1.A).

Increases in the world price of wheat produce very small gains for the poorest groups in rural areas and very small losses for other rural and all urban households.

The increase in agricultural prices as simulated here arises from changes in world market prices, which would have a stronger effect on India after it lowers its tariffs. However in studies and discussions of the proposals for "special products" and a "special safeguard mechanism" in the Doha Round, a price increase is sometimes treated as a surrogate for government action to mitigate global price declines through tariff measures.[10] In our

Table 4.8 Impact of a Change in the World Price of Rice on the Income to Factors in India

(BASELINE IN BILLION RUPEES, PERCENT CHANGE FROM BASELINE)

Factor	Baseline	World price of rice decreases by 25 percent	World price of rice decreases by 50 percent	World price of rice increases by 25 percent	World price of rice increases by 50 percent
Capital	8483.87	–0.05	–0.08	0.08	0.17
Rural labor					
Rural "scheduled tribes," illiterate males	78.97	–1.01	–1.47	2.03	6.06
Rural "scheduled tribes," illiterate females	60.00	–1.10	–1.60	2.22	6.62
Rural "scheduled tribes," some school males	144.56	–0.91	–1.32	1.82	5.45
Rural "scheduled tribes," some school females	32.82	–0.98	–1.43	1.97	5.90
Rural "scheduled tribes," graduate males	23.59	–0.33	–0.49	0.64	1.83
Rural "scheduled tribes," graduate females	1.75	–1.07	–1.56	2.14	6.37
Rural "scheduled castes," illiterate males	134.00	–0.96	–1.39	1.93	5.76
Rural "scheduled castes," illiterate females	73.52	–1.14	–1.66	2.30	6.87
Rural "scheduled castes," some school males	255.35	–0.79	–1.15	1.59	4.73
Rural "scheduled castes," some school females	37.21	–0.81	–1.18	1.62	4.83
Rural "scheduled castes," graduate males	40.03	–0.44	–0.65	0.87	2.53
Rural "scheduled castes," graduate females	3.74	–0.32	–0.48	0.61	1.73
Rural "other backward classes," illiterate males	184.27	–0.89	–1.30	1.79	5.35
Rural "other backward classes," illiterate females	111.60	–1.00	–1.45	2.01	6.01
Rural "other backward classes," some school males	460.39	–0.69	–1.01	1.39	4.14
Rural "other backward classes," some school females	98.46	–0.72	–1.06	1.45	4.33
Rural "other backward classes," graduate males	85.99	–0.47	–0.70	0.93	2.70
Rural "other backward classes," graduate females	7.32	–0.39	–0.57	0.75	2.16
Other rural illiterate males	123.14	–0.91	–1.32	1.83	5.46
Other rural illiterate females	77.63	–0.86	–1.25	1.72	5.12
Other rural some school males	566.43	–0.72	–1.05	1.44	4.28
Other rural some school females	168.06	–0.63	–0.93	1.26	3.74
Other rural graduate males	222.37	–0.41	–0.60	0.80	2.32
Other rural graduate females	20.41	–0.30	–0.44	0.56	1.59

view, an increase in world prices is not equivalent to a policy-induced domestic price change. However if the surrogate approach is taken, the impact of Indian government action to shield its domestic producers from a decline in the world price of rice would unambiguously be to reduce poverty and improve income distribution. In the case of wheat, government action could also have a net poverty reducing effect, although the determination would require a careful analysis of the extent of gains and losses in poor and near-poor households.

Table 4.8 (continued) Impact of a Change in the World Price of Rice on the Income to Factors in India

(BASELINE IN BILLION RUPEES, PERCENT CHANGE FROM BASELINE)

Factor	Baseline	World price of rice decreases by 25 percent	World price of rice decreases by 50 percent	World price of rice increases by 25 percent	World price of rice increases by 50 percent
Urban labor					
Urban "scheduled tribes," illiterate males	23.41	–0.15	–0.22	0.28	0.80
Urban "scheduled tribes," illiterate females	6.97	–0.34	–0.50	0.68	2.01
Urban "scheduled tribes," some school males	91.50	–0.02	–0.04	0.02	–0.01
Urban "scheduled tribes," some school females	14.84	0.01	0.02	–0.05	–0.21
Urban "scheduled tribes," graduate males	48.78	0.01	0.02	–0.06	–0.27
Urban "scheduled tribes," graduate females	8.68	–0.02	–0.04	0.01	–0.04
Urban "scheduled castes," illiterate males	80.73	–0.08	–0.12	0.14	0.38
Urban "scheduled castes," illiterate females	31.36	–0.22	–0.33	0.43	1.25
Urban "scheduled castes," some school males	247.87	0.01	0.01	–0.04	–0.17
Urban "scheduled castes," some school females	20.94	–0.10	–0.15	0.17	0.43
Urban "scheduled castes," graduate males	67.39	–0.03	–0.05	0.02	–0.02
Urban "scheduled castes," graduate females	6.67	–0.16	–0.24	0.28	0.74
Urban "other backward classes," illiterate males	99.97	–0.05	–0.07	0.08	0.21
Urban "other backward classes," illiterate females	34.42	–0.09	–0.13	0.17	0.48
Urban "other backward classes," some school males	435.56	0.06	0.08	–0.14	–0.45
Urban "other backward classes," some school females	52.79	0.03	0.04	–0.08	–0.27
Urban "other backward classes," graduate males	173.31	–0.04	–0.06	0.04	0.04
Urban "other backward classes," graduate females	22.39	–0.12	–0.18	0.20	0.49
Other urban illiterate males	89.77	0.02	0.02	–0.05	–0.19
Other urban illiterate females	25.08	–0.03	–0.05	0.05	0.13
Other urban some school males	644.03	0.13	0.18	–0.28	–0.88
Other urban some school females	99.96	–0.01	–0.01	–0.02	–0.12
Other urban graduate males	672.88	0.04	0.06	–0.12	–0.42
Other urban graduate females	153.37	–0.08	–0.13	0.13	0.30
All labor	6164.27	–0.36	–0.52	0.70	2.05

In the debate over the proposals for "special products" and a "special safeguard mechanism" some have argued that the poor in developing countries could be made worse off by use of these measures, because gains for the rural poor might be offset by losses to the urban poor.[11] Although this could happen under particular circumstances, the concentration of the poor in rural areas and in the agricultural sector in most developing countries suggests that the dominant impact of these policies would be to reduce poverty, as demonstrated here for the case of rice in India. Other careful studies of the distributional impact of agricultural price declines induced by

Table 4.9 Impact of a Change in the World Price of Wheat on India's Economy

(PERCENT CHANGE FROM BASELINE)

Macroeconomic indicator	World price of wheat decreases by 25 percent	World price of wheat decreases by 50 percent	World price of wheat increases by 25 percent	World price of wheat increases by 50 percent
Private consumption	0.03	0.10	–0.02	–0.03
Government consumption	0.00	0.01	0.00	0.00
Investment consumption	0.00	0.00	0.00	0.00
Absorption	0.02	0.06	–0.01	–0.02
Import demand	0.27	1.00	–0.12	–0.19
Export supply	0.12	0.33	–0.07	–0.13
Total domestic production	0.00	0.01	0.00	0.00

trade policy changes find that the overall impact on poor households can be negative even when the urban poor gain.[12] In addition, adverse agricultural price shocks can have negative effects on poor urban households through labor market transmission, which can offset the gains they might realize as net consumers of agricultural products.

These results demonstrate that the impact of world agricultural price changes on incomes and poverty depends on the specific patterns of production and consumption in a country. In the case of rice and wheat, the ability to use a "special products" designation and invoke a "special safeguard mechanism" would be important instruments for the Indian government to have available to avoid negative effects on the incomes of the poor in the face of global price changes. In the Doha negotiations, it would be most advantageous for developing countries like India to have the flexibility to respond to price shocks based on their own specific conditions at the time of the shock, rather than having rigid disciplines imposed in advance.

The Impact on the Rest of the World

The impact on the rest of the world of a Doha agreement like the one simulated here is positive but modest for other countries as a group (table 4.11). The world excluding India gains $30.4 billion in real income, of which households gain $20 billion and investment increases by $10.7 billion. Three regions lose slightly from a Doha agreement—Sub-Saharan Africa (except South Africa), the rest of North America (due to losses to Mexico), and the residual group in the model, which includes non-EU European nations, central Asia, Russia, and Turkey. The negative results for Mexico and Sub-Saharan Africa have been strikingly consistent across many simulations of the Doha round.

Table 4.10 Impact of a Change in the World Price of Wheat on the Real Incomes of Indian Households

(PERCENT CHANGE IN REAL INCOME RELATIVE TO BASELINE NOMINAL INCOME TO HOUSEHOLDS)

Household group	World price of wheat decreases by 25 percent	World price of wheat decreases by 50 percent	World price of wheat increases by 25 percent	World price of wheat increases by 50 percent
Rural				
Rural "scheduled tribes," income 0–30 percent	–0.08	–0.22	0.05	0.09
Rural "scheduled tribes," income 31–60 percent	–0.01	–0.01	0.00	0.01
Rural "scheduled tribes," income 61–90 percent	0.04	0.11	–0.02	–0.04
Rural "scheduled tribes," income >90 percent	0.04	0.10	–0.02	–0.04
Rural "scheduled castes," income 0–30 percent	–0.04	–0.10	0.02	0.04
Rural "scheduled castes," income 31–60 percent	–0.04	–0.11	0.03	0.05
Rural "scheduled castes," income 61–90 percent	0.01	0.04	–0.01	–0.01
Rural "scheduled castes," income >90 percent	0.04	0.11	–0.02	–0.04
Rural "other backward classes," income 0–30 percent	–0.02	–0.04	0.01	0.02
Rural "other backward classes," income 31–60 percent	–0.04	–0.11	0.03	0.05
Rural "other backward classes," income 61–90 percent	–0.03	–0.09	0.02	0.04
Rural "other backward classes," income >90 percent	0.03	0.08	–0.02	–0.03
Other rural, income 0–30 percent	–0.01	–0.02	0.01	0.01
Other rural, income 31–60 percent	–0.02	–0.04	0.01	0.02
Other rural, income 61–90 percent	–0.02	–0.06	0.02	0.03
Other rural, income >90 percent	0.01	0.04	–0.01	–0.01
Urban				
Urban "scheduled tribes," income 0–30 percent	0.06	0.18	–0.04	–0.06
Urban "scheduled tribes," income 31–60 percent	0.05	0.14	–0.03	–0.05
Urban "scheduled tribes," income 61–90 percent	0.04	0.11	–0.02	–0.04
Urban "scheduled tribes," income >90 percent	0.03	0.09	–0.02	–0.03
Urban "scheduled castes," income 0–30 percent	0.07	0.19	–0.04	–0.07
Urban "scheduled castes," income 31–60 percent	0.06	0.16	–0.03	–0.06
Urban "scheduled castes," income 61–90 percent	0.04	0.12	–0.03	–0.05
Urban "scheduled castes," income >90 percent	0.03	0.09	–0.02	–0.03
Urban "other backward classes," income 0–30 percent	0.07	0.20	–0.04	–0.07
Urban "other backward classes," income 31–60 percent	0.06	0.18	–0.04	–0.07
Urban "other backward classes," income 61–90 percent	0.05	0.14	–0.03	–0.05
Urban "other backward classes," income >90 percent	0.03	0.09	–0.02	–0.04
Other urban, income 0–30 percent	0.07	0.21	–0.05	–0.08
Other urban, income 31–60 percent	0.06	0.18	–0.04	–0.07
Other urban, income 61–90 percent	0.05	0.15	–0.03	–0.06
Other urban, income >90 percent	0.04	0.12	–0.03	–0.05
Total	0.03	0.07	–0.02	–0.03

Table 4.11 Impact on the Rest of the World of a Doha Liberalization by Sector

(CHANGE IN REAL INCOME, BILLION DOLLARS)

Country or region	Agricultural export subsidies removal	Agricultural domestic subsidies reduction	Agricultural tariff reduction	Food tariff reduction	Manufactures tariff reduction	Full Doha
Australia, New Zealand, Oceania	0.14	0.06	0.07	0.37	–0.04	0.66
China	–0.10	–1.93	–0.34	–1.66	4.02	6.16
Japan	–0.36	–0.49	0.08	–0.06	3.05	3.39
Rest of East Asia	–0.37	0.55	2.32	1.60	4.46	6.78
Rest of South Asia	–0.05	0.34	0.47	0.48	0.24	0.33
Rest of NAFTA	–0.05	0.22	–0.04	0.02	–0.97	–0.78
United States	–0.36	–1.87	–1.79	–1.87	1.52	2.63
Mercosur	0.07	0.03	0.33	0.82	0.83	2.03
Rest of the Americas	–0.20	0.26	0.65	0.70	0.66	0.92
EU	1.76	–1.33	–3.80	–3.46	2.76	7.66
South Africa	–0.01	–0.01	0.06	0.08	0.23	0.35
Rest of Sub-Saharan Africa	–0.32	–0.03	0.18	0.25	0.08	–0.12
Middle East, North Africa	–1.00	0.08	0.50	0.50	1.46	0.78
Rest of world	–0.62	0.22	0.20	0.15	0.08	–0.41
Total, Non–India	–1.47	–3.91	–1.10	–2.09	18.36	30.38

As in the case of India, most of the gains for the rest of the world as a whole come from reduction of manufacturing tariffs, although there is significant variation among countries, as would be expected given their differing endowments and competitive advantages. For example, Sub-Saharan Africa's losses are driven by the elimination of agricultural export subsidies, reflecting the fact that many of the countries in the region are net food importers. China gains from the elimination of manufacturing tariffs but loses from the elimination of agricultural and food tariffs and subsidies. The Mercosur bloc gains modestly and about equally from the elimination of tariffs on agriculture, food, and manufactures.

Additional results from the global model simulation of a Doha agreement, showing changes in the terms of trade for all countries and regions and for world prices of commodities, are presented in appendix A, table A.4.1 and figure A.4.1.

Notes

1. The change in real income (also called welfare) is calculated as the Slutsky equivalent variation, a measurement of the minimum amount that one who gains from a change would be willing to accept to forgo the change.
2. See, e.g., Polaski (2004); International Monetary Fund (2007a).

3. Laborsta database for 2004, http://laborsta.ilo.org/ (ILO 2007).
4. See, e.g., He, Li, and Polaski (2007).
5. van der Mensbrugghe (2006b).
6. The G33 includes the following 46 countries: Antigua and Barbuda, Barbados, Belize, Benin, Bolivia, Botswana, China, Congo, Côte d'Ivoire, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Jamaica, Kenya, Rep. Korea, Madagascar, Mauritius, Mongolia, Mozambique, Nicaragua, Nigeria, Pakistan, Panama, Peru, Philippines, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Senegal, Sri Lanka, Suriname, Tanzania, Trinidad and Tobago, Turkey, Uganda, Venezuela, Zambia, Zimbabwe (World Trade Organization, 2007a).
7. Conforti (2004). Changes in world prices may not be fully transmitted to all producers and households due to market imperfections, poor roads and other causes. However all households are likely to feel some direct effect of world price changes and may also be affected through labor and land markets (Dyer et al. 2005, Taylor et al. 2003). A reduction in tariffs is likely to increase price transmission (Brooks 2003).
8. Conforti (2004).
9. Recent work demonstrates how agricultural price shocks can be transmitted through labor and land markets. See, e.g., Dyer et al. (2005).
10. See, e.g., Ivanic and Martin (2006).
11. Ibid.
12. See, e.g., Ravallion and Lokshin (2004). Hertel et al. (2006) find that poverty can increase due to either agricultural price increases or decreases, depending on the specific circumstances of the country studied. Hertel and Reimer (2004) find that, in general, trade affects households more strongly through the income channel (as producers and wage earners) than through the expenditure channel (as consumers).

CHAPTER 5

Results from the Simulation of an India-EU Free Trade Agreement

Negotiations for a free trade agreement between India and the EU began in June 2007. If successful, this agreement would affect India's largest trade relationship and could be expected to have significant effects (table 2.2). We simulate the impact of such an agreement using the global model. This section reports the results of that experiment for both India and the EU.

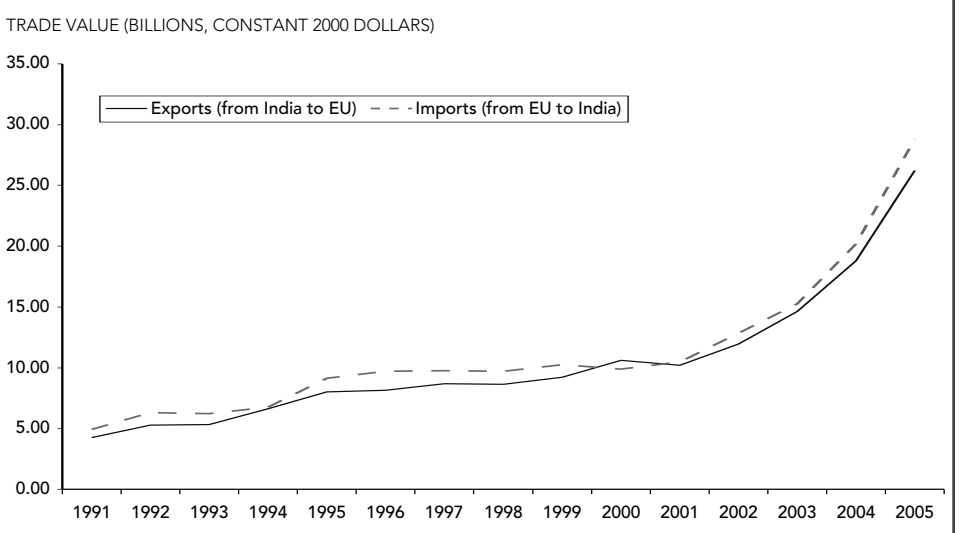
In the free trade simulation, India and the EU fully liberalize trade with each other in agricultural, processed food, and manufactured goods. Specifically, all import tariffs and export taxes are eliminated by both parties. However neither party alters domestic subsidies. Although domestic subsidies can be trade distorting, they are typically not addressed in bilateral trade negotiations, and there is no reason to expect that they will be part of an India-EU FTA. As noted in Chapter 3, we do not include liberalization of services trade in the simulation for the reasons that were discussed above. However we note again that if the liberalization measures were ambitious, the gains could be significant, and this should be kept in mind as possibly augmenting the results presented here.

To provide a context for the simulation of this major trade policy change, we present the evolution of trade between India and the European Union from 1991, when India significantly lowered tariffs, through 2005 (figure 5.1). The growth of trade between the parties in recent years would likely continue in the absence of an FTA, given the rapid growth of India's economy, ongoing unilateral reductions in tariffs by India, and established trade relationships and patterns.

Main Results for India

The main macroeconomic results for India of the simulation of full merchandise trade liberalization are presented in table 5.1.

Figure 5.1 The Evolution of India-EU Trade, 1991–2005



Note: In 2004, the EU expanded from fifteen to twenty-five countries. Earlier data are for EU-15; post-2004 data are for EU-25.
Source: United Nations, UN COMTRADE Database.

The bilateral FTA would increase overall exports and imports for both India and the European Union, as would be expected after the elimination of all tariffs. India's exports would increase by $3.5 billion (5.5 percent), with the largest increases seen in exports of apparel and textiles, which would increase by $1.9 billion, followed by increases in the category "other manufacturing," notably leather and footwear (an increase of $520 million), chemicals ($220 million), and services ($230 million). India's imports would increase by $2.6 billion (3.4 percent), concentrated overwhelmingly in manufactured goods, particularly capital goods ($2.1 billion), followed by smaller increases

Table 5.1 Macroeconomic Results for India of an India-EU Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	–1.34	–0.43
Government consumption	–0.03	–0.05
Investment consumption	1.12	1.05
Absorption	–0.25	–0.05
Import demand	2.61	3.43
Export supply	3.49	5.52
Total domestic production	2.93	0.34

in imports of minerals and metals ($420 million) and chemicals ($360 million). India's imports of vehicles would increase by $120 million, while its exports of vehicles would increase by $60 million. Because the overall increase in imports would be less than the increase in exports, India's existing bilateral trade deficit with the EU would narrow.

Overall, India would experience a very small welfare loss (–$250 million). While exporting more, India would consume slightly less domestically, at least in the short run. In terms of economic welfare, Indian households would lose from the agreement, with private consumption declining by $1.3 billion (0.4 percent). In the model it is assumed that the government would replace lost tariff revenue with an across-the-board increase in taxes, which in India fall most heavily on households. Investment would increase by $1.1 billion (1 percent), as tariff reductions lower prices of imported capital goods and new export opportunities increase demand for some Indian manufactures. In effect, investors gain at the expense of households.

The impact of the trade agreement on India varies depending on the sector that is liberalized (table 5.2). The country would see little overall change as a result of agricultural liberalization. Although agricultural production is a very important part of the Indian economy, trade in agricultural goods constitutes only a small portion of India's total trade. Its agricultural exports to the EU amount to 6.9 percent of exports to the bloc, whereas imports of agricultural goods make up only 0.5 percent of Indian imports from the EU. The liberalization of agricultural trade with the EU would reduce India's overall domestic production very slightly (by $50 million), as increased imports of $70 million outstrip a $20 million increase in exports and domestic consumption in India is largely unchanged.

Liberalization of trade in processed food has a slightly larger and more positive impact on India, with domestic production increasing by $200 million. As with agricultural liberalization, imports increase more than exports ($120 million and $70 million, respectively) as a result of the liberalization of trade in processed food; household consumption in India increases by $150 million.

The impact on India of manufacturing liberalization, by contrast, is larger and more varied. India's elimination of tariffs on manufactures has a relatively large negative impact on Indian households, whose consumption declines by $1.5 billion (–0.5 percent) despite a modest positive impact from EU liberalization. Government tariff revenue also declines slightly. Investment increases by $1.1 billion (1 percent). These results are dominated in each case by India's own manufacturing liberalization measures, including the loss of tariff revenue that must be offset by increases in taxes.

Table 5.2 Impact on India of India-EU Liberalization by Sector

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	European liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
5.2.A Agriculture Liberalization						
Private consumption	–0.01	0.00	0.03	0.01	0.01	0.00
Government consumption	0.01	0.02	–0.01	–0.01	0.01	0.01
Investment consumption	0.03	0.03	–0.01	–0.01	0.02	0.02
Absorption	0.03	0.01	0.01	0.00	0.04	0.01
Import demand	0.06	0.08	0.01	0.02	0.07	0.10
Export supply	–0.01	–0.02	0.03	0.05	0.02	0.03
Total domestic production	–0.13	–0.02	0.09	0.01	–0.05	–0.01
5.2.B Food Liberalization						
Private consumption	0.10	0.03	0.06	0.02	0.15	0.05
Government consumption	0.01	0.02	–0.01	–0.02	0.00	0.00
Investment consumption	0.03	0.03	–0.02	–0.02	0.01	0.01
Absorption	0.14	0.03	0.03	0.01	0.16	0.03
Import demand	0.09	0.12	0.04	0.05	0.12	0.16
Export supply	0.00	–0.01	0.08	0.12	0.07	0.11
Total domestic production	0.09	0.01	0.13	0.01	0.20	0.02
5.2.C Manufacturing Liberalization						
Private consumption	0.51	0.16	–2.01	–0.65	–1.50	–0.48
Government consumption	0.07	0.12	–0.11	–0.18	–0.04	–0.06
Investment consumption	0.24	0.22	0.84	0.79	1.08	1.02
Absorption	0.81	0.17	–1.27	–0.27	–0.45	–0.10
Import demand	0.71	0.93	1.67	2.19	2.41	3.18
Export supply	0.32	0.51	3.04	4.80	3.40	5.38
Total domestic production	1.11	0.13	1.61	0.19	2.79	0.32
5.2.D All Sectors Liberalization						
Private consumption	0.59	0.19	–1.92	–0.62	–1.34	–0.43
Government consumption	0.10	0.16	–0.12	–0.20	–0.03	–0.05
Investment consumption	0.30	0.28	0.81	0.77	1.12	1.05
Absorption	0.98	0.21	–1.23	–0.26	–0.25	–0.05
Import demand	0.85	1.12	1.72	2.27	2.61	3.43
Export supply	0.30	0.48	3.15	4.97	3.49	5.52
Total domestic production	1.06	0.12	1.83	0.21	2.93	0.34

The Distribution of India's Gains

Turning to the distribution of gains among factors of production within India, the simulation shows that the owners of natural resources would gain most, as a share of current incomes, with income to natural resources rising by 4.3 percent. Income to owners of land would rise by 1.5 percent, to unskilled labor by 0.5 percent, to skilled labor by 0.15 percent, and to owners of

Table 5.3 Impact on the Income to Factors in India of India-EU Liberalization

(PERCENT CHANGE)

Factor	Bilateral agricultural tariff removal	Bilateral food tariff removal	Bilateral manufactures tariff removal	Full bilateral FTA
Land	0.25	0.12	1.12	1.50
Unskilled labor	0.00	0.07	0.44	0.51
Skilled labor	–0.01	0.07	0.10	0.15
Capital	–0.01	0.06	0.07	0.12
Natural resources	–0.13	0.03	4.37	4.27

capital by 0.12 percent (table 5.3). These results suggest that natural resources and land are relatively more abundant in India than in the EU, compared with the abundance of other factors, which seems likely. It also seems likely that skilled labor and capital are relatively less abundant in India than in the EU, and this is reflected in the relative paucity of gains for those factors. The returns to unskilled labor are somewhat surprising, given that this factor is likely much more abundant in India than in the EU relative to other factors. However as noted above, several studies have shown surprisingly small gains for unskilled labor in recent episodes of trade liberalization, regardless of the relative abundance of the factor.

The strongest effects on all factors would arise from manufacturing liberalization. Even landowners would gain more from manufacturing liberalization than from agricultural liberalization (1.1 percent, compared with 0.3 percent).

In terms of employment generation, the India-EU FTA would increase the demand for unskilled labor modestly, by 0.5 percent, or approximately 2.3 million jobs based on current employment levels. Most of the increased demand would come from the apparel and textile sectors, with smaller additional increases from the construction, trade, and transport sectors. Other manufacturing sectors would demand *less* unskilled labor than under current conditions, although the decreases would be small. There would be little change in the demand for unskilled labor in agriculture.

Changes in the terms of trade for India and the EU under the simulation are presented in appendix A, table A.5.1.

Main Results for the European Union

In contrast to the mixed results for India, the European Union would benefit unambiguously from the agreement, although to a very modest extent (table 5.4). Overall welfare would increase by $2.2 billion, 0.03 percent of much

Table 5.4 Macroeconomic Results for the EU of an India-EU Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	1.57	0.03
Government consumption	0.00	0.00
Investment consumption	0.64	0.04
Absorption	2.22	0.03
Import demand	3.21	0.11
Export supply	1.35	0.05
Total domestic production	2.59	0.02

higher European consumption. Households in Europe would consume $1.6 billion more, an increase of 0.03 percent, while investment would increase by $640 million, a gain of 0.04 percent. Government income would be virtually unchanged. Exports would increase by $1.3 billion, a gain of 0.05 percent of total European exports. A gain of $1.6 billion in exports of machinery, electronic equipment, and other durable manufactures would be offset by moderate losses in exports of textiles, apparel, and services. Imports would increase by $3.2 billion (0.12 percent), with the largest increases in apparel and textiles ($750 million), chemicals ($230 million), minerals and metal ($250 million), vehicles ($190 million), other manufacturing ($710 million), and services ($510 million). Europe's existing bilateral trade surplus with India would decrease.

The impact on the EU of bilateral liberalization of agricultural goods and processed foods and of Europe's own liberalization of manufactures trade is extremely small. European gains arise almost entirely from India's opening of its market for manufactured goods to EU exports. Europe gains $2.4 billion in total consumption as a result of India's liberalization of manufactured goods, offset by a slight loss of $220 million from the EU's own manufacturing liberalization. Additional results for the EU of an India-EU free trade agreement are presented in appendix A, table A.5.2.

CHAPTER 6

Results from the Simulation of an India-U.S. Free Trade Agreement

The prospects of a free trade agreement between India and the United States are not strong in the foreseeable future. Nonetheless, we simulate such an agreement because India's trade relationship with the United States is the country's second largest, amounting to about half the level of trade with the EU. We simulate an agreement using the global model and provide aggregate results for India and the United States.

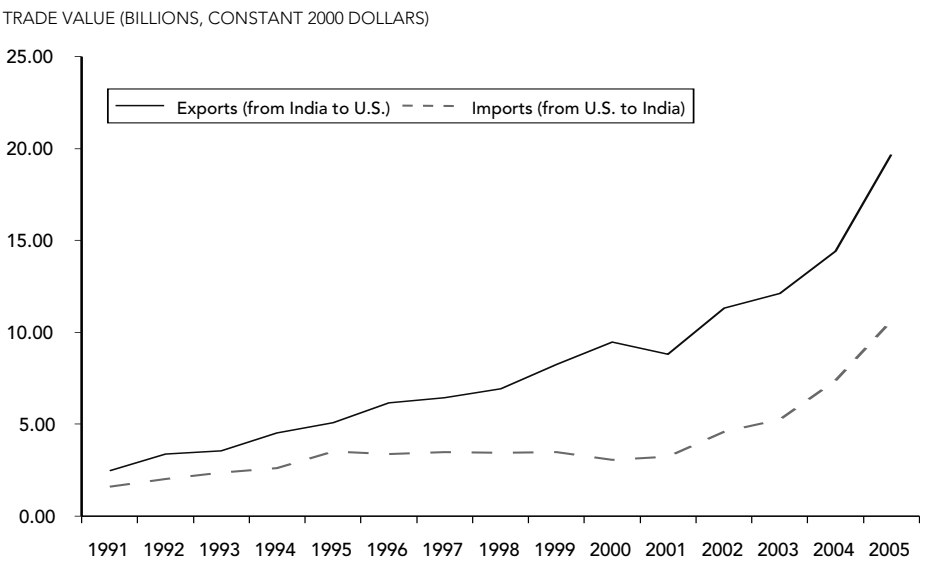
In the free trade simulation, India and the United States fully liberalize trade with each other in agricultural, processed food, and manufactured goods. Specifically, all import tariffs and export taxes are eliminated by both parties. However neither party alters domestic subsidies, because they are typically not addressed in bilateral trade negotiations. As with the other simulations, we do not include liberalization of services trade because of data and methodological problems. However we note again that if services trade were liberalized, additional gains could arise, and this should be kept in mind as possibly augmenting the results presented here.

Figure 6.1 presents the evolution of trade between India and the United States from 1991, when India significantly lowered tariffs, through 2005. The growth of trade between the parties in recent years would likely continue in the absence of an FTA, given the rapid growth of India's economy, ongoing unilateral reductions in tariffs by India, and established trade relationships and patterns.

Main Results for India

India's overall real income increases by about $260 million as a result of a free trade agreement between India and the United States, a gain of 0.05 percent (table 6.1). Indian households would lose about $40 million in real

Figure 6.1 The Evolution of India-U.S. Trade, 1991–2005



Source: United Nations, UN COMTRADE Database.

income under the agreement (–0.01 percent), whereas investment would increase by about $290 million (0.28 percent).

The slightly positive overall result for India contrasts with the slightly negative overall impact of an FTA with the EU. India would gain less from greater access to the U.S. market than it would gain from tariff-free access to the EU; however it would also lose less as a result of opening its own markets. This is a reflection of the fact that India's trade relationship with the United States is considerably smaller than that with the EU, and so the impact of tariff changes is less. India also enjoys a trade surplus with the United States while it has a trade deficit with the EU. The tariff loss to the Indian government of an India-U.S. agreement would be less than from an agreement with the EU, and thus smaller offsetting tax increases would be required.

Total domestic production would increase by $1.7 billion (0.2 percent). Exports would increase by $1.2 billion (2 percent), whereas imports would increase by $1 billion (1.3 percent). The only significant changes in exports are in the categories of apparel, with exports increasing by $720 million (12.7 percent), and textiles, with an increase of $280 million (3.7 percent). India imports more capital goods and other machinery, which increase by $430 million (2.3 percent), and intermediate inputs, including chemicals ($250 million, or 2.7 percent) and minerals and metals ($110 million, or 1.1 percent).

Table 6.1 Macroeconomic Results for India of an India-U.S. Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	–0.04	–0.01
Government consumption	0.00	0.01
Investment consumption	0.29	0.28
Absorption	0.26	0.05
Import demand	0.97	1.28
Export supply	1.24	1.96
Total domestic production	1.68	0.19

The sectoral components of the overall results are given in table 6.2. Liberalization of agricultural trade with the United States has even less of an impact on India than a similar agreement with the EU. The United States' elimination of agricultural and processed food tariffs has virtually no impact on India, and India's own liberalization of these sectors has very small and mixed effects. Given the limited nature of existing agricultural and food trade between the countries, their distance from each other, and the assumption that the United States will continue to provide agricultural subsidies, this result is not surprising. By way of illustration, Indian rice and cotton would not be competitive in the U.S. market, given high U.S. subsidies to those crops.

As with a free trade agreement with Europe, the modest overall results are driven by liberalization of the manufacturing sector. However in contrast to the agreement with the EU, gains from the United States' opening of its market to Indian manufactures offset the losses from India's own elimination of manufacturing tariffs. A majority (55 percent) of the increase in domestic production in India is driven by the United States' elimination of tariffs on Indian manufactures.

The Distribution of India's Gains

The largest gains to factors in India of an India-U.S. FTA would be claimed by the owners of natural resources, whose income would rise by 0.57 percent, followed by owners of land (gains of 0.39 percent) (table 6.3). Unskilled labor would see income rise by 0.33 percent, skilled labor by 0.21 percent, and the owners of capital by 0.17 percent. The pattern of distribution of gains is similar to that seen in the India-EU FTA, although the gains are smaller in every case except for skilled labor and owners of capital, whose very small gains would be slightly larger under the India-U.S. agreement. This suggests that the difference in the abundance of skilled labor and capital is slightly larger between India and the United States than between

Table 6.2 Impact on India of India-U.S. Liberalization by Sector

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	U.S. liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
6.2.A Agriculture Liberalization						
Private consumption	0.00	0.00	0.04	0.01	0.04	0.01
Government consumption	0.00	0.00	–0.01	–0.01	–0.01	–0.01
Investment consumption	0.00	0.00	–0.01	–0.01	–0.01	–0.01
Absorption	0.00	0.00	0.02	0.00	0.02	0.00
Import demand	0.00	0.00	0.02	0.03	0.03	0.03
Export supply	0.00	0.00	0.05	0.08	0.05	0.08
Total domestic production	0.00	0.00	0.14	0.02	0.13	0.02
6.2.B Food Liberalization						
Private consumption	0.01	0.00	0.02	0.01	0.03	0.01
Government consumption	0.00	0.00	–0.01	–0.01	–0.01	–0.01
Investment consumption	0.00	0.00	–0.02	–0.01	–0.01	–0.01
Absorption	0.01	0.00	0.00	0.00	0.01	0.00
Import demand	0.00	0.01	0.01	0.02	0.02	0.02
Export supply	0.00	0.00	0.05	0.08	0.05	0.07
Total domestic production	0.00	0.00	0.07	0.01	0.07	0.01
6.2.C Manufacturing Liberalization						
Private consumption	0.41	0.13	–0.51	–0.17	–0.11	–0.03
Government consumption	0.06	0.09	–0.04	–0.07	0.02	0.03
Investment consumption	0.19	0.17	0.13	0.12	0.32	0.30
Absorption	0.65	0.14	–0.42	–0.09	0.23	0.05
Import demand	0.58	0.76	0.34	0.44	0.92	1.21
Export supply	0.29	0.45	0.84	1.33	1.14	1.80
Total domestic production	0.93	0.11	0.52	0.06	1.47	0.17
6.2.D All Sectors Liberalization						
Private consumption	0.41	0.13	–0.45	–0.15	–0.04	–0.01
Government consumption	0.06	0.10	–0.05	–0.09	0.00	0.01
Investment consumption	0.19	0.18	0.10	0.10	0.29	0.28
Absorption	0.66	0.14	–0.40	–0.08	0.26	0.05
Import demand	0.59	0.77	0.37	0.49	0.97	1.28
Export supply	0.29	0.45	0.94	1.48	1.24	1.96
Total domestic production	0.93	0.11	0.73	0.08	1.68	0.19

India and the EU. The modest gains for unskilled labor present the same puzzle as with the India-EU agreement, given the strong abundance of this factor in India. Possible reasons for this result have been discussed above. The strongest effects on all factors would arise from manufacturing liberalization, as was the case in the India-EU agreement.

An India-U.S. FTA would increase the demand for unskilled labor very mod-

Table 6.3 Impact on the Income to Factors in India of India-U.S. Liberalization

(PERCENT CHANGE)

Factor	Bilateral agricultural tariff removal	Bilateral food tariff removal	Bilateral manufactures tariff removal	Full bilateral FTA
Land	–0.08	0.01	0.46	0.39
Unskilled labor	0.03	0.02	0.28	0.33
Skilled labor	0.03	0.02	0.15	0.21
Capital	0.04	0.02	0.11	0.17
Natural resources	0.10	0.11	0.36	0.57

estly, by 0.3 percent or approximately 1.4 million jobs based on current employment levels. Increases in demand would be seen in the apparel, textile, and trade and transport sectors. Other manufacturing sectors would see a small decrease in demand for unskilled labor. There would be almost no change in the demand for unskilled labor in agriculture.

Main Results for the United States

The United States gains more from the free trade agreement than India (a $700 million gain in real income, compared with $260 million), although as a percentage of its much larger economy the gains are trivial (table 6.4). U.S. households gain about $400 million, and U.S. investment increases by about $270 million. Exports increase by about $720 million (0.08 percent), dominated by capital goods and other machinery ($380 million) and chemicals ($230 million). The gains for the United States are partly offset by small losses in exports of services, transport, and wheat. Imports increase by $1.4

Table 6.4 Macroeconomic Results for the United States of an India-U.S. Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	0.40	0.01
Government consumption	0.03	0.00
Investment consumption	0.27	0.01
Absorption	0.70	0.01
Import demand	1.41	0.11
Export supply	0.72	0.08
Total domestic production	0.76	0.00

(0.11 percent), with the largest increases in apparel ($370 million), other manufactures ($350 million), textiles ($160 million), and vehicles ($110 million).

The gains for the United States are driven almost entirely by India's elimination of manufacturing tariffs on U.S. exports, which are partially offset by losses from the U.S. elimination of manufacturing tariffs. As with India, the United States is positively but only slightly affected by the liberalization of agriculture and processed food under the FTA, with all the effects on the United States arising from India's liberalization of its markets for these goods.

Additional results for the United States of an India-U.S. FTA are presented in appendix A, table A.6.1.

CHAPTER 7

Results from the Simulation of an India-China Free Trade Agreement

India and China launched a joint feasibility study in 2005 to determine whether to start negotiations for a free trade agreement. Their current trade relationship is the third-largest for India and one of the fastest-growing trade relationships for both countries. We simulate a free trade agreement between the parties using the global model and provide aggregate results for both India and China.

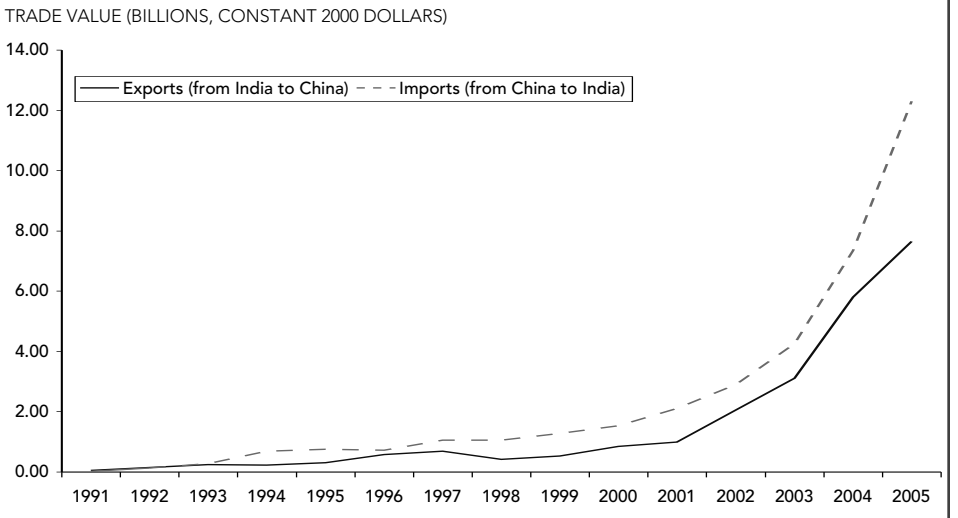
In the free trade simulation, India and China fully liberalize trade with each other in agricultural, processed food, and manufactured goods. Specifically, all import tariffs and export taxes are eliminated by both parties. Neither party alters domestic subsidies. As with the other simulations, we do not include liberalization of services trade because of data and methodological problems. Again we note that gains could be significant if services trade were liberalized to an ambitious extent, and this should be kept in mind as possibly augmenting the results presented here.

Figure 7.1 presents the evolution of trade between India and China from 1991, when India significantly lowered tariffs and China was beginning to open its economy, through 2005. The rapid growth of trade between the parties in recent years would likely continue in the absence of an FTA, given the high rates of growth of both economies and ongoing unilateral reductions in tariffs by India.

The Main Results for India

India's overall real income increases by about $110 million as a result of a free trade agreement between India and China, a gain of 0.02 percent (table 7.1). Indian households would lose about $10 million in real income under the agreement (–0.00 percent), while investment would increase by about $130 million (0.12 percent).

Figure 7.1 The Evolution of India-China Trade, 1991–2005



Source: United Nations, UN COMTRADE Database.

The gains for the overall economy and losses to households are both slightly smaller than in the India-U.S. free trade simulation, and in contrast to the larger losses in the India-EU simulation. However domestic production, exports, and imports would all increase less as a result of free trade with China than with the other two bilateral simulations. This largely reflects the smaller current trading relationship. Total domestic production would increase by $1.2 billion (0.14 percent). Exports would increase by $710 million (1.1 percent), whereas imports would increase by $480 million (0.6 percent). Exports would increase in the categories of other manufacturing ($190 million), chemicals ($130 million), textiles ($110 million), and apparel ($100 million). India's only significant increase in imports would be in chemicals

Table 7.1 Macroeconomic Results for India of an India-China Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	–0.01	0.00
Government consumption	–0.01	–0.02
Investment consumption	0.13	0.12
Absorption	0.11	0.02
Import demand	0.48	0.63
Export supply	0.71	1.12
Total domestic production	1.24	0.14

Table 7.2 Impact on India of India-China Liberalization by Sector

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	Chinese liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
7.2.A Agriculture Liberalization						
Private consumption	0.00	0.00	0.03	0.01	0.04	0.01
Government consumption	0.00	0.00	–0.01	–0.01	–0.01	–0.01
Investment consumption	0.00	0.00	–0.01	–0.01	–0.01	–0.01
Absorption	0.00	0.00	0.02	0.00	0.02	0.00
Import demand	0.00	0.00	0.02	0.02	0.02	0.03
Export supply	0.00	0.00	0.04	0.06	0.04	0.06
Total domestic production	0.00	0.00	0.11	0.01	0.11	0.01
7.2.B Food Liberalization						
Private consumption	0.02	0.01	0.00	0.00	0.02	0.01
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00
Investment consumption	0.01	0.01	0.00	0.00	0.00	0.00
Absorption	0.03	0.01	0.00	0.00	0.03	0.01
Import demand	0.02	0.02	0.00	0.00	0.02	0.02
Export supply	0.00	0.00	0.01	0.01	0.00	0.01
Total domestic production	0.02	0.00	0.01	0.00	0.03	0.00
7.2.C Manufacturing Liberalization						
Private consumption	0.13	0.04	–0.20	–0.07	–0.07	–0.02
Government consumption	0.02	0.03	–0.03	–0.04	–0.01	–0.01
Investment consumption	0.08	0.07	0.06	0.06	0.14	0.13
Absorption	0.23	0.05	–0.17	–0.04	0.06	0.01
Import demand	0.18	0.23	0.26	0.34	0.44	0.58
Export supply	0.04	0.06	0.63	1.00	0.67	1.06
Total domestic production	0.29	0.03	0.82	0.09	1.11	0.13
7.2.D All Sectors Liberalization						
Private consumption	0.15	0.05	–0.16	–0.05	–0.01	0.00
Government consumption	0.02	0.04	–0.03	–0.06	–0.01	–0.02
Investment consumption	0.08	0.08	0.05	0.05	0.13	0.12
Absorption	0.26	0.05	–0.15	–0.03	0.11	0.02
Import demand	0.19	0.26	0.28	0.37	0.48	0.63
Export supply	0.03	0.05	0.68	1.07	0.71	1.12
Total domestic production	0.30	0.03	0.94	0.11	1.24	0.14

($200 million), with additional increases of less than $100 million in imports of minerals and metals and other manufacturing.

In terms of sectoral impacts, liberalization of agricultural trade with China has little effect on India, with the very small changes and mixed results driven entirely by India's own liberalization (table 7.2). Manufacturing liberal-

Table 7.3 Impact on the Income to Factors in India of India-China Liberalization

(PERCENT CHANGE)

Factor	Bilateral agricultural tariff removal	Bilateral food tariff removal	Bilateral manufactures tariff removal	Full bilateral FTA
Land	–0.05	0.03	0.27	0.24
Unskilled labor	0.02	0.01	0.17	0.20
Skilled labor	0.03	0.01	0.14	0.17
Capital	0.03	0.01	0.15	0.19
Natural resources	0.01	–0.01	–0.19	–0.19

ization again dominates the simulation results, as with the other bilateral agreements. Gains from China's opening of its market to Indian manufactures more than offset the losses from India's own elimination of manufacturing tariffs to produce a small real income gain for India. In contrast to the FTA with the United States, about three-quarters of the overall increase in domestic production in India is driven by India's own elimination of tariffs, rather than by China's market opening.

The Distribution of India's Gains

In contrast to the pattern seen in simulations of free trade with the EU and the United States, the only loss to factors from an India-China agreement would be to owners of natural resources, who gained by far the most from free trade with the two developed-country groups (table 7.3). The other factors of production—land, unskilled labor, skilled labor, and owners of capital—would gain almost equally as a result of free trade with China. This suggests that aside from natural resources, the endowment of the two countries is roughly parallel, with no major realignment of returns to factors. The gains to land and unskilled labor that do occur are smaller in this simulation than in the India-EU and India-U.S. pacts. Returns to skilled labor and owners of capital increase about the same extent as in free trade with the EU and the United States. The strongest effects on all factors would arise from manufacturing liberalization, as was the case in the India-EU and India-U.S. agreements. Both Chinese and Indian liberalization would have positive, though very modest, impacts on unskilled labor, skilled labor, and the owners of land and capital.

An India-China FTA would increase the demand for unskilled labor very modestly, by 0.2 percent, or approximately 900,000 jobs. Increases in demand would be seen in trade and transport and other services, with

Table 7.4 Macroeconomic Results for China of an India-China Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

Macroeconomic indicator	Billion dollars	Percent
Private consumption	0.40	0.08
Government consumption	0.11	0.07
Investment consumption	0.43	0.10
Absorption	0.94	0.09
Import demand	0.77	0.24
Export supply	0.22	0.06
Total domestic production	1.66	0.05

smaller increases in construction and textiles. There would be almost no change in the demand for unskilled labor in agriculture.

The Main Results for China

China gains more in real income from the free trade agreement than does India (a $940 million gain, compared with $110 million), with Chinese households gaining about $400 million and investment in China increasing by $430 million (table 7.4). However India sees greater increases in exports than China ($710 million, compared with $220 billion). China's imports increase by $770 million, compared with India's increase of $480 million in imports. Chinese exports of chemicals rise by $240 million, and minerals and metals exports rise by $100 million. China's exports of other manufactured goods, apparel, and wood products all decline slightly. Chinese imports increase most in the categories other manufacturing ($290 million) and chemicals ($120 million). Total domestic production in China increases by $1.7 billion (0.05 percent).

China's gains in real income are driven almost entirely by India's elimination of manufacturing tariffs, while two-thirds of its gains in production arise from the same source, with the remaining gains arising from China's own elimination of manufacturing tariffs on Indian exports and the bilateral elimination of tariffs on processed food.

Additional results for China of an India-China FTA are presented in appendix A, table A.7.1.

CHAPTER 8

Comparison of the Impact on India of Different Trade Policy Choices

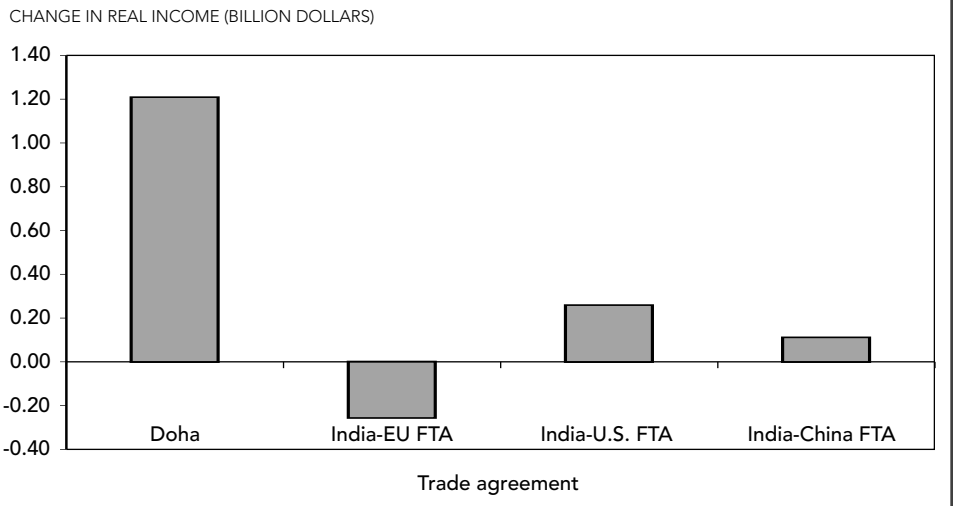
We now turn to a comparison of the results for the Indian economy, factors, and households of the different simulations. We then briefly review and compare results from other studies of Indian trade.

Comparing the Results of the Simulations in This Study

Comparing the impact on India of the four trade policy changes that have been simulated, it is clear that a multilateral trade agreement at the WTO, such as the Doha Round simulation, would have the largest impact by far on the Indian economy as a whole. A multilateral agreement would lead to an increase in India's overall real income of $1.2 billion, whereas bilateral trade pacts with the EU, United States, or China would lead to much smaller increases in welfare or even decreases, in the case of an India-EU FTA (figure 8.1).

From the perspective of Indian households, a Doha agreement would increase their welfare by $530 million, while each of the three bilateral FTAs would reduce household welfare (figure 8.2). In addition to changes in factor income and consumption prices, this is driven in part by a shift in the burden of supporting government after tariffs are reduced or eliminated. Tariffs remain a relatively important source of revenue for the Indian government, accounting for 11.4 percent of the combined tax revenue of the central and state governments in 2004–2005.[1] If they are reduced, the government would be forced either to reduce spending or to increase taxes, with either choice reducing the welfare of households, as happened during the early 1990s, when applied tariffs were lowered significantly.[2] The India-EU FTA would reduce Indian government revenue by nearly one-third, with lesser reductions arising under the other agreements simulated.

Figure 8.1 Change in Real Income for India under Different Trade Agreements



In terms of the contribution of sectors to the overall impact of the agreements, the strongest effects are caused by changes in manufacturing tariffs in all of the simulations. However in the case of a Doha agreement, both the partners' and India's own elimination of tariffs increase India's real income. By contrast, in each of the three bilateral FTAs, India benefits from its partner's elimination of tariffs but sees losses from its own elimination of tariffs.

Figure 8.2 Change in Real Income for Indian Households under Different Trade Agreements

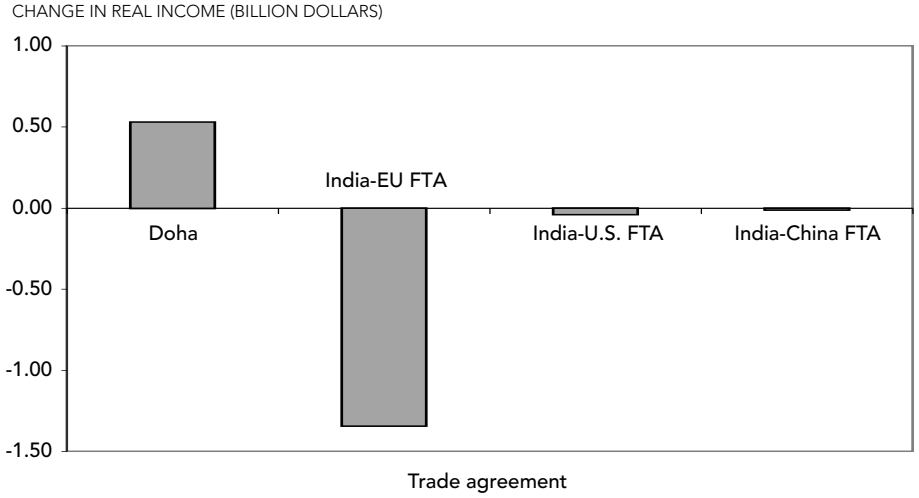
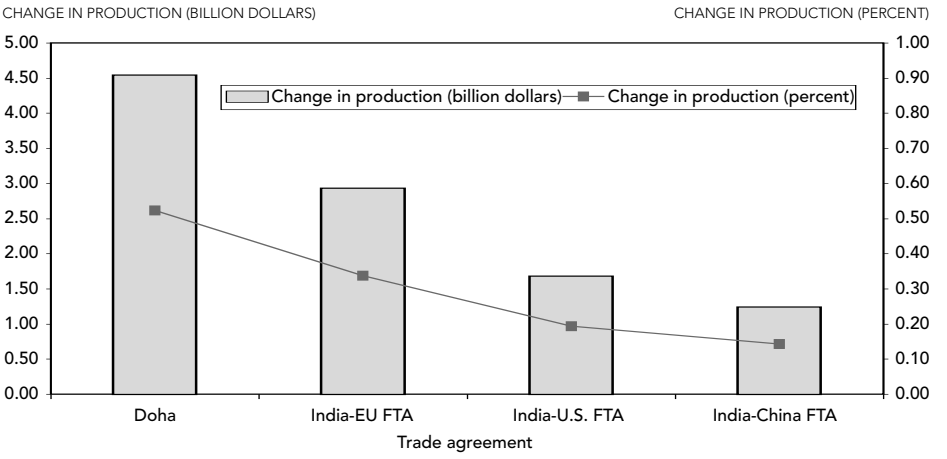


Figure 8.3 Change in Domestic Production in India under Different Trade Agreements



The effect of different trade policy choices on production in the Indian economy is slightly larger than the overall effect on income (figure 8.3). A Doha agreement increases production by $4.5 billion, or about 0.52 percent. The impact on production of the bilateral agreements is a gain of $2.9 billion (0.34 percent) under an India-EU FTA, $1.7 billion (0.19 percent) under an agreement with the United States, and $1.2 billion (0.14 percent) under an agreement with China.

Figure 8.4 Change in Indian Imports and Exports under Different Trade Agreements

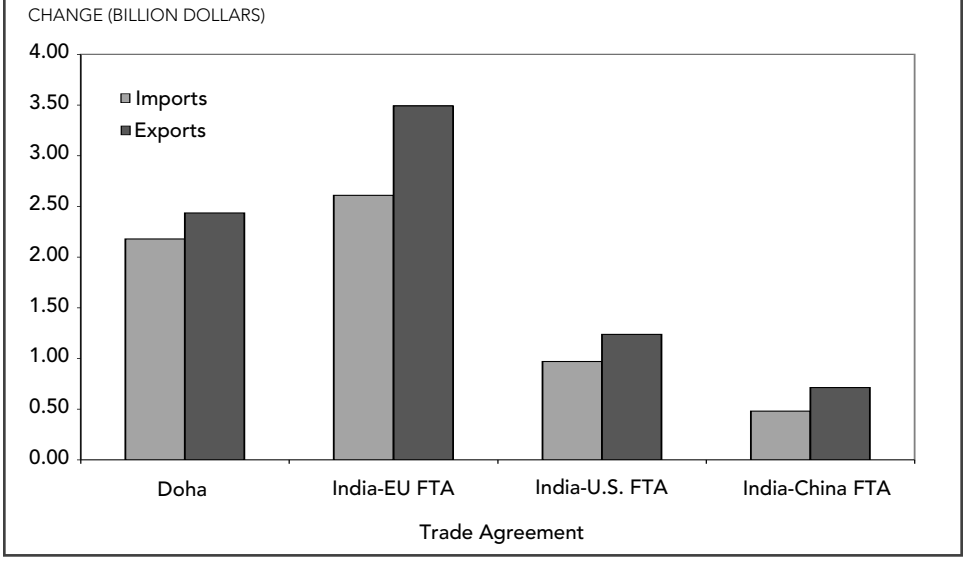
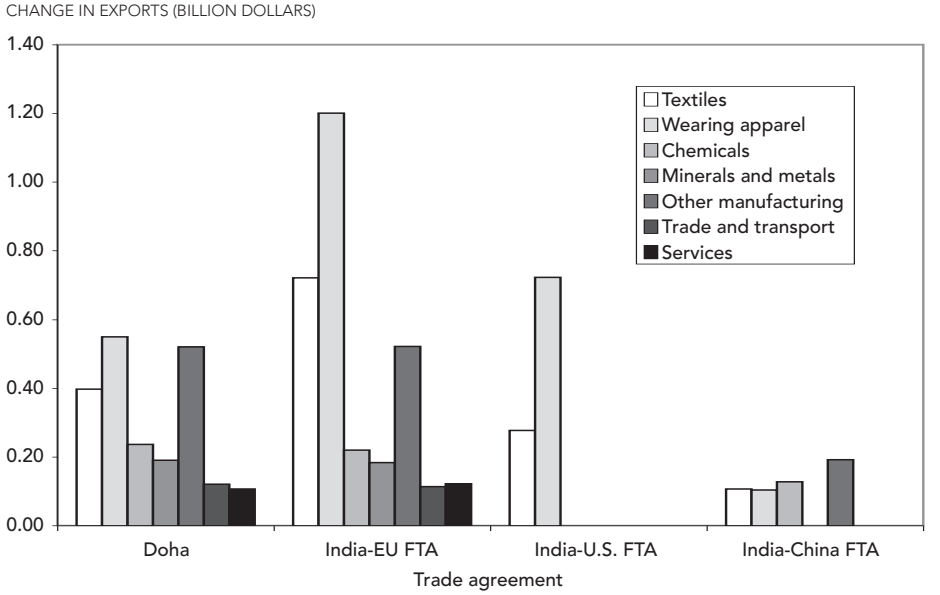


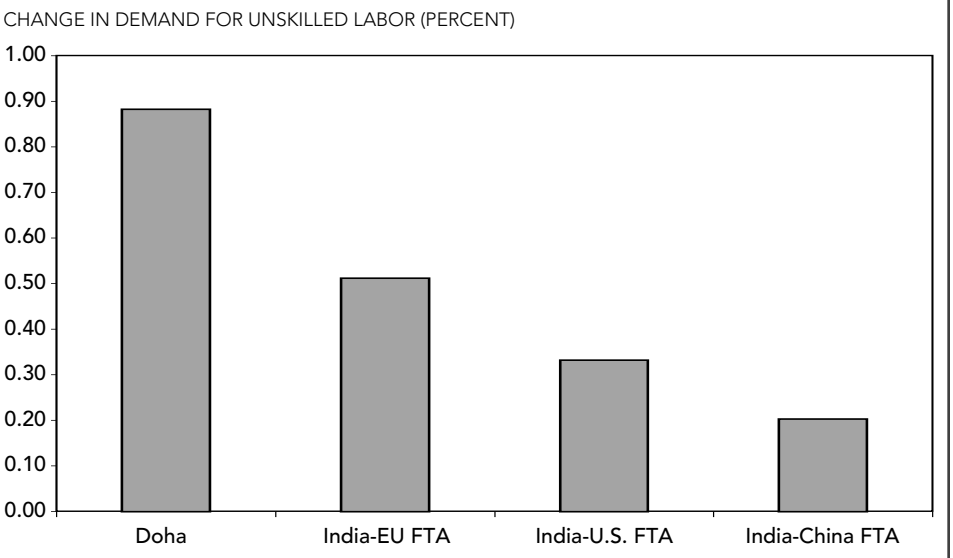
Figure 8.5 Main Changes in Indian Exports under Different Trade Agreements



India's imports and exports increase slightly more as a result of the India-EU FTA than under the Doha simulation (figures 8.4, 8.5). This result is perhaps surprising at first glance, but less so after considering that tariffs are completely eliminated in the bilateral agreement, whereas they are only reduced under the multilateral simulation. The deeper tariff cuts under the bilateral agreements change the resulting domestic prices more dramatically. Given that this is India's largest trading relationship, the impact on the country's imports and exports is understandable. However it is worth recalling that domestic production in India increases significantly *less* under the bilateral agreement with the EU than under the Doha multilateral agreement. This suggests that the increased bilateral trade flows do not necessarily lead to the most efficient reallocation of resources in the Indian economy. It may also be the case that some of the increased trade is trade diversion (that is, substitution of trade with the bilateral partner of trade that would have been carried out with other trading partners) rather than trade creation. India's imports and exports increase more modestly under the FTAs with the United States and China, reflecting the fact that these are much smaller trade relationships than that with the EU.

The demand for Indian unskilled labor is stimulated most by a Doha multilateral agreement (figure 8.6). Demand increases by 0.9 percent (about 4 million jobs, based on current employment levels) under the Doha simulations, whereas it increases by 0.5 percent (about 2.3 million jobs) under the India-EU free trade simulation. An agreement with the United States would increase demand by 0.3 percent (about 1.4 million jobs), whereas one with

Figure 8.6 Change in Demand for Unskilled Labor under Different Trade Agreements



China would produce an increase of 0.2 percent (about 900,000 jobs). The job gains under Doha would be spread across a number of service and support sectors, such as transport and construction, in addition to smaller gains in apparel, textile, other manufacturing, and a few agricultural commodities. By contrast, job gains arising from free trade with the EU and United States, in addition to being much smaller, would be concentrated in the apparel and textile sectors, with other manufacturing sectors reducing demand for unskilled labor. An agreement with China would produce an even smaller increase in the demand for unskilled labor, concentrated in trade, transport, and other services.

Comparing the Results from This Study to Other Studies of Indian Trade

Several other studies have analyzed the effects of trade liberalization on India. Parikh et al. (1995, 1997) and Panda and Quizon (1999) use country-level models of India to probe the effects. They start from a historical baseline in which the agricultural sector in India was typically "disprotected" and the manufacturing sector protected. This meant that the domestic prices of agricultural goods remained below world prices and those of industrial goods remained above world prices. Hence, trade liberalization experiments—involving the removal of protection or disprotection—led to higher agricultural prices and lower industrial prices compared with the baseline scenario.

These studies found that, in the short run, trade liberalization adversely affects both growth and equity. In the long run, the liberalization of agriculture and industry both have positive effects on growth, but their distributional effects are different. Liberalization in the industrial sector increases the real incomes of all groups, rich as well as poor, in both rural and urban sectors. However liberalization in the agricultural sector benefits only upper-income groups in rural areas and adversely affects all classes in urban areas. The simulation experiments show that the poor would need to be protected by safety net mechanisms, such as an expansion of public employment programs. Trade liberalization coupled with safety nets could lead to a Pareto-improving situation where both rich and poor in both rural and urban areas gain. In the long run, liberalization helps to modestly accelerate GDP growth (by about 0.6 percent) through a more efficient allocation of resources across sectors and through an increase in the real investment rate. This occurs because the same nominal savings or investment rate leads to a higher real investment rate after the relative price of investment goods falls with the removal of protection on capital goods. The extent of poverty is reduced in the long run.

Turning to multicountry global models, Hertel and Keeney (2006) examine the potential implications of *full* global merchandise free trade, involving the elimination of all tariffs, export subsidies, and domestic subsidies, for different countries and regions, using a variant of the Global Trade Analysis Project (GTAP) model. This is a much more ambitious scenario than that simulated in the present study and is not under consideration at the WTO. Their results for India show that *full* global merchandise free trade would lead to the expansion of imports of agricultural products, textiles and apparel, and other merchandise by 89 percent, 119 percent, and 54 percent, respectively; exports of these products would also rise, by 88 percent, 31 percent, and 57 percent. Curiously, Hertel and Keeney find that the gains for India from trade liberalization of nonagricultural sectors are less than those from agricultural liberalization, unlike the results from this study and most others. A decomposition of the welfare gains for India shows that they are driven by efficiency gains, of which nearly two-thirds are offset by terms-of-trade losses.

Anderson, Martin, and van der Mensbrugghe (2006) carry out a similar analysis of the impact of *full* global free trade in merchandise projected to 2015, using the World Bank's recursive dynamic model, known as LINKAGE. Their results show very muted gains for India, with real income only 0.4 percent higher in 2015 compared with the baseline case without reform. Aggregate real exports and real imports rise by about 64 and 57 percent, respectively. Agricultural and food products imports rise by 165 percent, while exports rise by just 53 percent, resulting in an output loss of about 3.7 percent. In a simulation of an ambitious Doha scenario, the authors find a real income gain of $2.2 billion (0.25 percent) for India by 2015 if additional investment is induced by trade liberalization. However in a sensitivity analysis, van der Mensbrugghe, one of the study's authors, finds losses for

India from Doha in comparative static results that do not include the dynamic model's assumption that trade will induce additional investment and productivity gains (van der Mensbrugghe 2006a). India also loses if standard GTAP assumptions about the elasticity of trade are used, rather than the more responsive elasticities chosen by Anderson, Martin, and van der Mensbrugghe.

Polaski (2006) finds that India gains about 0.5 percent in real income from a plausible Doha outcome, using a comparative static framework. The gains arise from manufacturing liberalization. India sees small losses from a Doha agricultural liberalization scenario similar to that simulated in the present study.

Ganesh-Kumar, Panda, and Burfisher (2006) conduct a study with a focus on India based on the global GTAP model. They analyze the potential effects of trade, investment, and other potential domestic reforms in the agricultural and agroprocessing sectors, both unilaterally by India and in the context of global trade reforms. Their results, like those mentioned above, show that the effects of trade reform per se are small. A major finding of this study is that domestic reforms in the agricultural and agroprocessing sectors that could induce increases in investment and productivity improvements in these sectors have larger effects than multilateral trade reforms.

A study of a potential FTA between the European Union and India by Decreux and Mitaritonna (2007) finds that India gains little from full merchandise trade liberalization with the EU. Although services liberalization is not simulated in the study, the authors speculate that such sectoral trade reforms could hold significant benefits for India.

The consistent message from these studies is that India is unlikely to see large impacts from either bilateral or multilateral trade reforms. Domestic measures that boost investment and productivity have a greater positive impact on welfare and growth.

Notes

1. As a share of GDP (current market prices), tariff revenue was 1.8 percent in 2004–2005.
2. The model assumes that taxes are increased by the percentage necessary to replace the lost tariff revenue, and in the Indian economy the heaviest tax burden falls on households.

CHAPTER 9

Conclusions and Recommendations

Given the relatively high levels of protection in the Indian economy, it might be expected that greater opening to trade would yield large gains. However the most striking overall result of the simulations in this study is that the gains for the Indian economy from both multilateral and bilateral trade agreements are surprisingly modest. Other studies have also shown limited gains from Indian trade opening.

Multilateral liberalization through the WTO's Doha Round would produce larger gains for India than free trade agreements with any of its major trading partners, including the EU, the United States, and China. Nonetheless, a Doha agreement would represent only a small gain for the Indian economy. In the simulation presented here, the gain in real income for India from Doha is $1.2 billion. Other models—using dynamic modeling frameworks in which gains in investment, productivity, and overall growth are assumed to accompany trade policy changes—have shown the Indian economy gaining from $1.6 to $2.8 billion by 2020, still very modest changes. Even the highest gains projected using dynamic frameworks in global models represent only about a one-quarter of one percent (0.27 percent) gain for the Indian economy. The World Bank study mentioned in Chapter 8 showed gains of $2.2 billion from an ambitious Doha outcome if additional investment is also realized, but actual losses for the Indian economy from a Doha agreement when only the direct effects of Doha changes are taken into account.

The simulations of the effects of world agricultural price changes on the Indian economy and households suggest that the government's concern over potential negative effects of a Doha agreement on poverty and rural development is well founded. The results presented here demonstrate that the impact of world price changes on poverty and income distribution depends on the specific patterns of production and consumption in a

country. As a result, it would be most advantageous for developing countries such as India to have the flexibility to respond to price shocks based on their own conditions at the time of the shock, rather than having rigid or arbitrary disciplines imposed in advance. India should continue to seek an agreement on "special products" and a "special safeguard mechanism" that gives it sufficient latitude to shield its households from negative price shocks that could increase poverty and worsen income distribution.

The three potential bilateral agreements simulated in this study result in smaller gains for the Indian economy than a Doha agreement and losses for Indian households. This suggests that the Indian government should proceed cautiously with bilateral agreements. It appears that such agreements would unambiguously increase investment in the Indian economy, a welcome development, but by extremely modest amounts. However there would be a trade-off to achieve these investments, with reductions in household welfare under free trade with the EU and United States, at least in the short term. Given the low incomes of most Indian households and the country's high poverty rate, inflicting even short-term welfare losses on these households is not to be taken lightly.

India has liberalized its trade gradually during the past two decades while maintaining significant policy levers to achieve desired outcomes in terms of growth, poverty reduction, and income distribution. The results presented here indicate that continued trade liberalization, particularly through multilateral agreements such as the Doha Round, can contribute to the country's development and growth in the future. However it should be recognized that the gains are likely to be modest, and the possibility of negative effects is real. Trade agreements must be negotiated with great care if they are to contribute to the country's development and broadly improve the living standards of its people.

APPENDIX A

Additional Tables and Figures

Table A.3.1 Countries and Regions in the Global Model

Region	Countries
Australia, New Zealand, and Oceania	American Samoa Australia Cook Islands Fiji French Polynesia Guam Kiribati Marshall Islands Micronesia, Federated States of Nauru New Caledonia New Zealand Niue Norfolk Islands Northern Mariana Islands Palau Papua New Guinea Samoa Solomon Islands Tokelau Tonga Tuvalu Vanuatu Wallis and Futuna
China	China
Japan	Japan
Rest of East Asia	Brunei Darussalam Cambodia Hong Kong Indonesia Korea Korea, Democratic People's Republic of Lao People's Democratic Republic Macau Malaysia Mongolia Myanmar Philippines

Rest of East Asia (continued)	Singapore Taiwan Thailand Timor Leste Vietnam
India	India
Rest of South Asia	Afghanistan Bangladesh Bhutan Maldives Nepal Pakistan Sri Lanka
United States	United States
Rest of NAFTA	Canada Mexico
Rest of the Americas	Anguilla Antigua & Barbuda Aruba Bahamas Barbados Belize Bermuda Bolivia Cayman Islands Chile Colombia Costa Rica Cuba Dominica Dominican Republic Ecuador El Salvador Falkland Islands (Malvinas) French Guiana Greenland Grenada Guadeloupe Guatemala Guyana Haiti Honduras Jamaica Martinique Montserrat Netherlands Antilles Nicaragua Panama Paraguay Peru Puerto Rico

Rest of the Americas (continued)	Saint Kitts and Nevis Saint Lucia Saint Pierre and Miquelon Saint Vincent and the Grenadines Suriname Trinidad and Tobago Turks and Caicos Venezuela Virgin Islands, British Virgin Islands, U.S.
Mercosur	Argentina Brazil Uruguay
United Kingdom	United Kingdom
Rest of European Union	Austria Belgium Croatia Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Ireland Italy Latvia Lithuania Luxembourg Netherlands Poland Portugal Slovakia Slovenia Spain Sweden
Middle East and North Africa	Algeria Bahrain Egypt Iran Iraq Israel Jordan Kuwait Lebanon Libyan Arab Jamahiriya Morocco Oman Palestinian Territory, Occupied

Middle East and North Africa (continued)	Qatar Saudi Arabia Syrian Arab Republic Tunisia United Arab Emirates Yemen
South Africa	South Africa
Rest of Sub-Saharan Africa	Angola Benin Botswana Burkina Faso Burundi Cameroon Cape Verde Central African Republic Chad Comoros Congo Congo, the Democratic Republic of the Côte d'Ivoire Djibouti Equatorial Guinea Eritrea Ethiopia Gabon Gambia Ghana Guinea Guinea-Bissau Kenya Lesotho Liberia Madagascar Malawi Mali Mauritania Mauritius Mayotte Mozambique Namibia Niger Nigeria Reunion Rwanda Saint Helena Sao Tome and Principe Senegal Seychelles Sierra Leone Somalia Sudan Swaziland

Rest of Sub-Saharan Africa (continued)	Tanzania Togo Uganda Zambia Zimbabwe
Rest of World	Albania Andorra Armenia Azerbaijan Belarus Bosnia and Herzegovina Bulgaria Faroe Islands Georgia Gibraltar Iceland Kazakhstan Kyrgyzstan Liechtenstein Macedonia, the former Yugoslav Republic of Malta Moldova, Republic of Monaco Norway Romania Russian Federation San Marino Serbia and Montenegro Switzerland Tajikistan Turkey Turkmenistan Ukraine Uzbekistan

Table A.3.2 Sectors in the Global Model

Sector	Description
Agriculture	
Rice	Paddy rice husked and unhusked
Wheat	Wheat and meslin
Plant-based fibers	Cotton, flax, hemp, sisal and other raw vegetable materials used in textiles
Oil seeds	Oil seeds and oleaginous fruit, soy beans, copra
Other crops	Maize, barley, rye, oats, other cereals, vegetables, fruits, nuts, sugar cane, sugar beets, other crops; forestry and logging
Cattle, sheep, goats	Cattle, sheep, goats, horses, asses, mules
Raw milk	Raw milk
Other animal products	Wool and silk; hunting and fishing; other animal products not elsewhere classified
Food	
Vegetable oils and fats	Crude and refined oils of soya-bean, maize, olive, and other vegetables; margarine and other animal fats or oils
Processed rice	Rice, semi- or wholly milled
Dairy products	Dairy products
Meat products	Meat of cattle, sheep, goats, pigs and other animals
Other food products	Sugar, beverages and tobacco, other food products
Manufacturing	
Textiles	Textiles and man-made fibers
Wearing apparel	Garments and fur
Wood and paper products	Lumber and wood products; paper and paper products, including publishing and printing
Petroleum products	Refined petroleum products, coke oven products
Chemicals	Basic chemicals, other chemical products, rubber and plastics products
Minerals and metals	Minerals, mineral products, metals, metal products, mining
Vehicles and other transport equipment	Motor vehicles, trailers, semitrailers, other transport equipment
Other manufacturing	Leather goods, footwear, luggage, electronic equipment, and other manufactures; machinery and equipment not classified elsewhere
Natural Resources	
Coal	Hard coal, lignite and peat
Oil and gas	Crude oil and natural gas
Services	
Utilities	Electricity, water, gas distribution
Construction	Building houses, factories, offices, and roads
Trade and transportation	Trade services, including all retail sales; land, water, and air transportation; post and telecommunications
Services	Financial, insurance, real estate, and other services; recreational, cultural and sporting activities; public administration, defense, education, health, and other government services

Table A.3.3 Macroeconomic Social Accounting Matrix for India, 1998–1999

(RUPEES CRORE)

	Commodity	Activity	Factors	Households	Private firms	Public firms	Direct taxes	Import duties	Export subsidies	Domestic net indirect taxes	Government	Gross fixed capital	Changes in stocks	Rest of world	Total
Commodity	0	1,400,115	0	1,189,267	0	0	0	0	0	0	214,032	395,147	–2125	199,691	3,396,127
Activity	2,998,241	0	0	0	0	0	0	0	0	0	0	0	0	0	2,998,241
Factors	0	1,598,127	0	0	0	0	0	0	0	0	0	0	0	8,133	1,606,260
Households	0	0	1,322,790	0	0	0	0	0	0	0	118,430	0	0	43,242	1,484,463
Private firms	0	0	40250	0	0	0	0	0	0	0	5,722	0	0	0	45,972
Public firms	0	0	15129	0	0	0	0	0	0	0	0	0	0	0	15,129
Direct taxes	0	0	0	28,317	24,529	0	0	0	0	0	0	0	0	0	52,846
Import duties	40,668	0	0	0	0	0	0	0	0	0	0	0	0	0	406,68
Export subsidies	–697	0	0	0	0	0	0	0	0	0	0	0	0	0	–697
Domestic net indirect taxes	111,587	0	0	0	0	0	0	0	0	0	0	0	0	0	111,587
Government	0	0	36,923	0	0	0	52,846	40,668	–697	111,587	0	0	0	0	241,327
Gross fixed capital	0	0	168,066	266,879	21,443	15129	0	0	0	0	–99,530	0	0	21,035	393,022
Changes in stocks	0	0	0	0	0	0	0	0	0	0	0	–2125	0	0	–2125
Rest of world	24,6327	0	23101	0	0	0	0	0	0	0	2673	0	0	0	272,101
Total	3,396,126	2,998,242	1,606,260	1,484,463	45,972	15,129	52,846	40,668	–697	111,587	241,327	393,022	–2,125	272,101	

Note: Crore = 10 million.

Table A.3.4 Overview of the Indian Economy as Represented in the India Country Model

(DOMESTIC PRODUCTION BY INDUSTRY IN RUPEES AND PERCENT SHARE)

Industry	Rupees (billion)	Share of total economy
Rice	641.60	2.23
Wheat	449.54	1.56
Plant-based fibers	143.72	0.50
Oil seeds	168.08	0.58
Other crops	1,645.26	5.72
Other animal products	558.36	1.94
Coal	246.22	0.86
Oil and gas	131.49	0.46
Dairy products	478.16	1.66
Vegetable oils and fats	376.14	1.31
Other food products	1,613.64	5.61
Textiles	1,067.74	3.71
Wearing apparel	129.81	0.45
Petroleum products	498.72	1.73
Chemicals	1,856.07	6.45
Minerals and metals	1,428.50	4.97
Vehicles and other transport equipment	509.17	1.77
Other manufacturing	2,711.53	9.43
Utilities	1,205.66	4.19
Construction	2,085.46	7.25
Trade and transportation	4,938.71	17.17
Dwellings	805.57	2.80
Public administration	2,151.50	7.48
Services	2,919.27	10.15
Total production	28,759.92	100.00

Table A.4.1 Impact of a Doha Liberalization on International Terms of Trade

(PERCENT CHANGE)

Country or region	Agricultural export subsidies removal	Agricultural domestic subsidies reduction	Agricultural tariff reduction	Food tariff reduction	Manufactures tariff reduction	Full Doha
Australia, New Zealand, and Oceania	0.13	0.06	0.07	0.40	–0.14	0.47
China	–0.01	1.22	1.18	1.17	–0.59	–0.65
Japan	–0.06	–0.06	–0.06	–0.21	0.51	0.27
Rest of East Asia	–0.02	0.13	0.05	0.04	0.01	–0.11
Rest of South Asia	–0.03	1.32	1.35	1.19	–0.82	–1.03
India	0.01	0.72	0.62	0.51	–1.13	–1.29
Rest of NAFTA	0.00	0.04	–0.01	–0.04	–0.24	–0.25
United States	–0.01	–0.21	–0.15	–0.08	0.08	0.22
Mercosur	0.05	0.02	0.20	0.50	–0.41	0.16
Rest of the Americas	–0.04	0.07	0.18	0.19	–0.41	–0.41
Rest of European Union	0.06	–0.13	–0.12	–0.12	0.07	0.13
United Kingdom	0.04	–0.20	–0.19	–0.20	0.04	0.07
South Africa	–0.01	0.00	0.06	0.06	–0.27	–0.22
Rest of Sub-Saharan Africa	–0.19	–0.03	0.11	0.21	0.03	–0.08
Middle East and North Africa	–0.18	–0.01	0.02	–0.05	–0.24	–0.54
Rest of world	–0.11	0.05	0.02	–0.04	–0.07	–0.25

Figure A.4.1 Impact of a Doha Liberalization on Aggregate World Prices

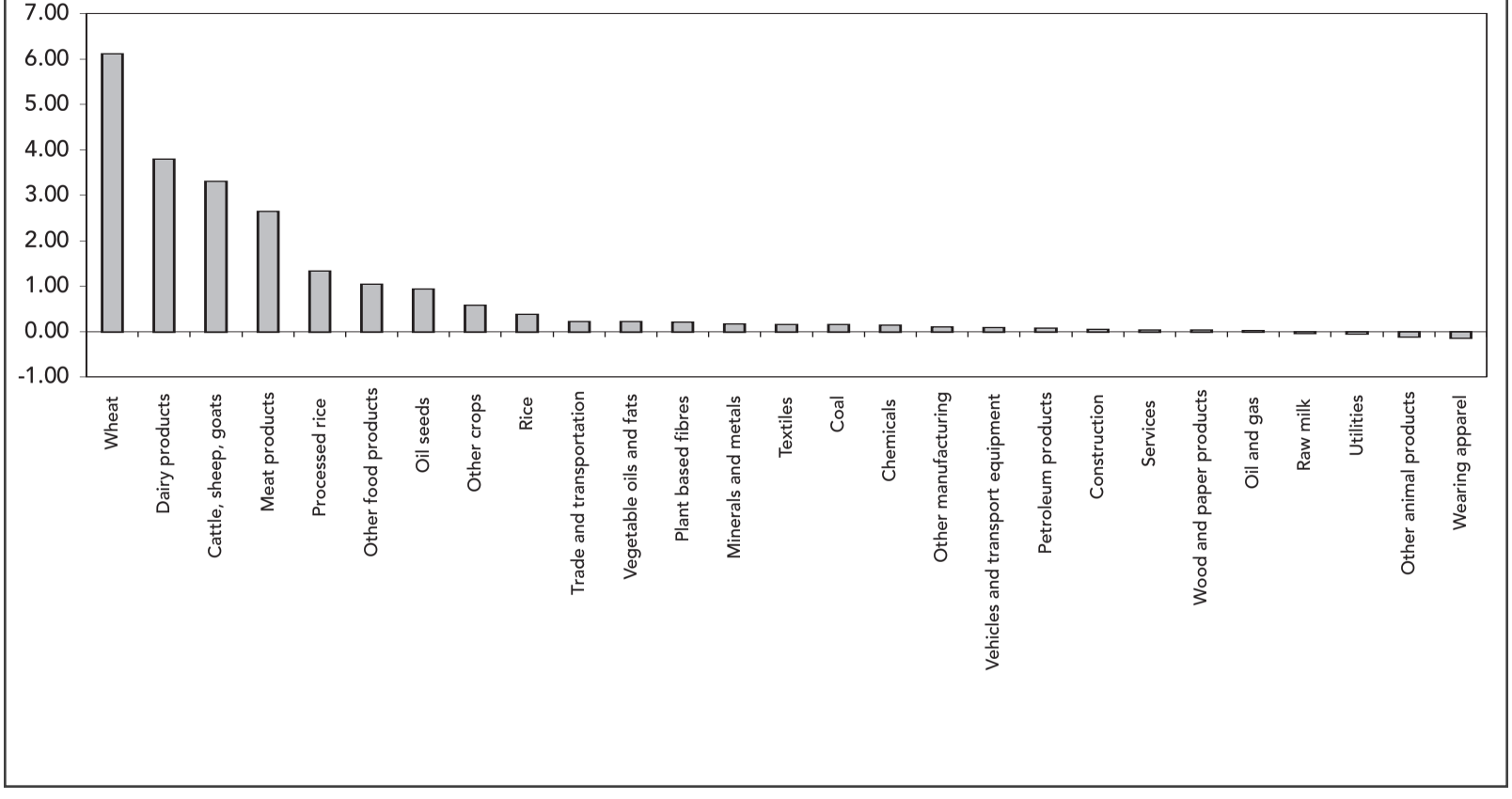


Table A.5.1 Impact of an India-EU Free Trade Agreement on Terms of Trade by Sector

(PERCENT CHANGE)

Sector	Bilateral agricultural liberalization	Bilateral food liberalization	Bilateral manufacturing liberalization	Full bilateral liberalization
A.5.1.A Impact on India's Terms of Trade				
Agriculture	0.72	0.00	-0.39	0.31
Food	0.00	0.49	-0.23	0.27
Manufacturing	0.02	0.00	-2.14	-2.12
Natural resources	0.01	0.00	-0.73	-0.71
Services	0.00	-0.02	-0.05	-0.08
Utilities	0.00	-0.01	-0.02	-0.02
A.5.1.B Impact on EU's Terms of Trade				
Agriculture	0.01	0.00	0.03	0.04
Food	0.00	-0.01	0.00	-0.01
Manufacturing	0.00	0.00	0.05	0.05
Natural resources	0.00	0.00	0.08	0.08
Services	0.00	0.00	0.01	0.01
Utilities	0.00	0.00	0.00	0.00
A.5.1.C Impact on United Kingdom's Terms of Trade				
Agriculture	-0.03	-0.02	0.06	0.01
Food	-0.01	0.16	0.00	0.14
Manufacturing	0.00	0.00	0.19	0.19
Natural resources	0.00	0.00	0.03	0.03
Services	0.00	0.00	0.00	0.00
Utilities	0.00	0.00	-0.06	-0.06

Note: "EU" does not include the United Kingdom.

Table A.5.2 Macroeconomic Results for the EU of an India-EU Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	European liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
A.5.2.A Agriculture Liberalization						
Private consumption	0.00	0.00	0.02	0.00	0.01	0.00
Government consumption	–0.02	0.00	0.00	0.00	–0.02	0.00
Investment consumption	–0.02	0.00	0.00	0.00	–0.01	0.00
Absorption	–0.04	0.00	0.02	0.00	–0.02	0.00
Import demand	0.02	0.00	0.01	0.00	0.04	0.00
Export supply	0.06	0.00	–0.01	0.00	0.05	0.00
Total domestic production	0.08	0.00	–0.01	0.00	0.07	0.00
A.5.2.B Food Liberalization						
Private consumption	0.00	0.00	0.05	0.00	0.05	0.00
Government consumption	–0.02	0.00	0.00	0.00	–0.01	0.00
Investment consumption	–0.02	0.00	0.00	0.00	–0.02	0.00
Absorption	–0.05	0.00	0.06	0.00	0.02	0.00
Import demand	0.04	0.00	0.05	0.00	0.08	0.00
Export supply	0.08	0.00	–0.01	0.00	0.06	0.00
Total domestic production	0.02	0.00	0.04	0.00	0.06	0.00
A.5.2.C Manufacturing Liberalization						
Private consumption	–0.05	0.00	1.55	0.03	1.51	0.03
Government consumption	–0.09	–0.01	0.12	0.01	0.03	0.00
Investment consumption	–0.08	0.00	0.75	0.04	0.67	0.04
Absorption	–0.22	0.00	2.42	0.03	2.21	0.03
Import demand	0.14	0.00	2.90	0.10	3.08	0.11
Export supply	0.33	0.01	0.88	0.03	1.24	0.04
Total domestic production	0.11	0.00	2.31	0.01	2.46	0.02
A.5.2.D All Sectors Liberalization						
Private consumption	–0.06	0.00	1.61	0.03	1.57	0.03
Government consumption	–0.12	–0.01	0.13	0.01	0.00	0.00
Investment consumption	–0.12	–0.01	0.76	0.04	0.64	0.04
Absorption	–0.31	0.00	2.50	0.03	2.22	0.03
Import demand	0.19	0.01	2.96	0.11	3.21	0.11
Export supply	0.47	0.02	0.85	0.03	1.35	0.05
Total domestic production	0.22	0.00	2.34	0.02	2.59	0.02

Table A.6.1 Macroeconomic Results for the United States of an India–U.S. Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	U.S. liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
A.6.1.A Agriculture Liberalization						
Private consumption	0.00	0.00	0.03	0.00	0.03	0.00
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00
Investment consumption	0.00	0.00	0.01	0.00	0.01	0.00
Absorption	0.00	0.00	0.04	0.00	0.04	0.00
Import demand	0.00	0.00	0.05	0.00	0.05	0.00
Export supply	0.00	0.00	0.01	0.00	0.01	0.00
Total domestic production	0.00	0.00	0.00	0.00	0.00	0.00
A.6.1.B Food Liberalization						
Private consumption	0.00	0.00	0.04	0.00	0.03	0.00
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00
Investment consumption	0.00	0.00	0.01	0.00	0.00	0.00
Absorption	0.00	0.00	0.04	0.00	0.04	0.00
Import demand	0.00	0.00	0.05	0.00	0.05	0.00
Export supply	0.00	0.00	0.01	0.00	0.01	0.00
Total domestic production	0.00	0.00	0.03	0.00	0.04	0.00
A.6.1.C Manufacturing Liberalization						
Private consumption	–0.01	0.00	0.35	0.00	0.34	0.00
Government consumption	–0.04	0.00	0.06	0.00	0.02	0.00
Investment consumption	–0.07	0.00	0.32	0.02	0.26	0.01
Absorption	–0.12	0.00	0.73	0.01	0.62	0.01
Import demand	0.12	0.01	1.17	0.09	1.31	0.10
Export supply	0.24	0.03	0.45	0.05	0.70	0.08
Total domestic production	0.05	0.00	0.66	0.00	0.72	0.00
A.6.1.D All Sectors Liberalization						
Private consumption	–0.01	0.00	0.41	0.01	0.40	0.01
Government consumption	–0.04	0.00	0.07	0.00	0.03	0.00
Investment consumption	–0.07	0.00	0.34	0.02	0.27	0.01
Absorption	–0.12	0.00	0.82	0.01	0.70	0.01
Import demand	0.12	0.01	1.27	0.10	1.41	0.11
Export supply	0.24	0.03	0.46	0.05	0.72	0.08
Total domestic production	0.05	0.00	0.70	0.00	0.76	0.00

Table A.7.1 Macroeconomic Results for China of an India–China Free Trade Agreement

(CHANGE FROM BASE SIMULATION IN BILLION DOLLARS AND PERCENT)

	U.S. liberalization		Indian liberalization		Bilateral liberalization	
Macroeconomic indicator	Billion dollars	Percent	Billion dollars	Percent	Billion dollars	Percent
A.7.1.A Agriculture Liberalization						
Private consumption	0.00	0.00	0.03	0.01	0.03	0.01
Government consumption	0.00	0.00	0.01	0.01	0.01	0.01
Investment consumption	0.00	0.00	0.03	0.01	0.03	0.01
Absorption	0.00	0.00	0.07	0.01	0.07	0.01
Import demand	0.00	0.00	0.03	0.01	0.03	0.01
Export supply	0.00	0.00	–0.02	0.00	–0.01	0.00
Total domestic production	0.01	0.00	0.02	0.00	0.03	0.00
A.7.1.B Food Liberalization						
Private consumption	0.01	0.00	0.01	0.00	0.02	0.00
Government consumption	0.00	0.00	0.00	0.00	0.00	0.00
Investment consumption	0.00	0.00	0.00	0.00	0.00	0.00
Absorption	0.01	0.00	0.01	0.00	0.02	0.00
Import demand	0.01	0.00	0.01	0.00	0.02	0.00
Export supply	0.02	0.01	0.00	0.00	0.02	0.01
Total domestic production	0.07	0.00	0.01	0.00	0.09	0.00
A.7.1.C Manufacturing Liberalization						
Private consumption	–0.01	0.00	0.35	0.07	0.35	0.07
Government consumption	–0.01	0.00	0.11	0.07	0.10	0.07
Investment consumption	0.00	0.00	0.39	0.10	0.40	0.10
Absorption	–0.01	0.00	0.85	0.08	0.85	0.08
Import demand	0.10	0.03	0.62	0.20	0.72	0.23
Export supply	0.20	0.05	0.01	0.00	0.21	0.05
Total domestic production	0.40	0.01	1.13	0.04	1.54	0.05
A.7.1.D All Sectors Liberalization						
Private consumption	0.01	0.00	0.39	0.08	0.40	0.08
Government consumption	–0.01	0.00	0.12	0.08	0.11	0.07
Investment consumption	0.00	0.00	0.42	0.10	0.43	0.10
Absorption	0.00	0.00	0.93	0.09	0.94	0.09
Import demand	0.11	0.03	0.65	0.21	0.77	0.24
Export supply	0.22	0.06	–0.01	0.00	0.22	0.06
Total domestic production	0.49	0.02	1.17	0.04	1.66	0.05

APPENDIX B

Description of the Global Model

The GLOBE model is a member of the class of multicountry computable general equilibrium models that are descendants of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982).[1] The model is a SAM-based CGE model, wherein the SAM serves to identify the agents in the economy and provides the database with which the model is calibrated. The SAM also serves an important organizational role because the groups of agents identified in the SAM structure are also used to define submatrices of the SAM for which behavioral relationships need to be defined.[2] The implementation of this model, using the General Algebraic Modeling System (GAMS) software, is a direct descendant and extension of the single-country and multicountry CGE models developed in the late 1980s and early 1990s.[3]

International Trade

Trade is modeled using a treatment derived from the Armington "insight"; namely, domestically produced commodities are assumed to be imperfect substitutes for traded goods, both imports and exports. The properties of models using the Armington insight are well known.[4] Import demand is modeled via a series of nested constant elasticity of substitution (CES) functions; imported commodities from different source regions to a destination region are assumed to be imperfect substitutes for each other and are aggregated to form composite import commodities that are assumed to be imperfect substitutes for their counterpart domestic commodities. The composite imported commodities and their counterpart domestic commodities are then combined to produce composite consumption commodities, which are the commodities demanded by domestic agents as intermediate inputs and final demand (private consumption, government, and investment). The presumption of imperfect substitutability between imports from different sources is relaxed where the imports of a commodity from a source region

account for a "small" (value) share of imports of that commodity by the destination region.[5] In such cases the destination region is assumed to import the commodity from the source region in fixed shares. This is a novel feature of the model introduced to ameliorate the terms-of-trade effects associated with small trade shares.

Export supply is modeled via a series of nested constant elasticity of transformation (CET) functions; the composite export commodities are assumed to be imperfect substitutes for domestically consumed commodities, while the exported commodities from a source region to different destination regions are assumed to be imperfect substitutes for each other. The composite exported commodities and their counterpart domestic commodities are then combined as composite production commodities. The use of nested CET functions for export supply implies that domestic producers adjust their export supply decisions in response to changes in the relative prices of exports and domestic commodities. This specification is desirable in a global model with a mix of developing and developed countries that produce different kinds of traded goods with the same aggregate commodity classification, and yields more realistic behavior of international prices than models assuming perfect substitution on the export side.[6]

Agents are assumed to determine their optimal demand for and supply of commodities as functions of relative prices, and the model simulates the operation of national commodity and factor markets and international commodity markets. Each source region exports commodities to destination regions at prices that are valued free on board (*fob*). Fixed quantities of trade services are incurred for each unit of a commodity exported between each and every source and destination, yielding import prices at each destination that include carriage, insurance, and freight charges (*cif*).[7] The *cif* prices are the "landed" prices expressed in global currency units. To these are added any import duties and other taxes, and the resultant price is converted into domestic currency units using the exchange rate to get the import price specific to the source region. The price of the composite import commodity is a weighted aggregate of the region-specific import prices, while the domestic supply price of the composite commodity is a weighted aggregate of the import commodity price and the price of domestically produced commodities sold on the domestic market.

The prices received by domestic producers for their output are weighted aggregates of the domestic price and the aggregate export prices, which are themselves weighted aggregates of the prices received for exports to each region in domestic currency units. The *fob* export prices are then determined by the subtraction of any export taxes and converted into global currency units using the regional exchange rate.

Two important features of the price system in this model deserve special mention. First, each region has its own numéraire, such that all prices within

a region are defined relative to the region's numéraire. We specify a fixed aggregate consumer price index to define the regional numéraire. For each region, the real exchange rate variable ensures that the regional trade-balance constraint is satisfied when the regional trade balances are fixed. Second, in addition, there is a global numéraire, such that all exchange rates are expressed relative to this numéraire. The global numéraire is defined as a weighted average of the exchange rates for a user-defined region or group of regions. In this implementation of GLOBE, the basket of regions approximates the economies that are part of the Organization for Economic Cooperation and Development (OECD).

Fixed country trade balances are specified in "real" terms defined by the global numéraire. If the global numéraire is the U.S. exchange rate and it is fixed to one, then the trade balances are "real" variables defined in terms of the value of U.S. exports. If global numéraire is a weighted exchange rate for a group of regions, as in this case, and it is fixed to one, then the trade balances are "claims" against the weighted average of exports by the group of regions in the numéraire.

Production and Demand

Production relationships by activities are defined as nested constant elasticity of substitution (CES) production functions. Activity output is a CES aggregate of the quantities of aggregate intermediate inputs and aggregate value added, while aggregate intermediate inputs are a Leontief aggregate of the (individual) intermediate inputs, and aggregate value added is a CES aggregate of the quantities of primary inputs demanded by each activity. Producers are assumed to maximize profits, which determines product supply and factor demand. Product markets are assumed to be competitive, and the model solves for equilibrium prices that clear the markets.

Factor markets in developed countries are assumed to have fixed labor supplies, and the model solves for equilibrium wages that clear the markets. In developing countries, however, the implications of two alternative factor-market-clearing conditions were investigated. In the first, it was assumed that there was full employment and full mobility in all labor markets. This specification can be viewed as an archetypal free market model; but the presumption of full employment in all economies is questionable. Hence the second alternative considered the case where there are excess supplies of unskilled labor in developing regions. (In this study that applies to: India; China; the countries grouped as the rest of East Asia, the rest of South Asia, Mercosur, and the rest of Latin America; all of the African country groupings; and a residual group designated rest of the world.) Where there is unemployment, the real wage is held constant, and the supply of unskilled labor is assumed to be infinitely elastic at that wage. As a result, it is labor supply that clears the market, and any shock that would otherwise increase the

equilibrium wage will instead lead to increased employment. Thus aggregate unskilled employment, rather than the real wage, is endogenous. The results reported are for the second alternative.

Final demand by the government and for investment is modeled under the assumption that the relative quantities of each commodity demand by these two institutions is fixed—this treatment reflects the absence of a clear theory that defines an appropriate behavioral response by these agents to changes in relative prices. For the household, there is a well-developed behavioral theory; and the model contains the assumption that households are utility maximizers that respond to changes in relative prices and incomes. In this version of the model, the utility functions for private households are assumed to be Stone-Geary functions; for the OECD countries, they are parameterized as Cobb-Douglas functions, that is, there are no subsistence expenditures.

Macroeconomic Closure

All economy-wide models must incorporate the standard three macroeconomic balances: current account balance, savings-investment balance, and the government deficit/surplus. How equilibrium is achieved across these macro balances depends on the choice of macro "closure" of the model. For this exercise a "neutral" or "balanced" set of macro closure rules is specified.[8] This ensures that the model is focused on the effects of changes in relative prices on the structure of production, employment, and trade. While it may be of interest to examine the impact of trade liberalization on, for example, asset markets and macro flows, such a focus is better studied by using macro-econometric models that incorporate asset markets than by using a CGE model that focuses on changes in equilibrium relative prices in factor and product markets. The strength of the multicountry CGE model is that it elegantly incorporates the features of neoclassical general equilibrium and real international trade models in an empirical framework while it also abstracts from macro effects working through the operation of asset markets.

Current account balances are assumed to be fixed for each region (and must sum to zero for the world). Regional real exchange rates adjust to achieve equilibrium, as discussed above. The underlying assumption is that any changes in aggregate trade balances are determined by macroeconomic forces working mostly in asset markets, which are not included in the model, and these balances are treated as exogenous. This assumption ensures that there are no changes in future "claims" on exports across the regions in the model; that is, the net asset positions are fixed.

Changes in aggregate absorption are assumed to be shared equally (to maintain the shares evident in the base data) among private consumption,

government, and investment demands. The underlying assumption is that there is some mix of macroeconomic policies that ensures an equal sharing of the benefits of any increase in absorption or the burden of any decrease among the major macro "actors": households, government, and investment; that is, final demand allocations are distributionally neutral. To satisfy the savings-investment balance, the household savings rate adjusts to match changes in investment. Government savings are held constant; direct income tax rates on households adjust to ensure that government revenue equals government spending plus government savings. The tax replacement instrument, direct taxes on households, is likely to be less distorting than the trade taxes that it replaces, but there are reasons to be skeptical about its appropriateness in the context of many least-developed economies. One potential consequence of this assumption is that the results for the least-developed economies may be more positive than otherwise.

Notes

1. The GLOBE model is described in more detail in McDonald et al. (2007).
2. As such, the modeling approach has been influenced by Pyatt's "SAM Approach to Modeling" (Pyatt 1987).
3. For examples of earlier models, see Robinson et al. (1993), and Lewis, Robinson, and Wang (1995). The World Bank global CGE model described in van der Mensbrugghe (2006b) has a common heritage.
4. See de Melo and Robinson (1989) and Devarajan et al. (1990).
5. The import shares defined as small are case specific and defined by the model user.
6. Though the nested CET specification is widely used in both single and multicountry trade-focused CGE models, it is not used in the GTAP model.
7. Bilateral data on trade margins are not available in the GTAP database. Instead, trade margin services are assumed to be a homogeneous good; they are not differentiated by country of origin.
8. Other alternatives were explored but are not discussed in this paper.

APPENDIX C

Description of the India Country Model

The Static Applied General Equilibrium (STAGE) model[1] is a member of the class of single-country CGE models that are descendants of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982) and models reported by Robinson et al. (1990) and Kilkenny (1991). The model is implemented using the General Algebraic Modeling System (GAMS) software. The model is a SAM-based CGE model, and the modeling approach has been influenced by Pyatt's "SAM Approach to Modeling" (Pyatt 1987).

The description of the model proceeds in two stages. The first stage is the identification of the behavioral relationships; while the second stage illustrates the price and quantity systems embodied within the model.

Behavioral Relationships

The behavioral relationships in this model are a mix of nonlinear and linear relationships that govern how the model's agents will respond to exogenously determined changes in the model's parameters and/or variables. Households choose the bundles of commodities they consume to maximize utility where the utility function is a Stone-Geary function that allows for subsistence consumption expenditures, which is an arguably realistic assumption when there are substantial numbers of very poor consumers. The households choose their consumption bundles from a set of "composite" commodities that are constant elasticity of substitution (CES) aggregates of domestically produced and imported commodities, which are imperfect substitutes. This is the so-called Armington "insight" (Armington 1969), which allows for product differentiation via the assumption of imperfect substitution. The assumption has the advantage of rendering the model practical by avoiding the extreme specialization and price fluctuations associated with other trade assumptions. In this model, the country is assumed to be a price taker for all imported commodities.

Domestic production uses a two-stage production process. In the first stage, aggregate intermediate and aggregate primary inputs are combined using CES technology. At the second stage, intermediate inputs are used in fixed proportions relative to the aggregate intermediate input used by each activity, while primary inputs are combined to form aggregate value added using CES technologies, with the optimal ratios of primary inputs being determined by relative factor prices. The activities are defined as multi-product activities with commodities differentiated by source activity. Total commodity demands are determined by the domestic demand for domestically produced commodities and export demand. Assuming imperfect transformation between the domestic and export commodities the optimal distribution between the domestic and export markets is determined using constant elasticity of transformation (CET) functions. The model can be specified as a small country—that is, price taker, on all export markets—or selected export commodities can face downward sloping export demand functions—that is, a large country assumption. The model is set up with a range of flexible closure rules.

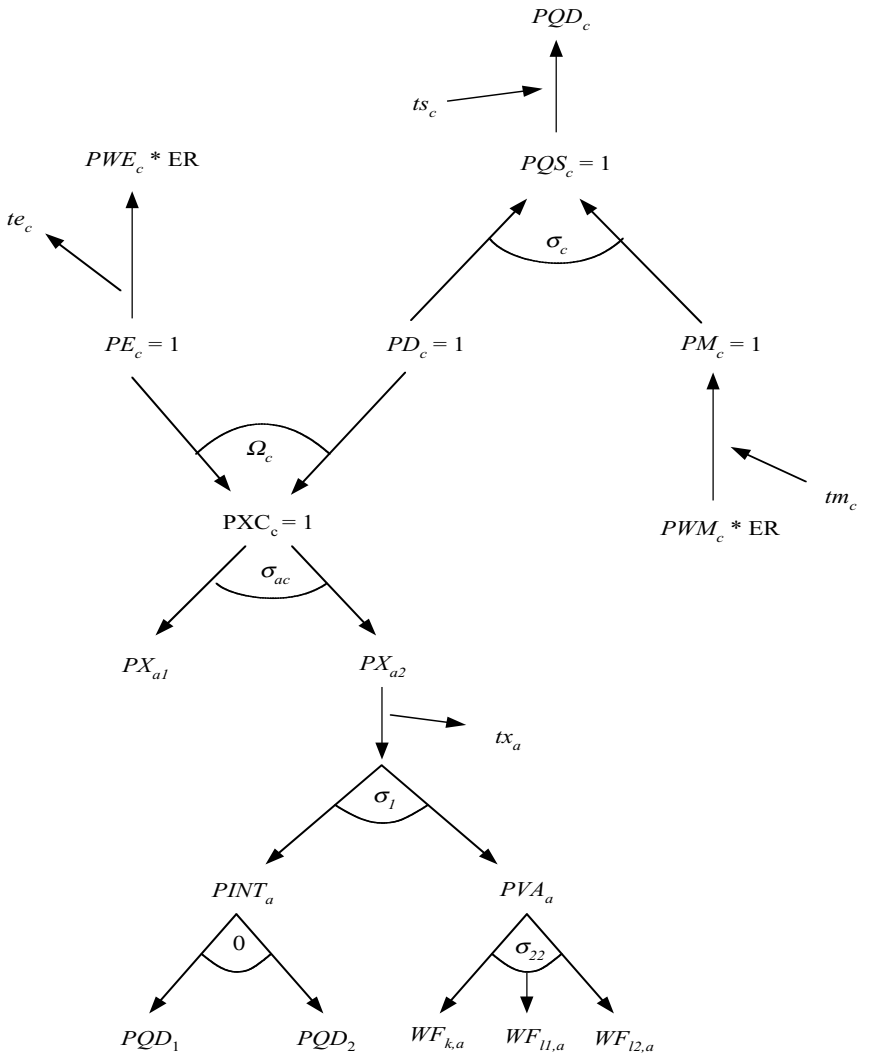
Price and Quantity Relationships

Figures C.1 and C.2 provide an overview of the interrelationships between the prices and quantities. The supply prices of the composite commodities (PQS_c) are defined as the weighted averages of the domestically produced commodities that are consumed domestically (PD_c) and the domestic prices of imported commodities (PM_c), which are defined as the products of the world prices of commodities (PWM_c) and the exchange rate (ER) uplifted by ad valorem import duties (tm_c). Consumer prices for commodities (PQD_c) are defined as supply prices plus (ad valorem) sales taxes (ts_c). The producer prices of commodities (PXC_c) are weighted averages of the prices received for domestically produced commodities sold on domestic and export (PE_c) markets. The prices received on the export market are the products of the world price of exports (PWE_c) and the exchange rate (ER) less any ad valorem export duties (te_c).

The average price per unit of output received by an activity (PX_a) is defined as the weighted average of the domestic producer prices. The prices of value added (PVA_a)—that is, the amount available to pay primary inputs—are defined as activity prices less indirect taxes (tx_a) and payments for intermediate inputs ($PINT_a$), where the (aggregate) intermediate input prices are defined as the weighted sums of the prices of the inputs (PQD_c).

Total demand for the composite commodities, QQ_c, consists of demand for intermediate inputs, $QINTD_c$, consumption by households, QCD_c, enterprises, $QENTD_c$, and government, QGD_c, gross fixed capital formation, $QINVD_c$, and stock changes, $dstocconst_c$. Supplies from domestic producers, QD_c, plus imports, QM_c, meet these demands. Commodities are delivered

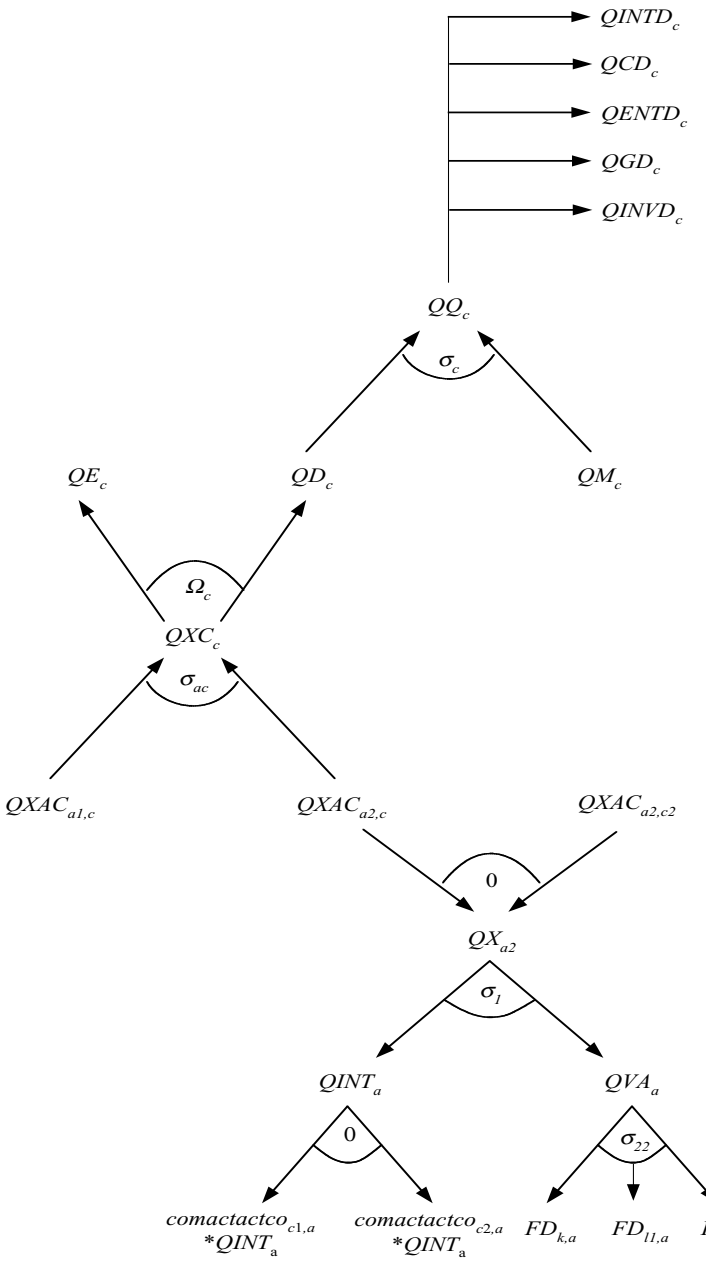
Figure C.1 Price Relationships for a Standard Model with Commodity Exports



to both the domestic and export, QE_c, markets subject to equilibrium conditions that exhaust all domestic commodity production, QXC_c. Domestic production by commodity is an aggregate of the quantities of that commodity produced by a number of different activities ($QXAC_{a,c}$).

Production relationships by activities are defined as nested CES production functions. The nesting structure is illustrated in the lower part of figure C.2, where, for illustration purposes only, two intermediate inputs and three primary inputs ($FD_{k,a}$, $FD_{l1,a}$ and $FD_{l2,a}$) are identified. Activity output is a CES aggregate of the quantities of aggregate intermediate inputs ($QINT_a$) and value added (QVA_a), while aggregate intermediate inputs are a Leontief

Figure C.2 Quantity Relationships for a Standard Model



aggregate of the (individual) intermediate inputs and aggregate value added is a CES aggregate of the quantities of primary inputs demanded by each activity ($FD_{k,a}$).

The base model contains the assumption that all factors are fully employed and mobile; however this assumption is questionable with regard to

unskilled labor in India. We vary the standard assumption with an alternative labor market closure for unskilled labor that reflects unemployment and underemployment among unskilled laborers. The real wage is held constant, and the supply of unskilled labor is assumed to be infinitely elastic at that wage. As a result, it is labor supply that clears the market, and any shock that would otherwise increase the equilibrium wage will instead lead to increased employment. The results we report are for this alternative.

Note

1. The STAGE standard computable general equilibrium (CGE) model used for this study is fully documented in McDonald 2006, available from the author: smcdonald@brookes.ac.uk.

APPENDIX D

Description of the Social Accounting Matrix and Data for the India Country Model

The Social Accounting Matrix reports all the flows of receipts accruing to and expenditures incurred by all the agents in the economy for a particular year. The agents in the economy are typically the production sectors, social groups (households), firms, government, and the foreign sector. These flows take place on account of commodity transactions (buying-selling) between the agents for purposes of consumption, intermediate use, investment, and so on, and by way of interagent transfers. The SAM is constructed in two stages. The first is a "macro SAM" that presents the aggregates of these flows for the economy as a whole. Next is the "micro SAM" that disaggregates the commodities, activities, factors, and households into their respective components. This top down approach is adopted in preference to the UN System of National Accounts preferred bottom-up method to ensure that the final micro SAM is consistent with the published national accounts aggregates.

The Macro SAM

Table A.3.3 gives the structure of the macro SAM, and the flow values for the year 1998–1999. Most of the data for the macro SAM come from the Input-Output (IO) Table for 1998–1999 and from the National Accounts Statistics (NAS), both prepared by the Central Statistical Organization, Government of India. It must be noted here that the IO Table is balanced and is consistent with the NAS data available at the time of its preparation. However all the revisions that the NAS undergoes after the preparation of the IO Table are not carried over to the IO Table. Thus, there are some small differences in the macro aggregates between these two sources. Where such differences are observed, we defer to the values in the IO Table, due to its internal consistency across its rows and columns. These two data sources are supplemented with data on government transfers from Pradhan, Saluja, and Singh (2005).

Some of the entries of the macro SAM are derived residually to maintain row-column balance. In the rest of world (RoW) account, data are available for all the row entries, and for all the column entries except capital transfers to RoW. The latter was then obtained residually as the difference between the row total and sum of column entries for which we have data. Next, we worked out the net household savings in the gross fixed capital account row residually as the difference between the column total (for which we had all the information) and the sum of the row entries for which we had data. Factor payments to households, firms, and government were also derived sequentially following a similar procedure.

The Micro SAM

The macro SAM gives a snapshot of the economy and also provides several control totals for the micro SAM. The micro SAM distinguishes 115 commodities, 115 activities, 49 factors, and 352 households. The 115 commodities and 115 activities directly correspond to the IO Table. With regard to factors, we distinguish 1 capital (non-labor) and 48 labor types based on the following characteristics:

- location (rural/urban),
- social group ("scheduled tribes"/"scheduled castes"/"other backward classes"/ others),
- education level (illiterate/education up to high school/graduates and above), and
- sex (male/female).

Households are distinguished into 352 types based on the following characteristics:

- location (rural/urban),
- social group ("scheduled tribes"/"scheduled castes"/"other backward classes"/others),
- region (North/East/West/South), and
- eleven mean per capita expenditure (MPCE) classes (the first nine deciles in the sample, and the top decile further split into 91–95 percentile and 96–100 percentile).

Database. The data for the micro SAM are from (1) the IO table mentioned above, (2) unit (household)–level data from sample surveys on Consumer Expenditure and Employment/Unemployment, 55th Round for 1999–2000, carried out by the National Sample Survey Organization (NSSO), (3) Pradhan and Roy (2003), and (4) Pradhan, Saluja, and Singh (2005). The IO Table gives data on intermediate flows (use matrix), sectoral value added, the commodity composition (make matrix), and commodity-wise total private consumption and other final demand vectors. Of these, the use matrix, make

matrix, and the final demands (except private) are used directly in the micro SAM.

Distribution of factor income. The sectoral value added from the IO Table is distributed first into labor and capital (non-labor) based on the labor-capital shares derived from Pradhan, Saluja, and Singh (2005). The value added accruing to labor is then distributed to the forty-eight labor types based on information from the NSSO Employment/Unemployment Survey. The survey provides information on household characteristics (location, social group, region, and mean per capita expenditure); characteristics of each household member (age, sex, and education level); employment status (usually employed or unemployed); and, for those who are employed, the sector of usual employment (at the National Industrial Classification, NIC, 5-digit level) and the total wages received during the week preceding the survey. From the unit-level data, we first generate the labor types as described above. Second, for each labor type, the sector of employment was mapped from the NIC 5-digit level to our 115-sector level, and the deployment of each labor type by sector was generated. Third, for each labor type, an average daily wage rate was constructed from the data on wages available at the unit level. With the sectoral employment and average wage information, we could obtain sectoral wage income for each labor type. The structure implied by these data was used to disaggregate the total sectoral labor value added from the IO Table across our forty-eight labor types by adjusting the wage rate for each labor type.

Household labor endowment. The household characteristics reported in the Employment/Unemployment Survey enables us to construct household groups as defined above. For each of these household categories, we then develop the total endowment of different types of labor from the unit-level information. Given the characteristics used to classify labor types, every household category will have more than one labor type. This information on labor endowments and the wage rates obtained above are used to generate total labor income for each household category.

Household consumption expenditures. The NSSO Consumption Expenditure provides information on household characteristics (location, social group, region, and mean per capita expenditure) and also detailed information on commodity-wise consumption at the household level. The common information on household characteristics from the two NSSO surveys enables us to use a consistent definition of household categories across both surveys. Thus, for our 352 household categories, we develop the commodity-wise consumption expenditures by mapping the detailed commodity list in the survey to the 115 commodities in the IO Table. It is well known that the aggregate total consumption expenditure data from the survey usually do not tally with the estimates of consumption from the NAS data, due to differences in the methodology of the two approaches and their coverage. Because the IO Table is the main basis for the SAM, we use the consumption

structure across households from the survey and apply them on the commodity-wise total private consumption expenditure reported in the IO Table. This enables us to maintain internal consistency in the SAM.

Household income expenditure balance. Thus far, we have only labor income and consumption expenditure for each household, which is insufficient to close the income-expenditure accounts for households. Detailed data on savings, transfers, and non-labor income are not available for our household categories. The NCAER-MIMAP Survey (Pradhan and Roy 2003) allows us to compute decile-wise savings or dis-savings rates for rural and urban areas separately. We have assumed that these rates prevail for each decile within rural and urban areas independent of other household characteristics, namely, region and social group. Thus we could generate household savings. Total household income was then obtained with certain assumptions on the distribution of direct taxes and transfers. Given this total income and the wage income estimated above, the income from capital (non-labor factors) was obtained for all the household categories.

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