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Carnegie Endowment for International Peace
1779 Massachusetts Avenue, N.W.
Washington, D.C. 20036
202-483-7600
Fax 202-483-1840
www.CarnegieEndowment.org

International Labour Office
Employment Sector
4 route des Morillons
1211 Geneva 22
Switzerland
+41 22-799-7722
Fax +41 22-799-7562

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Preface

We write this preface at a time of economic crisis, with projections for global economic growth rates shrinking each month and global trade actually contracting. The potential of increased trade to create jobs and lift people out of poverty appears to be temporarily on hold. In the developing world, even leading trade powers such as China are experiencing plunging exports and are importing less from others. This translates into lost jobs, which leads to further reductions in economic growth, imports, and exports.

Even while trade was expanding rapidly during most of the last two decades, it was clear that there were major imbalances in the patterns of trade—imbalances that must now be unwound. It was also clear that there were inequities in the trading system that left some countries and, to some extent, even the entire continent of Africa largely on the sidelines. Within many countries, it was evident that the benefits of trade were distributed in very unequal ways and that those who lost from the structural adjustments induced by trade were seldom compensated by those who won.

It was in this context that the Carnegie Endowment for International Peace and the International Labour Office (ILO) launched the project that led to this report. We recognized the great potential of trade to improve economic output and the incomes of workers and households across the world. At the same time, we saw data suggesting that job and wage growth after trade liberalization was weaker than expected or needed, even in the countries that engaged most successfully with the world economy. The Carnegie Endowment had already been analyzing the impact of different trade policy choices on the distribution of the gains from trade, most notably in the study *Winners and Losers: Impact of the Doha Round on Developing Countries* and in country studies of China and India. The ILO had also undertaken studies evaluating the employment effects of trade and offshoring in a number of countries, including Bangladesh, Chile, and Costa Rica, as well as in its study *Trade and Employment: Challenges for Policy Research*, conducted jointly with the World Trade Organization. It also provides ongoing assistance to policy makers on trade adjustment measures.

We decided to jointly launch a study of the trade policy choices confronting Brazilian policy makers and to evaluate the likely consequences of those choices for the country's various sectors, regions, types of labor, and households. The choice of Brazil was based on its large size, importance in the developing world, and growing role in global trade negotiations. The approach we took was to use sophisticated computable general equilibrium models to simulate the impact of different trade policies and of other economic shocks that could have larger effects on Brazil as it liberalizes its economy. We used the most up-to-date data available for both the global and Brazilian economies and paid considerably more attention to employment and labor incomes than is the case for most trade studies. Specifically, we included very detailed data on Brazilian labor demand and labor income in order to assess the differentiated effects of trade liberalization on workers at various skill and income levels. We departed from the traditional approach used in general equilibrium trade models, which is to assume that all labor is fully employed. Instead, we recognize that there is unemployment among unskilled workers at low- and medium-wage levels in Brazil, and our model allows for total employment to expand or contract as trade leads to changes in labor demand. Such changes in the utilization of labor can potentially magnify the benefits or costs of trade. In most trade models, with the full employment assumption, labor simply shifts between sectors.

Another innovation of our study is that we address the costs of structural adjustment. These costs should be kept in mind when weighing the costs and benefits of trade policies; however, they are typically neglected in trade studies. We also present an overview of the existing social and economic programs in Brazil that could be available to cushion the transition to other types of employment of those displaced by trade. This information allows the benefits and costs of government adjustment assistance programs to be taken into account as well, and suggests areas where such programs might require adjustment or expansion.

We are pleased that once our project was under way, it was joined by the United Nations Development Programme's Inclusive Globalization Cluster of the Poverty Group, Bureau for Development Policy, which provided institutional and financial support.

We hope that policy makers and the public in Brazil and elsewhere will find in our study additional insights into the complex issues involved in economic growth and development and the contribution that trade policy can make, if handled carefully.

Sandra Polaski
Director, Trade, Equity, and Development Program
Carnegie Endowment for International Peace

José Manuel Salazar-Xirinachs
Executive Director, Employment Sector
International Labour Office

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The conclusions are those of the authors and do not necessarily represent the views of the Carnegie Endowment for International Peace, International Labour Office, United Nations Development Programme, or Hewlett Foundation.

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Overview of the Report

The Brazilian economy has experienced sustained growth since 2000, after several turbulent decades. The country's engagement with the global economy has played a largely positive, if secondary, role and Brazil has assumed a leading position in world trade negotiations. At the same time, the country has struggled to generate sufficient employment and improve labor incomes. Unemployment hovers at about 8 percent, and of those who work, slightly more than half do so informally. Average earnings today are lower than in the mid-1990s.

Brazilian policy makers face complicated challenges as they try to grow the economy in ways that will generate better livelihoods and incomes. The current global economic downturn is likely to make these tasks even more difficult.

The purpose of this study is to contribute to the knowledge base upon which the Brazilian government and public, as well as the international community, evaluate the policy choices the country faces in the realm of trade. We employ computable general equilibrium models of the global and Brazilian economies to simulate a range of possible trade agreements as well as other changes in the global economy that could affect the country. We explore the effects of these changes on the Brazilian economy, including its sectors, workforce, and households.

With regard to trade policies, we conduct simulations of an agreement in the Doha Round of negotiations in the World Trade Organization to liberalize global trade and a series of trade agreements among developing countries, so-called South–South agreements. Specifically, we explore trade pacts among Brazil, India, South Africa, China, and Mercosur.

With regard to external economic shocks, we simulate the effects on Brazil of rapid growth in China and India. We also simulate world price increases

for agricultural products that are important exports (soybeans) or imports (wheat) for Brazil, and for petroleum. These simulations represent shocks that Brazil cannot control. However, if policy makers choose to open the Brazilian economy further through trade agreements, unilateral tariff cuts, or other liberalization measures, the changing conditions in other countries and in commodity markets would affect Brazil more strongly. Trade agreements might also eliminate policy tools that currently exist, for example, policies to stabilize agricultural prices.

This study includes three innovations compared with most other studies of trade that use general equilibrium models. First, the country model contains detailed information on eleven aggregated regions in Brazil, allowing us to probe the differential effects of economic changes in different parts of the country. Second, we provide significant detail on labor markets; and in the case of low- and medium-wage labor, we incorporate the reality that there is significant unemployment among these groups in Brazil. Because there is surplus labor supply, there can be a net increase (or decrease) in employment after an economic shock. Most trade models assume full employment of all labor. Under that approach, economic shocks can shift labor among sectors but cannot show changes in overall employment levels.

Third, we consider the costs of adjusting to structural changes that would be induced in the Brazilian economy by the trade agreements and external shocks that we model. These adjustment costs would be borne by firms, workers, and households. We also review existing policy mechanisms to address the burden of adjustment and explore where these mechanisms might need to be augmented to be effective.

The results of the simulations indicate that any of the trade agreements explored will have positive, but very modest, effects on the Brazilian economy and on Brazilian households as a whole. Both a Doha agreement and a broad South–South free trade agreement that includes Brazil and all of Mercosur, India, China, and South Africa would lead to overall gains in real income of about 0.4 percent. More limited South–South agreements would produce even smaller gains; in the case of an India–Brazil–South Africa agreement, the gain would be less than 0.1 percent.

Under all the trade scenarios, small overall gains in real income mask somewhat larger changes for different sectors, producing both winners and losers. A Doha agreement would generally favor agricultural sectors but deal losses to some manufacturing sectors. The impact of different South–South free trade agreements varies considerably within the agricultural sector, reflecting the elimination of existing high tariffs imposed by one or more partners. Brazilian manufacturing sectors tend to lose under any of these agreements, with the exception of the automotive sector.

Strong growth in China and India has positive, but extremely small, effects on overall real income in Brazil, which increases by 0.1 percent. This is contrary to a common perception that rapid growth in the two huge economies will be negative for Brazil, as it faces stronger competition. It is true, however, that primary industries are the main beneficiaries, while most manufacturing sectors experience very small contractions.

Changes in world prices for soybeans and petroleum have significantly larger effects on the economy than either trade agreements or growth in China and India. A 50 percent increase in the price of soybeans leads to a real income gain of 1.4 percent, while increases in the price of petroleum of a magnitude significantly less than that seen in 2008 drive real income down by 1.3 percent. As would be expected, the largest effects of these price changes accrue as gains to sectors and regions that produce the affected commodities, with some positive spillover to other agricultural commodities in the case of soybean and wheat price rises. In the case of an increase in world petroleum prices, only petroleum extraction and refining benefit, while all other sectors lose when the price of this important input increases.

At the regional level in Brazil, both a Doha agreement and rapid growth in China and India have small net positive effects in all parts of the country, although Doha gains are concentrated in São Paulo, Central West, Paraná, the other southern regions, and Rio de Janeiro. Gains from growth in the two large Asian countries are more equally distributed, with the largest gain accruing to the Central West region. As would be expected, commodity price shocks have a positive effect on the regions where the commodities are produced, while dealing losses to most other regions.

Turning to the workforce, all the trade policies that were simulated have small positive effects on labor demand in Brazil, while global price changes generate larger employment effects, which are positive in the case of price increases for soybean exports and negative for increases in the price of imported wheat and petroleum.

It is worth noting that although both the Doha Round and a broad South–South agreement produce almost equal gains in overall real income, a Doha agreement increases employment of unskilled labor by more (0.6 percent) than an agreement among the large developing countries alone (0.4 percent). A Doha agreement is also more favorable for skilled labor.

These small gains in employment would be welcome, particularly in the context of the country's continued high unemployment rates for unskilled labor. However, to realize these gains would require considerable shifts of unskilled workers across sectors, a process that can be difficult and costly. Under most scenarios, there will be a shift of employment from the manufacturing sector to the agricultural sector, where wages are lower and working conditions are quite different. Production does not typically occur in the

same regions, and migration would be required, with a pattern that could reverse the long-term trend of migration from rural to urban areas. It is, therefore, not guaranteed that displaced manufacturing workers will find new employment in growing agricultural sectors. Policy makers thus face the question of whether net gains will outweigh the necessary adjustment costs and how to facilitate the employment transitions. Existing adjustment programs are not available to all workers, and those not covered would bear the full adjustment costs. The programs could be expanded, but at a cost to the government.

Overall, this study shows that the impact of increased trade on the Brazilian economy will be very small, even from a new global agreement at the World Trade Organization or from a very ambitious free trade pact with the largest developing countries. In addition, Brazil will expose its economy to stronger effects from other global policy shocks, such as world price volatility, as it opens its markets. After a careful analysis of the benefits and costs of trade liberalization and specific trade policy choices, increased global economic engagement may still be seen as beneficial for the Brazilian economy. However, it is important in policy debates that the nature and costs of structural adjustment be taken into account and that the pattern of trade achieved serves the country's long-term development goals.

CHAPTER 1

Introduction

Brazil's economic growth rate has been positive for the past eight years, after two decades of setbacks and extreme volatility. The country has once again been growing—for a sustained period—at rates that exceed its population growth, with average gross domestic product (GDP) growth per capita averaging 1.63 percent from 2000 to 2007. This exceeds average per capita GDP growth of 0.83 percent from 1980 to 1989 and 0.28 percent from 1990 to 1999, although it still falls well short of the 5.92 percent per capita growth rate from 1970 to 1979.

Brazil's engagement with the global economy has played a largely positive, if secondary, role in this recent economic progress, with a positive external balance of 1.5 percent in 2007 and 2.9 percent in 2006.[1] Exports grew by 150 percent from 2000 to 2006, while imports grew by 62.5 percent during the same period (United Nations Statistics Division 2008). Brazil has also emerged as a leading actor in twenty-first-century global economic policy discussions. With regard to trade policy, it heads the Group of Twenty (G-20), a coalition of developing countries united to press their interests in negotiations at the World Trade Organization (WTO).[2] It also plays a leading role in regional integration with its neighbors in the Mercado Comun del Cono Sur (Southern Cone Common Market, known as Mercosur) and has expressed interest in an economic alliance with India and South Africa known as the India–Brazil–South Africa Dialogue Forum (IBSA). In the Western Hemisphere, it almost single-handedly blocked agreement on the Free Trade Area of the Americas, due to its conviction that the proposed pact was unbalanced. Brazil is also an important actor in a different G-20, in this case the group of leading economies from both developed and developing regions.[3] In that forum, it has urged a greater role for emerging powers in international macroeconomic policy making.

The strides in overall economic growth have been accompanied by some progress in job creation, income distribution, and poverty alleviation,

although many challenges remain. Unemployment has fallen since 2003 but still stood at 8.2 percent in 2007. Slightly over half of the population is employed informally.[4] After years of slow improvements (and a rapid fall during the inflation spike of 2003), labor earnings rose at a rapid annual rate of 3.8 percent from mid-2005 through 2007. Nonetheless, average earnings in 2007 of R$960 per month were lower than the level of 1994. The share of the population living in poverty declined from 37.5 percent in 1999 to 33.3 percent in 2006, while the share living in extreme poverty declined from 12.9 to 8 percent during the same period.[5] It appears that this progress was a result of direct cash transfers from the government to poor households (primarily the Bolsa Família program) as well as the effects of increases in the minimum wage, which boosted incomes among low-wage workers.[6] Inequality has also decreased somewhat. Between 1995 and 2004, the Gini coefficient decreased from 0.599 to 0.571, with most of the reduction attributable to improvement in the distribution of labor income (Soares and others 2007).

Given the depth of Brazil's employment and poverty-alleviation challenges, and in the context of a global economic downturn that may reduce externally driven growth, it is clear that Brazilian economic and social policy makers face difficult tasks. New or additional policies, including international economic policies, may be needed to prevent unemployment from rising and to address the continuing deficits in wages and poverty.

This study seeks to contribute to the knowledge base that the Brazilian government and public can draw on for evaluating international economic policy choices in the current context. The study is the result of a collaboration between the Carnegie Endowment for International Peace, a global think tank, the Employment Sector of the International Labour Organization, a specialized agency of the United Nations, and the United Nations Development Program, as well as several academic partners (see the acknowledgments). In this study, the Carnegie Endowment builds on its work in recent years in producing path-breaking studies that assess the likely impact of trade policies and other international economic changes on employment and livelihoods in developing countries. The study is also meant to complement ongoing work by the International Labour Organization to assist policy makers in addressing any negative consequences of trade and preparing enterprises and workers to take advantage of potential opportunities.

The present study uses computable general equilibrium models to simulate the impact of different policy choices and international developments on the overall economic growth of the Brazilian economy, as well as on sectoral restructuring, labor demand, labor income, and differing regional effects. We use a global trade model and a national model of the Brazilian economy to explore the impact of a potential Doha Development Round agreement in the WTO and of potential South–South trade agreements. We also employ

the models to simulate other potential shocks from the global economy, including the impact of fast growth in China and India and of changes in global agricultural and petroleum prices. The scenarios represent a spectrum of changes in the global economy that are of current concern to Brazilian policy makers and stakeholders, as well as to the international community. By using both global and country-level models, we are able to trace the impact of a variety of policy choices and other changes that occur beyond Brazil's borders back to its sectors, its labor markets, and its households. This allows us to probe both the overall effects and the distributional consequences.

In addition to the objective of identifying national and international policies that could improve economic growth, employment generation, and living standards for large segments of the population, the authors also hope to stimulate broader use of these analytical tools to study the links between trade policy, employment, and income distribution.

It is important to keep in mind when evaluating the results that general equilibrium models are useful tools for isolating the effects of specific policies. In practice, other changes occurring in the Brazilian or global economies could easily offset the effects being estimated. Because the base year for the analysis is 2004 (the most recent data available), some changes have already occurred that could not be taken into account, such as further economic growth and increases in the minimum wage. This does not mean that the predicted effects of the different scenarios modeled are not valid, but rather that they may have been offset by other developments.

The study is organized as follows. Chapter 2 provides an overview of Brazil's economy and labor market to set the context for the study's simulations and the policy choices that the country confronts. Chapter 3 describes the models and simulations that were undertaken and the data that were used. Chapter 4 presents the results of a simulation of a multilateral agreement in the Doha Round negotiations. The chapter also briefly reviews the results from some other recent studies on these topics. Chapter 5 presents the results from simulations of a potential regional agreement among Brazil, India, and South Africa and of other potential South–South trade liberalizations, including with China. Chapter 6 discusses the impact on Brazil of rapid productivity growth in China and India. Chapter 7 explores the impact of changes in global agricultural and petroleum prices. Chapter 8 presents a comparative overview of the results of the different simulations and their relative impact on Brazil's economy. It also examines the policy implications of the simulation exercises and offers conclusions.

Notes

1. The external balance is defined as exports and imports of goods and nonfactor services as a percentage of nominal GDP at market prices. The data for 2006 are from the World Bank (2008). The data for 2007 are from the Economist Intelligence Unit (2008).

2. These countries are members of the G-20 group of developing countries in the WTO: Argentina, Bolivia, Brazil, Chile, China, Cuba, Ecuador, Egypt, Guatemala, India, Indonesia, Mexico, Nigeria, Pakistan, Paraguay, Peru, Philippines, South Africa, Tanzania, Thailand, Uruguay, Venezuela, and Zimbabwe.
3. These countries are members of the grouping known as G-20 that addresses global macroeconomic issues: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, and the United States.
4. Comisión Económica para America Latina y el Caribe, United Nations Development Program, and International Labour Organization (2008).
5. Comisión Económica para America Latina y el Caribe (2008); Zepeda et al. (2007). The definition of informal workers used here includes unregistered employees (*carteira*), domestic workers, self-account workers, and work for self-consumption. The data from table 4.9 are from www.ibge.gov.br/servidor_arquivos_est.
6. See Zepeda et al. (forthcoming); Coady, Grosh, and Hodinott (2004); and Saboia (2007).

CHAPTER 2

The Structure of the Brazilian Economy

The Brazilian economy is the largest in South America and the tenth largest in the world, worth about $1.3 trillion at the official exchange rate[1] and $1.8 trillion at purchasing power parity in 2007.[2] It is reasonably diversified, with fairly well-developed agricultural, mining, petroleum, manufacturing, and services sectors. Recent discoveries of large petroleum reserves suggest that the country may be able to avoid disruptions caused by future global oil price shocks and indeed may become a major petroleum exporter.

The current global financial turbulence is affecting Brazil through withdrawals of foreign investment, currency fluctuations, and a shortage of trade finance. However, the country's macroeconomic fundamentals are reasonably sound. Brazil holds over $200 billion in foreign exchange reserves, giving it a cushion against external disturbances. Contrary to popular notions, Brazil is not that deeply integrated into the global economy compared with other countries.[3] Most production is mainly for the domestic market (table 2.1), and the large role of domestic consumption means that the country may be able to weather a period of slower demand for exports reasonably well, although lower global economic growth will undoubtedly reduce the country's rate of growth to some extent. As will be seen in subsequent chapters, our simulations of various scenarios for global or regional trade liberalization, shocks from other developing countries' growth, and global price volatility have relatively modest effects on the country. (Note: The data in the following tables and figures are drawn from the database, called a social accounting matrix, or SAM, used in the models in this report. A description of those data can be found in appendix C.)

In terms of sectoral composition, the Brazilian economy is dominated by the service sector, which makes up more than half of the economy; followed by the manufacturing sector, at about 30 percent; processed food; agriculture; and natural resources (figure 2.1). The major exports and imports are

Table 2.1 Macroeconomic Components of Brazilian GDP

(EXPENDITURE AS PERCENTAGE OF GDP)

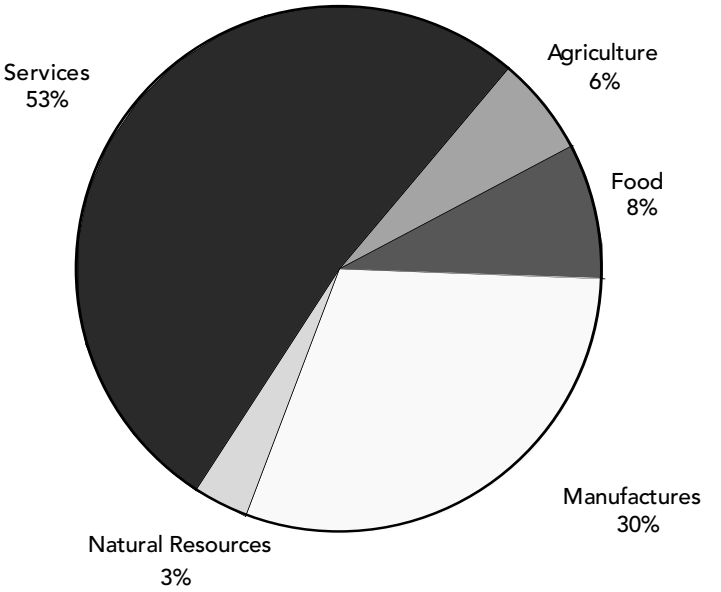
Component	Percent
Private consumption	61
Government consumption	20
Investment consumption	16
Import demand	14
Export supply	17

Source: Social accounting matrix (see appendix C).

reported in table 2.2. In evaluating external shocks to the economy, it is important to remember that some commodities that are strongly exposed to trade, such as soybeans and minerals, nonetheless make up a relatively small share of total exports and an even smaller share of production. Therefore, the current contraction in the global economy may have relatively modest effects on Brazil, while expansion of trade (as represented in the simulations) may have smaller or different effects than some popular assumptions about the economy might suggest.

As noted in the chapter 1, inadequate employment creation, extensive informality, income inequality, and poverty continue to be major problems for the Brazilian economy and society. Table 2.3 illustrates the wide variation in unemployment by region and by years of schooling.

Figure 2.1 Sectoral Composition of the Brazilian Economy



Source: Social accounting matrix (see appendix C).

Table 2.2 Brazil's Main Exports and Imports, 2004

Commodity or Activity	Exports (thousand reais)	Percentage of Exports
Automobiles and other transportation equipment	43,993	13.7
Metals	33,462	10.4
Other services	27,435	8.5
Other food products	24,649	7.7
Mineral extraction	20,393	6.3
Wood and paper	20,129	6.2
Meat products	17,331	5.4
Refined petroleum products	15,786	4.9
Machinery	15,253	4.7
Soybeans	14,774	4.6

Commodity or Activity	Imports (thousand reais)	Percentage of Imports
Electrical machinery	41,624	16.0
Other services	32,084	12.3
Chemicals	29,946	11.5
Petroleum and gas extraction	26,270	10.1
Refined petroleum products	24,218	9.3
Automobiles and other transportation equipment	19,571	7.5
Machinery	18,970	7.3
Metals	13,668	5.2
Transportation	10,983	4.2
Other food products	6,587	2.5

Table 2.3 Unemployment Rate for People Ten Years or Older, by Years of Schooling, 2005

(PERCENT)

Region	Total	0 to 8	9 to 11	12 or More
Brazil	9.3	8.5	12.7	6.1
North	7.9	6.7	11.7	6.7
Other Northeast	8.4	8.3	13.5	6.1
Pernambuco	11.2	10.4	16.6	7.8
Bahia	9.9	9.3	14.9	8.3
Minas Gerais	8.5	7.9	11.3	6.5
Espírito Santo	9.6	8.2	14.0	5.9
Rio de Janeiro	12.6	12.4	14.7	8.1
São Paulo	11.5	11.3	14.3	5.9
Other South	5.5	4.4	7.4	4.7
Paraná	6.7	6.7	8.5	3.9
Central West	9.6	9.6	11.2	5.4

Source: IBGE (2005, table 3.6).

Each of the trade policy changes and external economic shocks simulated in this study would cause at least some structural adjustment in the Brazilian economy, with some sectors expanding and others contracting. Labor would be shed in contracting sectors, while labor demand would grow in expanding sectors. Even those economic changes that lead to increased overall demand for labor would be likely to generate transitional unemployment as the economy adjusts. It must also be recognized that some workers would find it difficult to qualify for new employment opportunities. The labor market effects of Brazil's trade and economic policy choices therefore need to be taken into account by policy makers.

In recent decades, Brazil has made important progress in developing labor market policies to aid displaced workers. The main emphasis has been on providing temporary income relief to unemployed workers through unemployment insurance and on offering training programs to prepare the labor force for changing labor demand. The government has also initiated microcredit programs targeted to small firms, cooperatives, and informal production as a way of generating employment and income. In addition, the Brazilian government operates an extensive conditional cash-transfer program to low-income households, known as Bolsa Família, which could be made available to some workers who are displaced during economic restructuring. These programs are described briefly in box 2.1. After examining the effects of various economic changes on labor demand, we return to a discussion of the existing adjustment programs in chapter 8 and evaluate whether further labor market programs might be needed.

Notes

1. In U.S. dollars; IMF (2008).
2. In international dollars; IMF (2008).
3. According to the *World Development Indicators*, Brazil ranked 166th of 209 countries on the ratio of exports to GDP and 168th of 169 on the ratio of imports to GDP; see World Bank (2008).

Box 2.1 Helping Workers Adjust to the Impact of Trade and Structural Reform

The following are the principal labor market programs that are available in Brazil to assist workers who are negatively affected by trade opening, economic restructuring, or other causes.

Unemployment insurance. Although somewhat limited by international standards, Brazil's unemployment insurance program is the most extensive in Latin America. The program is available to only about 35 percent of workers, primarily because it covers only wage workers in the formal sector. The program provides benefits for three to five months to registered workers who meet minimum contribution requirements (specifically, three months of benefits for workers employed at least six out of the last 36 months, increasing in steps to five months of benefits for those employed at least 24 out of the last 36 months). Because the turnover rate in the Brazilian labor market is high, even among formal workers, only about two-thirds of formal-sector workers who lose their jobs are eligible for benefits. Nevertheless, the number of recipients is still significant. In 2005, 5.3 million workers received an average benefit of R$389 (equal to 1.36 times the minimum wage) for an average period of 4.2 months.

Public Employment Service. The Brazilian public employment service, Sistema Nacional de Emprego (SINE), was created in 1975 to provide guidance to unemployed workers, improve information on the labor market, and aid in the design and development of labor market policies. The sharp increase in unemployment in the 1990s led to the creation of additional training and certification programs and an increase in the number of branches. The number of workers registered at SINE has surpassed 5 million annually since 2002.

Training programs. The 1995 National Plan for Professional Formation (PLANFOR) sought to increase labor productivity and set the goal of training 20 percent of the country's economically active population. The program was implemented through state governments and social entities without the involvement of SINE. Eleven million workers were trained between 1990 and 2001; however, many courses did not meet program guidelines. In 2003, PLANFOR was replaced by the National Qualification Plan (known as PNQ), which established specific pedagogic content and increased the hours of training.

Microcredit programs. The Program for the Creation of Employment and Income (PROGER) was established in 1994 for the purpose of extending credit to microenterprises and small enterprises, cooperatives, and production initiatives in the informal sector. The goal was to generate employment and income by making loans available to entities that otherwise would have little access to credit. Credit is offered through various public financial institutions. The program initially focused on urban workers in metropolitan regions with the highest unemployment levels. In 1995, credit was also made available in the rural sector, first through the Rural PROGER and later through the National Program to Strengthen Family Agriculture (known as PRONAF). In 2006, roughly 2.8 million loans were offered by the various programs with an average credit of R$9,000.

Cash transfer programs. Although not a labor market policy per se, the conditional cash transfer program, Bolsa Família, serves as a safety net for workers from poor families. The program was established in 2003 by combining several existing cash transfer programs. Families with per capita income of less than R$120 per month are eligible to obtain benefits if they meet requirements for school attendance, immunizations, and prenatal and postnatal care. More than 11 million Brazilian families received benefits in 2006.

CHAPTER 3

Description of the Models, Data, and Simulations

The study uses two general equilibrium models, one a global trade model and the other a detailed general equilibrium model of the Brazilian economy. The global model was used to evaluate the impact of trade reforms at the multilateral and regional levels, including simulations of a new global trade agreement in the Doha Round, an India–Brazil–South Africa free trade agreement (FTA), and other potential FTAs with developing countries including China. We also simulated the effects of rapid productivity growth in China and India, the most populous countries in the world and among the fastest growing. We used the more detailed model of the Brazilian economy to probe more deeply the effects of selected simulations on sectoral restructuring, labor demand, and distributional effects. We also used the country model to simulate the impact of world price changes for key commodities that are important to the Brazilian economy, including petroleum, soybeans, and wheat, and we traced the effects to employment, incomes, and regional distribution.

The global model used in this study, called GLOBE, was developed by Scott McDonald, Sherman Robinson, and Karen Thierfelder and is a member of the class of multicountry, computable general equilibrium (CGE) models that are descendants of the approach described by Dervis, de Melo, and Robinson (1982).[1] It uses data derived from the Global Trade Analysis Project database (Dimaranan 2006). A short description of the model is presented in appendix A. The countries or regions as aggregated in the model and the commodity/sectoral aggregations are presented in tables A.1 and A.2 in appendix A.

As part of 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 global model this applies to China, the rest of East Asia, India, the rest of South Asia, Mercosur, including Brazil, the rest of Latin America, all of the African country groupings, and a residual group designated the "rest of the world." Where there is surplus labor (which may include open unemployment and underemployment) in unskilled labor markets, the real wage is held constant and the level of employment will adjust following a policy shock. That is, if a policy shock generates increased demand for unskilled labor, more workers will be employed or will work more hours, although the wage rate will not increase. The results reported are for this alternative. For skilled labor markets, we adopt the assumption of full employment for all countries.

The national model of the Brazilian economy used in this study is the Static Applied General Equilibrium-Labor (STAGE_LAB) model developed by Scott McDonald and Karen Thierfelder. 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 the 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 (1987) "SAM Approach to Modeling." The model is adapted to provide greater detail on labor and to take account of regional variations. We aggregate Brazil's twenty-six states and Federal District into eleven regions for tractability. A description of the model is presented in appendix B.

The market-clearing conditions for the factor markets in the country model assume that capital is fully employed within each region. The total supply of capital to each region is fixed. However, production activities demand capital, and producers can substitute capital between regions in response to changes in the price of capital in each region. Land is fully employed within its respective region and cannot relocate between regions. Each region produces crops suitable for the climate, soil quality, and availability of infrastructure in the region; land in a region cannot shift to commodities that are not already produced there. When agricultural output expands in a region, crop production expands in fixed proportion (and the proportions are the share of each crop in total agricultural output initially produced in that region). These constraints are meant to approximate the effect of factors that limit the potential expansion of agricultural production in response to price changes.

The labor market is divided into three types of labor: high-wage, medium-wage, and low-wage. The high-wage labor category encompasses the top three deciles of labor income and corresponds generally to labor with higher education (defined as twelve years or more of schooling). In the model, this group is assumed to be fully employed and to be mobile within its region. In 2005, unemployment among higher-educated workers was 6.1 percent at the national level. It was our judgment that this made it reasonable to adopt the

standard modeling assumption of full employment for that category of labor. High-wage workers can migrate between regions if changes in regional labor demand lead to changes in regional wage rates relative to the overall national average wage rate for high-wage labor. Net migration inflows will occur if a region's wage rates are higher than the national average; if a region's wages are lower than the average wage, there will be net migration out of the region.

We disaggregate the remaining labor groups into low-wage and medium-wage categories in the country model. (This contrasts with the global model, in which we distinguish only high-skilled and unskilled labor due to data limitations.) The low-wage category corresponds to the bottom four deciles of labor income, while the medium-wage category includes workers in the three deciles immediately above that. We assume that there are excess supplies (a surplus) of labor in each of these categories in each region, based on official data (table 2.3). It was our judgment that national unemployment rates of 8.5 to 12.7 percent for less-educated workers clearly justified a rejection of the standard modeling assumption of full employment for workers in these categories. Under surplus labor conditions, changes in demand for labor will be reflected in the number of workers hired rather than changes in the wage rate. The model allows employment to expand without driving up real wages until the unemployment rate in a region falls to the level of what is sometimes called the frictional or "natural" unemployment rate.[2] When the supply of surplus labor for a region has been absorbed, the wage will then adjust. If full employment is achieved in some regions and wages begin to rise, low- and medium-wage labor can migrate to those regions in response.

As noted above for high-wage labor, net migration flows will depend upon each region's wage rate compared with the national average wage for that labor category. For example, if a region's wage rate increases more than the increase in the national average wage for that category of labor as a result of a simulation, there will be net migration into that region; if a region's wage rate increases less than the national average, there will be net migration out of the region. If a region continues to have unemployment of low- or medium-wage labor after a policy shock simulation, there will be no new immigration to that region because the migration decision in the model is based on the wage comparison. As will be seen, unemployment persists in all regions after each of the simulations conducted in this study because the magnitude of effects is not sufficient to absorb all surplus labor. Thus wage rates for low- and medium-wage labor do not increase in response to the policy shocks. Existing migration patterns would persist, but there would be no new impetus to migrate provided by the policy shocks we simulate. Table B.1 in appendix B presents data on the three labor groups by region and earnings.

The Social Accounting Matrix and Data for the Brazil 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 Joaquim Bento de Souza Ferreira Filho (one of the authors of the current study). It improves upon earlier SAMs for the Brazilian economy by updating the economic data to 2004. Another characteristic of this SAM is the degree of regional detail, with information for the twenty-seven regions of Brazil (twenty-six states plus the Federal District) aggregated into eleven regional groups. It also provides a disaggregated representation of labor and households, with ten different labor types and ten different household groups. A description of the SAM is presented in appendix C. Table C.3 in appendix C provides an overview of the Brazilian economy as represented in the model.

Simulations

We conducted a range of simulations to explore the effects of potential trade policy choices that Brazil might consider. We also simulate several external shocks, to explore how developments or policy choices abroad might affect the country as a result of its greater global economic integration.

Doha Round Simulation

The Doha Round negotiations for a new multilateral trade agreement in the WTO have not concluded, and as a result the precise structure of such an agreement remains speculative. We have devised a simulation that can be considered a stylized version of the proposals that are currently under consideration in the Doha Round (WTO 2008a, 2008b). Our scenario covers changes to tariffs and subsidies in the agriculture and nonagricultural sectors. (We do not simulate services trade liberalization, for reasons discussed below.) Specifically, we simulate reductions in applied agricultural and nonagricultural tariffs of 36 percent by developed countries and 24 percent by developing countries. We also simulate a reduction of applied domestic agricultural subsidies by one-third and the complete elimination of agricultural export subsidies.

A recent assessment of the proposals under consideration in the Doha negotiations as of July 2008 by Will Martin and Aaditya Mattoo (2008) of the World Bank finds that under those proposals, developed countries would

reduce applied manufacturing tariffs by 35 percent, and developing countries would reduce them by 25 percent, once allowed flexibilities are taken into account. These reductions are almost identical to the reductions in our simulation for those groups of countries. With respect to agricultural tariffs, the World Bank researchers found that current proposals would result in smaller tariff reductions than we simulate in this study. They estimate that developed countries would reduce applied agricultural tariffs by 27 percent under the July proposals, and developing countries would reduce them by 14 percent. These tariff cuts are less than our simulation of 36 and 24 percent reductions by developed and developing countries, respectively. Martin and Mattoo also suggest that flexibilities still under consideration could further reduce these cuts. With regard to reductions in domestic agricultural subsidies, they find that the July 2008 proposals would constrain the United States and European Union from raising subsidies above current levels (by reducing their bound levels for total subsidies) but would not reduce actual applied subsidies. The July proposals have not been accepted, and WTO members continue to press for changes, some more ambitious and some less ambitious than those evaluated by Martin and Mattoo. The final agreement will likely differ from the July proposals. However, based on the current state of negotiations, our Doha simulation can be considered reasonably realistic for manufacturing liberalization but should be viewed as an upper bound for potential agricultural liberalization. Therefore, our simulation results will likely overstate the gains to Brazilian agriculture.

South–South Free Trade Agreements

There has been substantial interest in the developing world about whether increased trade among developing countries could provide an alternate or additional path for engagement with the global economy, perhaps on more equal or favorable terms than those achievable in multilateral or North–South trade agreements. We explore this question through a series of simulations. First, we conduct a simulation of a regional FTA between Brazil, India, and the Southern African Customs Union, which is designated IBSA. The countries involved agreed in principle in 2007 to launch such a negotiation. In this simulation, we completely eliminate tariffs between the parties. Unlike the Doha simulation, this simulation does not include reductions in domestic or export subsidies to agriculture by Brazil or its trading partners. This reflects the practical reality that countries have not been willing to address their domestic agricultural subsidy programs in the context of bilateral or regional FTAs. The simulation does not establish common external tariffs.

We then simulate an expansion of the India–Brazil–Southern African Customs Union trading bloc to include China. Next, we include all of Mercosur, in addition to Brazil, in such a South–South free trade arrangement. As with the IBSA scenario, we eliminate tariffs between the parties in each of these simulations. The experiments are then compared for the scale of their effects.

The Rapid Growth of China and India

We next explore trade among developing countries from another perspective, one that has been the subject of considerable attention in Brazil and also globally. That is the question of how rapid growth in China and India affects other developing countries. In this case, we explore the impact on Brazil of a rapid growth in total factor productivity (TFP) in China and India. We conduct two simulations. First, using the global model, we simulate the impact of an increase of 20 percent in TFP in manufacturing in China and India. We then use the country model to simulate a stronger shock, namely, an increase of 33 percent in TFP, in the two countries' industrial sectors. (The larger shock was chosen because the first experiment produced only modest effects in Brazil.)

The productivity growth in China and India affects Brazil via changes in world prices. Due to TFP growth in industrial sectors in China and India, the prices of commodities they produce fall, and at the same time the prices of the commodities that China and India import will change, often increasing. We introduce the global price changes and describe their impact on Brazil's production and trade.

Price Shocks and Volatility

Our final simulations explore the impact of changes in world prices for some key commodities that are important exports, imports, or inputs for Brazil. These changes could arise as the result of trade or agricultural policy changes elsewhere in the world, disruptions in the growth and consumption patterns of major countries, behavior by private actors, weather, or other causes. Using the detailed country model of Brazil, we simulate the impact on the Brazilian economy of a 50 percent increase in the price of soybeans compared with the base price in the model; a 100 percent increase in the price of wheat compared with the base price; and a 35 percent increase in the price of petroleum over the base price. The level of the price shocks was designed to approximate the price spikes observed during 2007 and 2008.

We probe the differential effects of these price changes on sectors, different types of labor, and different regions to explore the implications for sectoral restructuring and income distribution.

While prices have declined from the highest levels reached during 2008, the price of these commodities will continue to be vulnerable to supply and demand shocks and to speculation. Given the historical volatility of commodity prices, the sectoral and distributional consequences of large price swings for soybeans, wheat, and petroleum will continue to be important shocks transmitted from the global economy to Brazil.

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 the 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 CGE models, which 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 quantifiable in terms of their impact on price or quantity. 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 such policy changes, we recognize that services trade liberalization could amplify the impact of trade agreements for some countries. The size of the gains or losses would depend on the level of ambition, the sectors affected, the modes of services trade that are covered in any potential agreement, and the importance of services trade for a particular economy. Additional gains could accrue to Brazil under regional or multilateral trade agreements if services were included, and this potential should be kept in mind when reviewing the following results.

Notes

1. The GLOBE model is described in detail in McDonald, Thierfelder, and Robinson (2007). For examples of earlier models, see Robinson et al. (1993); and Lewis, Sherman, and Wang (1995). The World Bank global CGE model, described by van der Mensbrugghe (2006), has a common heritage.
2. In the model, we assume the frictional rate of unemployment is 3 percent for the low-wage group and 5 percent for the medium-wage group. The medium-wage group is more likely to be covered by employment-related social insurance or to have other assets with which to sustain a period of unemployment and therefore to have a higher reservation wage.

CHAPTER 4

The Impact of a Doha Round Agreement in the World Trade Organization

The 153 member countries of the World Trade Organization have been engaged for the past seven years in an effort to revise the rules of the multilateral trading regime. This effort is known as the Doha Round, named after the city in Qatar where the negotiations were launched in late 2001. Brazil has taken a keen interest in the Doha Round and has become one of the key actors in the negotiations, both on its own behalf and as a representative of the G-20 group of developing countries.

A multilateral trade agreement would affect Brazil's trade relations with all its trading partners, and thus it could have a larger impact on the economy than bilateral or regional free trade agreements. The Doha Round also will include reductions in domestic agricultural subsidies by all countries, in contrast to most bilateral trade agreements, which do not address subsidies. At the same time, it should be noted that the depth of tariff reductions in a multilateral agreement is likely to be less than in full bilateral or regional FTAs, which typically involve full elimination of most tariffs over time.

The Doha Round negotiations have been prolonged and difficult; however, there is no indication that WTO members have abandoned the goal of concluding a new multilateral trade regime. Therefore, it is useful to simulate the impact of a plausible Doha outcome on Brazil. We employ a liberalization scenario for manufactured goods that is very close to the overall level of liberalization under consideration in late 2008, based on the December 2008 negotiating text. Our scenario for the liberalization of trade in agricultural goods is somewhat more ambitious than envisioned in the current negotiating text for agriculture, as discussed in more detail in chapter 3. Therefore, our results for agricultural liberalization can be considered an upper bound of possible effects. Specifically, we simulate applied tariff reductions of 36 percent by developed countries and 24 percent by developing countries, including Brazil, on agricultural and nonagricultural goods. In addition, we simulate a reduction in domestic agricultural subsidies by one-third and the

complete elimination of agricultural export subsidies. These reductions are also taken from applied rates. We simulate each of the Doha changes separately to discover the relative contribution of changes in agriculture and nonagricultural liberalization.

We begin by presenting the results of these simulations using the global model. Thereafter, we present the results of simulations using the country model, which allows us to probe the effects on Brazil at more disaggregated levels, including the results for different regions and households. The final section of the chapter presents and compares results from several other studies of the Doha Round that use CGE models.

Results From the Global Model Simulations

Table 4.1 presents the aggregate results for the Brazilian economy after all the changes required by the Doha Round scenario have been implemented and a new equilibrium has been achieved. The tables in this section present the separate contributions of agricultural liberalization and nonagricultural market access liberalization, referred to as NAMA, in the WTO. Agricultural liberalization comprises primary agriculture and semiprocessed agricultural goods, while excluding fish and forestry. Nonagricultural liberalization comprises manufactures, minerals, and other natural resources but not services.

The aggregate results in table 4.1 suggest that Brazil would see small net gains from the Doha Round, with real GDP increasing by 0.2 percent. Overall economic welfare would increase by 0.4 percent compared with the level of household expenditures before the simulation.[1]

Both imports and exports rise modestly in real terms, with a slightly larger gain in exports. The increase in exports is driven largely by nonagricultural trade liberalization, contrary to a popular belief that Brazilian agricultural exports would be the main winner from the Doha Round. By contrast, imports are stimulated more by agricultural liberalization.

To understand the modest results for Brazil from agricultural liberalization, it is instructive to separate the components of such liberalization: domestic subsidy reduction, export subsidy elimination, and tariff reduction. Appendix D presents the results from the separate components of the agricultural liberalization simulation in greater detail. The reduction of domestic subsidies in high-income countries such as the United States and EU member states, which has been a major goal of many developing countries, including Brazil, in the Doha Round negotiations, produces both positive and negative results for Brazil. For cereal grains, among the most heavily subsidized sectors, EU and U.S. supply prices rise in response to the drop in support. As a result, demand by domestic residents, food processors, and exporters is reduced in those two regions. In the European Union, the same direction of

Table 4.1 Doha Round Scenarios: Main Macroeconomic Results for Brazil From Global Model Simulations

(PERCENT CHANGE)

Measure	Agriculture	Nonagriculture	Full Doha
Net welfare[a]	0.31	0.08	0.40
Real imports	0.81	0.58	1.41
Real exports	0.16	1.36	1.52
Real GDP	0.09	0.11	0.20
Terms of trade	0.69	–0.80	–0.09
Unskilled employment	0.29	0.30	0.59

Source: Global model simulation results.
[a]Equivalent variation as a percentage of initial consumer expenditures.

effects also occurs for oilseeds and the animal agriculture sector. However, the associated drop in demand for land by the shrinking sectors spurs a substantial drop in the rental price of land in the two regions. The equilibrium rental price of land falls by 39 percent in the EU and by 19 percent in the United States relative to the presimulation price. Though the *net* effect on heavily subsidized sectors is dominated by the loss of subsidies and equilibrium, supply prices in those sectors are higher than before. For the less heavily subsidized sectors, the general equilibrium land price effect dominates the effects of the subsidy cut, so that—counter to partial equilibrium intuition—equilibrium prices for the sectors that were not highly subsidized actually fall in the two regions.[2] As a consequence, the EU "other crop" agriculture sector and all U.S. agricultural sectors except cereal grains are able to increase their world market exports to some extent after the reduction in domestic subsidies.

These results clearly highlight the need for, and value of, a general equilibrium perspective in the context of multilateral trade analysis. It should be noted that several other major studies of the Doha Round also find that the reduction of domestic agricultural subsidies and agricultural export subsidies would not be a source of large gains for developing countries including Brazil (discussed below).

Brazil's terms of trade deteriorate slightly. ("Terms of trade" refers to the quantity of exports that can be exchanged for a given quantity of imports. A gain in a country's terms of trade means that the same amount of exports can be traded for a larger volume of imports, whereas a loss means that more exports are required.) In this case, the terms-of-trade loss results from the liberalization of manufacturing import duties and is largely offset by terms-of-trade gains from the reductions in distortions to trade in agricultural and processed food commodities.

Table 4.2 Doha Round Scenarios: Change in Brazil's Real Exports by Commodity

(PERCENT CHANGE, EXCEPT BASE LEVELS IN BILLION DOLLARS)

Commodity	Base Level	Agriculture	Nonagriculture	Full Doha
Cereal grains	0.73	11.19	1.37	12.81
Oilseeds	2.86	0.07	1.31	1.41
Other crop agriculture	3.28	–1.03	1.21	0.18
Animal agriculture	0.26	0.11	0.32	0.43
Minerals	3.84	–0.41	0.74	0.28
All other extractive	0.49	–0.34	0.74	0.42
Vegetable oils and fats	0.61	–1.20	1.53	0.35
Sugar and related products	1.48	4.26	1.17	5.52
Animal products	2.99	9.66	1.64	11.51
Other food products	4.10	1.35	0.81	2.19
Textiles	1.16	0.03	0.94	0.83
Leather products	2.62	–1.81	4.27	2.41
Wood and paper products	4.79	–1.03	1.91	0.86
Petroleum and chemicals	5.60	–0.48	1.24	0.75
Mineral products	1.30	–0.51	1.55	1.02
Ferrous metals	3.29	–0.97	1.75	0.76
Metals	2.21	–1.96	3.00	0.98
Metal products	0.76	–0.54	1.99	1.41
Motor vehicles and parts	5.22	–0.42	2.38	1.92
Transportation equipment	3.64	–1.71	2.95	1.21
Electrical/electronic equipment	7.83	–0.27	0.19	–0.09
All other manufactures	0.68	–0.06	0.22	0.16
Utilities	0.01	0.01	0.20	0.21
Construction	0.03	0.00	0.00	0.00
Trade	0.71	0.00	0.01	0.01
Transportation	2.70	0.04	0.19	0.23
All other services	6.00	–0.15	0.25	0.10

Source: Global model simulation results.

The Doha Round produces a small positive effect on unskilled labor employment, which rises about 0.6 percent compared with the level of employment before the simulation. Manufacturing and agricultural liberalization each contribute roughly half of this new job generation.

The strongest boosts to exports occur in cereal grains (from a small base), animal products, and sugar, with much smaller gains for leather products, other food products, and motor vehicles and parts (table 4.2). The only sector that experiences a small decline in exports is the electronic equipment sector, which includes electrical machinery as well as electronics. Most commodities see little change in export demand. Imports increase modestly across most manufacturing sectors (table 4.3). Most agricultural sectors see declines in imports; however, these imports were at very low levels before the simulation.

Table 4.3 Doha Round Scenarios: Change in Brazil's Real Imports by Commodity

(PERCENT CHANGE, EXCEPT BASE LEVELS IN BILLION DOLLARS)

Commodity	Base Level	Agriculture	Nonagriculture	Full Doha
Cereal grains	1.22	–0.27	0.22	–0.02
Oilseeds	0.15	–1.09	–0.61	–1.72
Other crop agriculture	0.86	2.80	–0.71	2.07
Animal agriculture	0.15	2.54	–0.42	2.18
Minerals	0.55	–0.03	0.34	0.33
All other extractive	3.64	0.92	–0.73	0.13
Vegetable oils and fats	0.16	2.64	–0.90	1.69
Sugar and related products	0.02	–4.04	–0.99	–4.99
Animal products	0.34	–4.78	–0.68	–5.27
Other food products	1.21	1.33	–0.53	0.82
Textiles	1.49	1.16	2.29	3.91
Leather products	0.35	0.98	1.62	2.64
Wood and paper products	1.36	1.10	1.10	2.23
Petroleum and chemicals	15.06	0.81	0.67	1.50
Mineral products	1.31	0.87	0.87	1.91
Ferrous metals	0.78	0.59	1.48	2.08
Metals	1.37	0.69	0.80	1.50
Metal products	1.01	1.01	2.75	3.76
Motor vehicles and parts	5.17	0.65	2.33	3.13
Transportation equipment	3.36	1.17	–1.03	0.09
Electrical/electronic equipment	23.46	0.80	1.24	2.04
All other manufactures	0.78	1.31	3.09	4.41
Utilities	1.96	0.73	–0.63	0.08
Construction	0.03	0.66	–0.81	–0.17
Trade	1.21	0.79	–0.83	–0.05
Transportation	3.92	0.75	–0.66	0.07
All other services	8.72	0.77	–0.77	–0.02

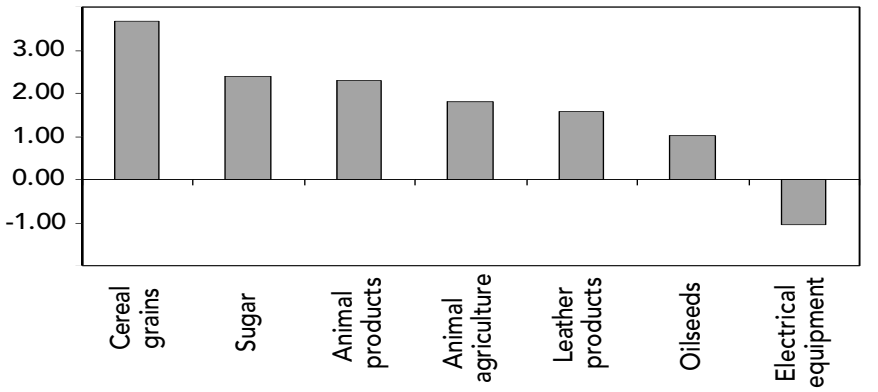
Source: Global model simulation results.

The main implications for Brazil's sectoral production structure are shown in figure 4.1, with more detail provided in table 4.4. Modest output increases occur in cereal grains, sugar processing, animal products (the expansion of which also entails an expansion of animal agriculture further up in the agro-industrial value chain) and oilseeds. Leather production also expands somewhat. The one sector with a drop in gross output exceeding 1 percent is electrical machinery and electronic equipment.

As would be expected, the changes in output translate into changes in employment. Figure 4.2 presents the percentage changes in unskilled employment in each sector as well as the base level of total demand (measured as total compensation) for such labor. The sectors that show notable increases in demand for unskilled labor, primarily in agriculture, are very small contributors to overall employment of such labor. The sectors that account for significant employment of unskilled labor, mainly services and some manufactures, grow by modest amounts, less than 1 percent in each case.

Figure 4.1 Major Changes in Production in Brazil

PERCENT CHANGE



Source: Global model simulation results.

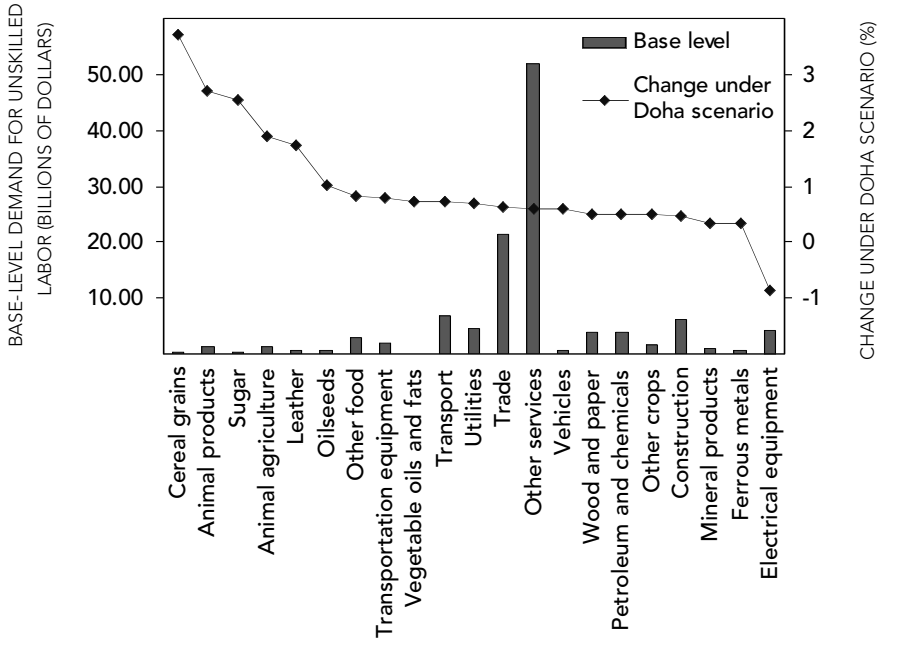
Table 4.4 Doha Round Scenarios: Change in Production by Commodity

(PERCENT CHANGE, EXCEPT BASE LEVELS IN BILLION DOLLARS)

Commodity	Base Level	Agriculture	Nonagriculture	Full Doha
Cereal grains	3.79	3.10	0.50	3.67
Oilseeds	6.22	0.16	0.84	1.01
Other crop agriculture	14.61	–0.10	0.49	0.40
Animal agriculture	13.81	1.45	0.32	1.81
Minerals	6.83	–0.37	0.64	0.23
All other extractive	8.93	–0.41	0.65	0.26
Vegetable oils and fats	6.71	0.00	0.35	0.35
Sugar and related products	4.85	1.83	0.53	2.40
Animal products	20.93	1.89	0.34	2.28
Other food products	36.02	0.37	0.20	0.58
Textiles	18.23	0.11	0.01	0.07
Leather products	4.98	–1.15	2.78	1.59
Wood and paper products	23.94	–0.22	0.57	0.34
Petroleum and chemicals	60.04	–0.04	0.22	0.18
Mineral products	11.24	–0.16	0.24	0.05
Ferrous metals	17.03	–0.57	0.64	0.06
Metals	7.00	–1.27	1.18	–0.13
Metal products	14.99	–0.28	0.22	–0.07
Motor vehicles and parts	17.81	–0.12	0.50	0.34
Transportation equipment	14.76	–0.83	1.51	0.66
Electrical/electronic equipment	39.59	–0.51	–0.56	–1.06
All other manufactures	10.63	0.01	–0.05	–0.03
Utilities	24.66	–0.02	0.39	0.36
Construction	68.89	0.01	0.01	0.02
Trade	67.94	0.27	0.12	0.39
Transportation	37.07	0.21	0.19	0.41
All other services	292.43	0.16	0.05	0.21

Source: Global model simulation results.

Figure 4.2 Change in Employment of Unskilled Labor



Source: Global model simulation results.

Electrical and electronic equipment is the only sector with a net loss of jobs for unskilled workers. Table 4.5 provides more detailed information on the aspects of the Doha Round that drive the employment changes. As noted above, the overall impact is an increase in demand of 0.6 percent, with manufacturing and agricultural liberalization each contributing roughly half.

Demand for skilled labor declines in numerous contracting manufacturing sectors, including some that are major current sources of employment for skilled workers, and shifts to expanding agricultural and food processing sectors (figure 4.3). This suggests that there will be significant transitional adjustment costs to achieve the new equilibrium. Table 4.6 provides additional sectoral detail. It should be remembered that in the model, skilled workers are assumed to be fully employed, and therefore there can be shifts of such workers between contracting and expanding sectors; however, there can be no net change in employment. This contrasts with the assumption that there is unemployment of unskilled workers and that the total employment of this group can expand.

The reallocation of factors of production—land, labor, capital, and natural resources—is not costless and is thus of concern to policy makers. To estimate the costs, we sum the proportionate changes for each factor employed by each activity and divide this amount by the total amount of each factor

Table 4.5 Doha Round Scenarios: Change in Employment of Unskilled Labor by Commodity

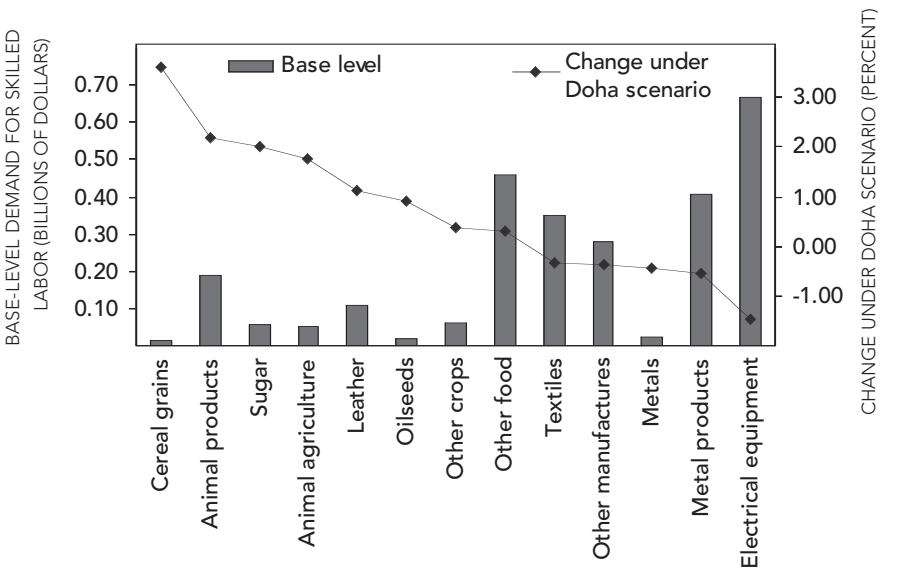
(PERCENT CHANGE)

Commodity	Agriculture	Nonagriculture	Full Doha
Cereal grains	3.11	0.54	3.72
Oilseeds	0.15	0.86	1.03
Other crop agriculture	–0.06	0.54	0.49
Animal agriculture	1.48	0.37	1.88
Minerals	–0.33	0.52	0.16
All other extractive	–0.36	0.58	0.23
Vegetable oils and fats	0.25	0.47	0.73
Sugar and related products	1.89	0.60	2.54
Animal products	2.09	0.56	2.71
Other food products	0.48	0.34	0.83
Textiles	0.21	0.08	0.24
Leather products	–1.04	2.80	1.73
Wood and paper products	–0.11	0.63	0.51
Petroleum and chemicals	0.06	0.46	0.51
Mineral products	–0.02	0.37	0.33
Ferrous metals	–0.41	0.73	0.32
Metals	–1.12	1.29	0.14
Metal products	–0.19	0.23	0.04
Motor vehicles and parts	0.02	0.61	0.60
Transportation equipment	–0.74	1.54	0.79
Electrical/electronic equipment	–0.39	–0.50	–0.88
All other manufactures	0.15	0.07	0.22
Utilities	0.13	0.55	0.68
Construction	0.25	0.22	0.48
Trade	0.39	0.24	0.64
Transportation	0.36	0.36	0.73
All other services	0.37	0.23	0.61
Total unskilled employment	0.29	0.30	0.59

Source: Global model simulation results.

used in the economy. The first column of table 4.7 reports these factor-adjustment estimates for Brazil. Although the numbers are small, they represent substantial reallocations of factors. To put them in perspective, the second column of table 4.7 expresses the total factor reallocation for Brazil as a percentage of the reallocation of that factor required in the European Union as a result of the Doha Round. For example, unskilled labor in Brazil experiences over four and one half times the reallocation compared with unskilled labor in the EU. Brazil would also see substantially greater reallocation of capital than would be required in the EU to achieve the new equilibrium. Conversely, the EU would need to undertake greater reallocation of land due to the removal of agricultural export subsidies and domestic agricultural subsidies, because these distortions are much greater there than in Brazil. Overall, this exercise indicates that the realization of the estimated

Figure 4.3 Changes in Brazil's Skilled Labor Employment



Source: Global model simulation results.

gains from the Doha Round will require Brazil to undertake considerable structural adjustment. The most affected factor is unskilled labor, whose adjustment is likely to be both difficult and costly.

Results From the Country Model Simulations

We next repeat simulations of the Doha Round using the detailed national model of the Brazilian economy. This allows us to investigate the results for the country at more disaggregated levels, including differences in regional effects, more detail about changes in labor demand, and the possibility of migration between regions in response to changes in regional wage rates.

We begin the simulation by introducing into the country model the changes in world prices and export demand generated by the Doha Round simulations using the global model.[3] We then reduce Brazil's own tariffs as required under the Doha scenario. Brazil cuts all initial applied tariff rates by 24 percent, which is defined in our Doha scenario as the commitment required of developing countries. It should be noted that although Brazil's trade policy changes are included in the global model simulation that produced the world price and quantity changes, they account for only a small share of the total changes. By incorporating Brazil's tariff reductions separately in the country model, we reflect more accurately the impact of Brazil's own trade liberalization, which induces larger changes in the final domestic prices of

Table 4.6 Doha Round Scenarios: Change in Employment of Skilled Labor by Commodity

(PERCENT CHANGE)

Commodity	Agriculture	Nonagriculture	Full Doha
Cereal grains	3.04	0.49	3.60
Oilseeds	0.09	0.81	0.91
Other crop agriculture	–0.12	0.49	0.37
Animal agriculture	1.41	0.32	1.77
Minerals	–0.38	0.48	0.06
All other extractive	–0.42	0.54	0.14
Vegetable oils and fats	–0.05	0.25	0.21
Sugar and related products	1.59	0.38	2.00
Animal products	1.79	0.34	2.18
Other food products	0.18	0.12	0.30
Textiles	–0.12	–0.16	–0.34
Leather products	–1.37	2.55	1.14
Wood and paper products	–0.45	0.39	–0.07
Petroleum and chemicals	–0.28	0.21	–0.08
Mineral products	–0.35	0.13	–0.26
Ferrous metals	–0.74	0.49	–0.26
Metals	–1.46	1.04	–0.44
Metal products	–0.52	–0.02	–0.55
Motor vehicles and parts	–0.31	0.36	0.01
Transportation equipment	–1.07	1.29	0.20
Electrical/electronic equipment	–0.73	–0.74	–1.46
All other manufactures	–0.19	–0.18	–0.37
Utilities	–0.21	0.30	0.09
Construction	–0.12	–0.05	–0.18
Trade	–0.06	–0.08	–0.14
Transportation	–0.04	0.07	0.03
All other services	0.04	–0.02	0.02

Source: Global model simulation results.

Table 4.7 Full Doha Round Scenario: Factor Reallocation

Factor	Reallocation of Factors Required for Brazil[a]	Reallocation for Brazil Relative to European Union (percent)
Land	0.00404	–93.1
Unskilled labor	0.00325	453.8
Skilled labor	0.00034	32.6
Capital	0.00143	81.3
Natural resources	0.00043	–87.3

Source: Global model simulation results.
[a]Sum of changes in factor employed by each activity relative to the total amount of factor used in the economy.

Table 4.8. Doha Round Scenarios: Main Macroeconomic Results for Brazil From Country Model Simulations

(PERCENT CHANGE)

Measure	Agriculture	Nonagriculture	Full Doha
Absorption	0.01	0.05	0.06
Real exports	0.03	0.60	0.63
Real imports	0.04	0.88	0.92
Total domestic production	0.01	0.09	0.10

Source: Country model simulation results.

some imports than the modest world price changes generated by the Doha simulation.

At the macroeconomic level, the results from the country model follow the general pattern of those from the global model simulations. However, the impact on Brazil is more muted after its own tariff changes are taken into account (table 4.8). There are smaller increases in domestic absorption (which is an alternative measure of welfare), production, and trade volumes. In contrast to the results from the global model simulations, the Doha scenario induces a somewhat larger increase in imports than in exports in the country model simulations, driven by the reduction in Brazil's own tariffs.

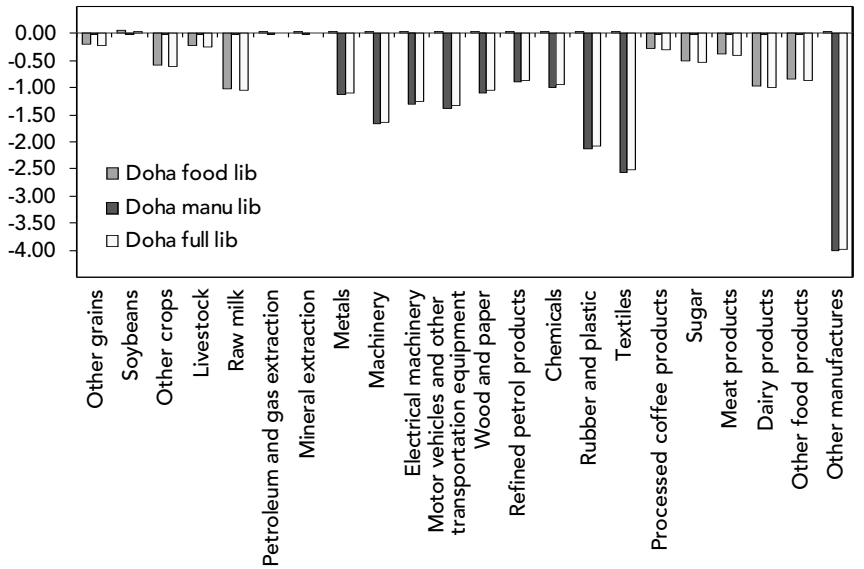
As evident in table 4.8, the changes are driven primarily by nonagricultural trade liberalization rather than by agricultural opening. This reflects in part the fact that Brazil's applied tariffs on agricultural imports are generally lower than those on manufactured imports. The largest declines in domestic prices of imports are in sectors with high initial tariff rates (figure 4.4). For example, the initial tariff of the product group "other manufactures" is 20 percent, the highest applied tariff rate in the data used in the model.[4] Tariffs are also reduced by more than 5 percent on textiles, rubber, plastic, machinery, motor vehicles, and electrical machinery.

The reductions in the import prices of capital goods and some intermediate inputs would lower investment and production costs and stimulate production of some manufactured goods. There is considerable variation in the effects on different sectors, although even the largest changes are only about 0.5 percent (figure 4.5).

Production increases most in the aggregate sector "motor vehicles and other transportation equipment," followed by meat products. (It should be noted that the sectoral aggregations are slightly different in the global and country models because the models necessarily use different databases. For example, in the country model, aircraft, railroads, and some agricultural machinery are included along with automobiles and auto parts in the sectoral

Figure 4.4 Main Changes in Import Prices in Domestic Currency

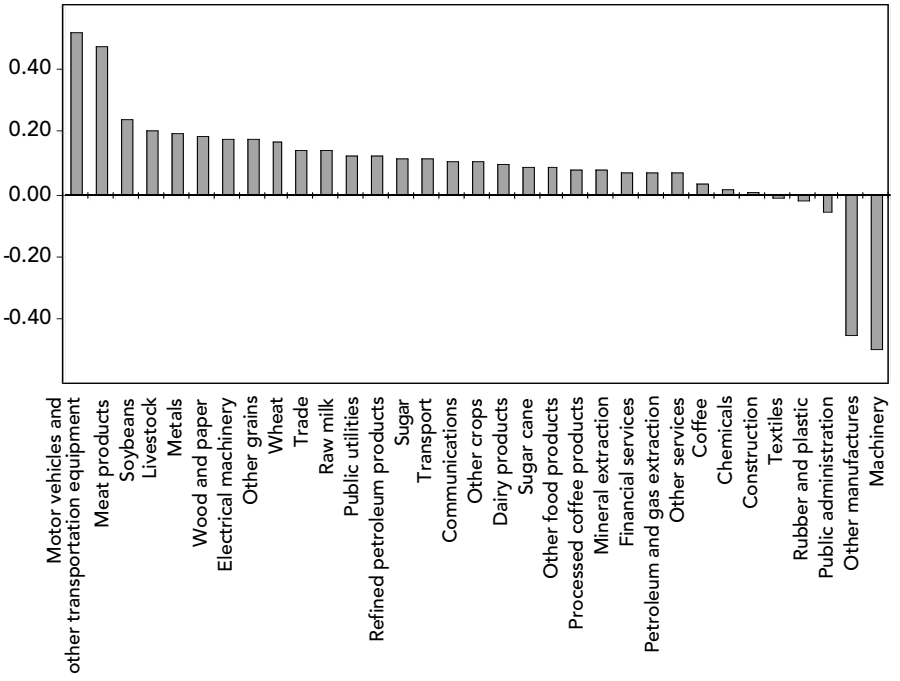
PERCENT CHANGE



Source: Country model simulation results.

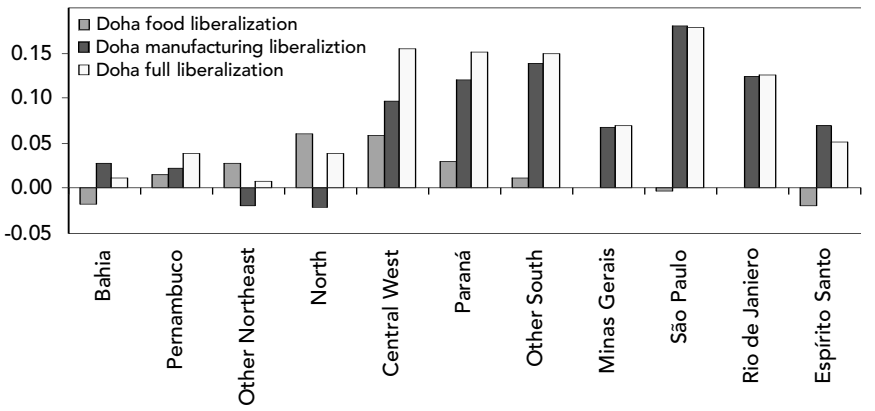
Figure 4.5 Change in Domestic Production After Full Doha Liberalization

PERCENT CHANGE



Source: Country model simulation results.

Figure 4.6 Change in Welfare by Region, Doha Round Simulations



Source: Country model simulation results.
Note: The change in welfare is the equivalent variation as a percentage of initial consumer expenditures.

aggregate "motor vehicles and other transportation equipment," while in the global model they are separate.) In addition to lower input costs, the changes in production are driven in part by a very slight depreciation of the real, which facilitates exports. The depreciation is so small that its effect on production can be disregarded for most sectors. However, motor vehicles and other transportation equipment make up the single largest component of Brazil's exports (14 percent), and a large share (28 percent) of total production is exported, so it is more responsive to modest changes in the exchange rate.

There are smaller increases in the production of soybeans, livestock, metals, wood and paper products, electrical machinery, and grains. Production in the sectors "other manufactures" and machinery contracts by about 0.5 percent after relatively high Brazilian tariffs on these sectors are reduced and imports of these goods increase. Most sectors see extremely small changes in final output of 0.1 percent or less.

Looking beyond the national results, the distribution of gains by region is not even.[5] As evident in figure 4.6, the northern regions see little net change under the Doha Round scenarios while the central and southern regions gain modestly. Welfare gains are concentrated in São Paulo, Central West, Paraná, the other southern regions, and Rio de Janeiro. This suggests that a Doha scenario similar to what is currently under negotiation might be associated with some nontrivial regional distribution effects that might be of concern to the government.

The welfare changes are based on the variation in gains and losses among sectors and commodities, which in turn translate into differences in income to factors (labor, land, and capital) across regions. There are small positive

changes in employment for both low- and medium-wage labor (figure 4.7). It should be remembered that in the model, we take into account the presence of unemployment among low- and medium-wage labor. Increases or decreases in demand will affect the level of employment among such workers. Only when low- and medium-wage workers in a region become fully employed will changes in demand affect the earnings of these workers. At that point, the simulation will reflect a switch from a fixed wage to a flexible wage. However in the Doha Round simulations, these groups do not become fully employed: There is still surplus labor in each region following the policy simulation, and therefore there is no change in wage levels. Because there are no wage increases in any region, there is no stimulus for new migratory flows. For high-wage labor, which is modeled as fully employed, changes in demand are reflected in changes in wages, as well as in migration of high-wage labor between regions based on differing wage rates. The net results show small improvements in labor income for high-wage labor in all regions (figure 4.7).

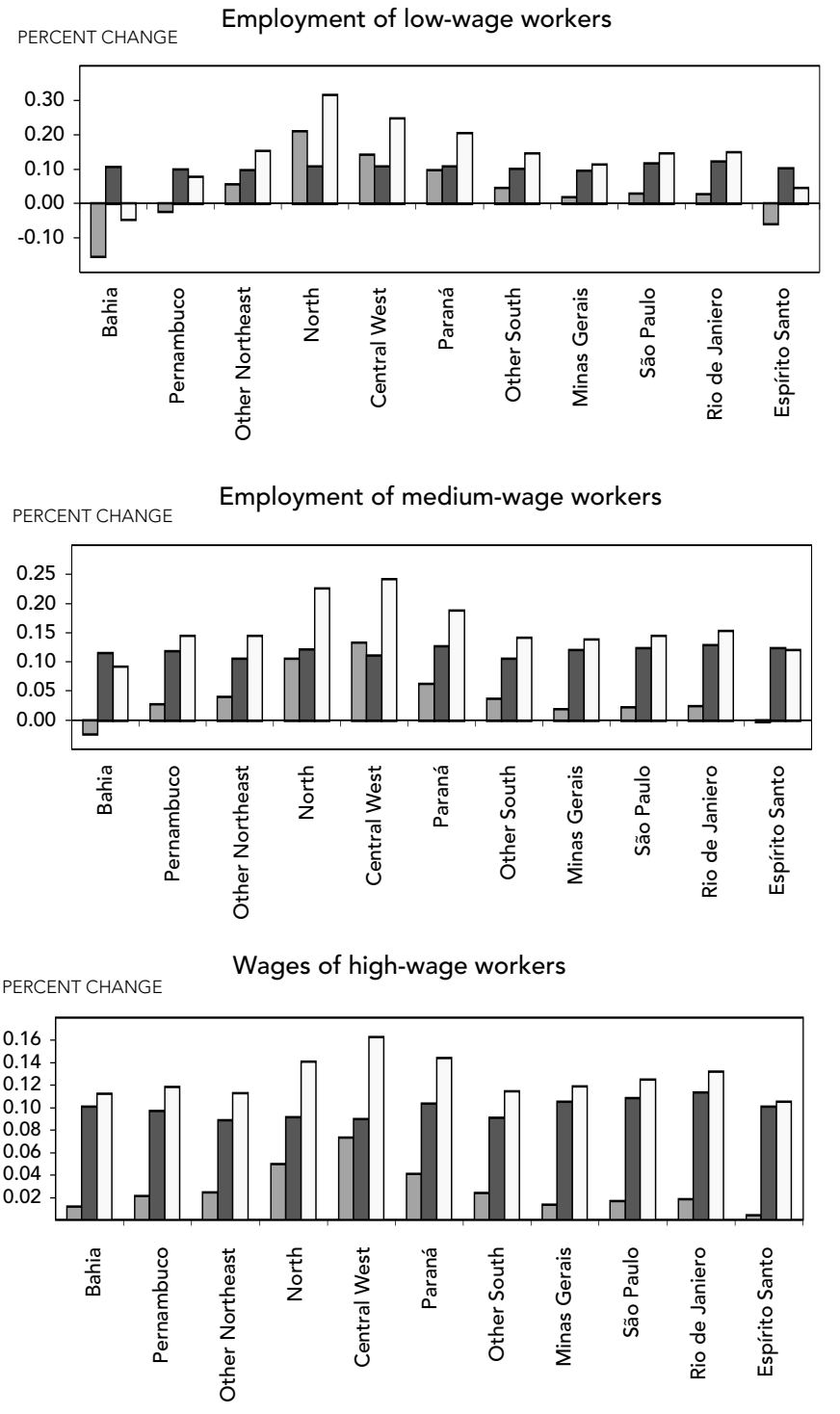
Liberalization of manufacturing trade results in modest and relatively uniform gains of about 0.1 percent to labor across regions and at all wage levels. Agricultural liberalization, by contrast, produces more varied results. For low-wage workers, it leads to employment losses in Bahia, Pernambuco, and Espírito Santo, and gains for workers in the North, Central West, and Paraná regions. Combined effects of manufacturing and agricultural trade changes produce small net employment gains for low-wage labor in all regions except Bahia, where a drop in employment induced by agricultural trade liberalization is not offset by small gains in other sectors. Only in North and Central West are gains driven primarily by agricultural trade liberalization.

Changes in employment of medium-wage labor follow a similar pattern. The gains are again driven by manufacturing liberalization, except in the Central West region, where agricultural liberalization contributes more.

For high-wage labor, the results are also positive and driven mainly by manufacturing liberalization.

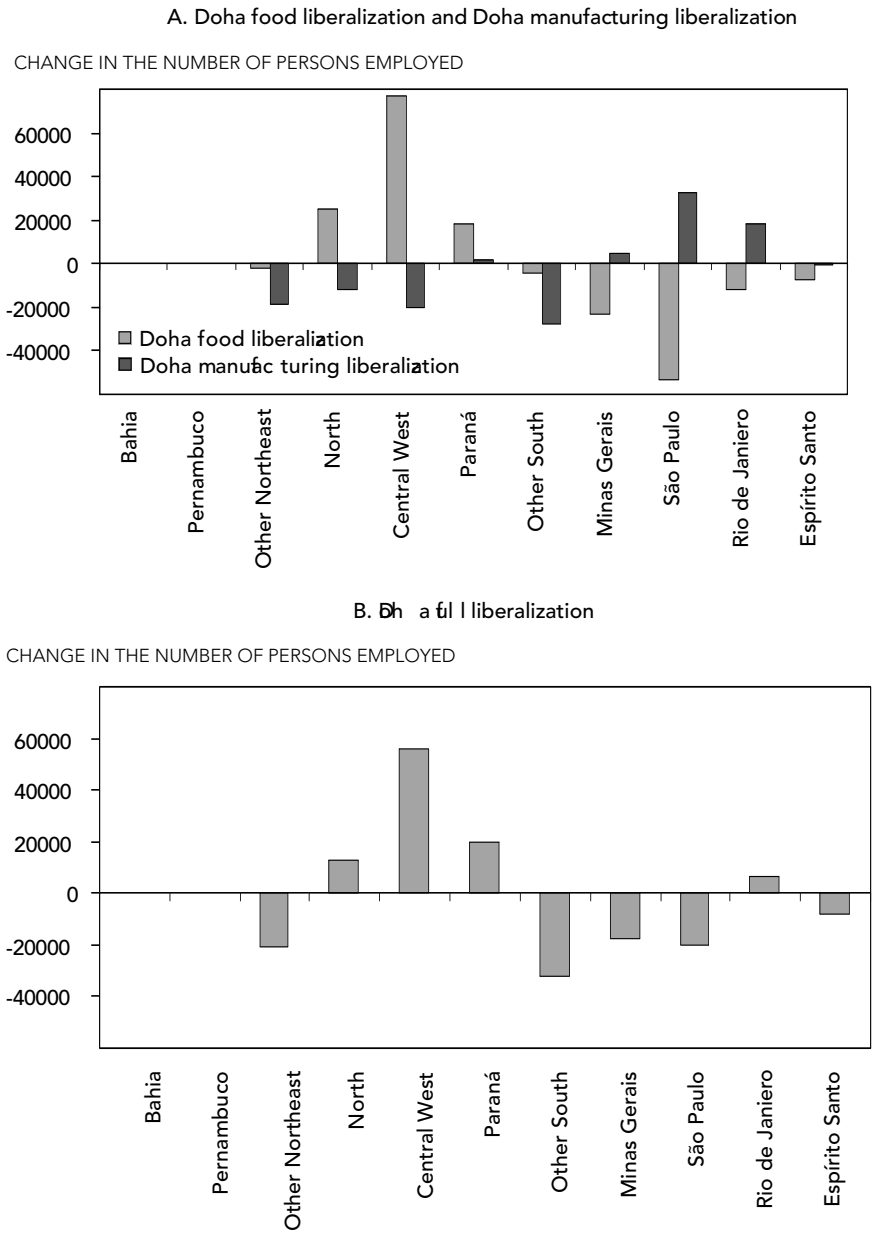
Regional changes in the employment of high-wage workers are presented in figure 4.8, panels A and B. Agricultural liberalization increases demand for high-wage workers in the Central West region that more than offsets reduced demand for high-wage labor in the manufacturing sector there. Wages rise, inducing migration. The same occurs, to a lesser extent, in the North and Paraná. There is a net loss of high-wage labor in the Northeast, "other South," Minas Gerais, São Paulo, and Espírito Santo, although the changes are small. There is virtually no change in Bahia and Pernambuco.

Figure 4.7 Employment and Labor Incomes, Doha Round Simulations



Source: Country model simulation results.

Figure 4.8 Employment of High-Wage Workers, Doha Round Simulations



Source: Country model simulation results and own tabulations from microdata; IBGE (2006).

Comparison With the Results of Other Doha Round Studies

There have been a number of studies of the impact on the Brazilian economy of a possible Doha Round agreement. In general, studies that use the most up-to-date trade database (Global Trade Analysis Project, or GTAP,

Version 6) have found results that are broadly similar at the aggregate level to those in the present study.

A report from the Organisation for Economic Co-operation and Development (OECD) on multilateral trade liberalization used a comparative static model to simulate cuts of 50 percent in applied tariff levels for all countries and sectors, 50 percent cuts in applied agricultural export subsidies, and a 50 percent cut in applied domestic agricultural support in OECD countries, Brazil, and China (OECD 2006). The authors estimate Brazil's welfare gains from such a global trade agreement to amount to $1.7 billion, or 0.3 percent of GDP. The gains come overwhelmingly from OECD country liberalization, with developed countries' agricultural reform contributing 68 percent of Brazil's gains, developed countries' manufacturing liberalization accounting for 21 percent, and developing countries' liberalization of agriculture and manufacturing each contributing 5 percent of Brazil's gains (OECD 2005).

A World Bank study uses a dynamic CGE model to project the impact of a Doha Round agreement several years into the future (Anderson, Martin, and van der Mensbrugghe 2006). The authors simulate a very ambitious agreement. Bound agriculture tariffs are cut using a tiered formula, with reductions of 75 percent for the highest tariffs in developed countries and 60 percent in developing countries. There are no exceptions for sensitive products. Domestic support for agriculture is cut by 60 to 75 percent from bound levels, with the higher cuts applied to countries that provide higher subsidies. Export subsidies are eliminated. Manufacturing tariffs are cut by 50 percent and 33 percent from bound levels by developed and developing countries, respectively. The authors find welfare gains for Brazil of $3.3 billion in 2015, which is about 0.5 percent of Brazil's projected baseline GDP in 2015. However, their results also show that should a final agreement include even modest exceptions for sensitive agricultural products (2 percent of agricultural tariff lines for developed countries and 4 percent for developing countries), Brazil's gains would be significantly lower at $1.1 billion in 2015, or 0.16 percent of GDP. Expanding sensitive product allowances further to 5 percent of tariff lines for developed countries and 10 percent for developing countries does not change these figures greatly; in this scenario, Brazil gains $900 million in 2015, or 0.13 percent of GDP. Sensitive product exceptions for 4 percent of agricultural tariff lines for developed countries and 5.3 percent for developing countries have already been tentatively agreed to in the Doha negotiations.

A study published by the International Food Policy Research Institute also estimates Brazil's gains from a Doha Round agreement using a dynamic CGE model (Bouet, Mevel, and Orden 2007). The authors simulate an ambitious agreement. Agricultural tariffs above 60 percent are cut by 85 to 90 percent in developed countries, with lesser cuts in three bands of lower initial tariffs. The simulation includes a very limited (1 percent) exception for sensitive products, and domestic agricultural support is reduced by 20 percent. The

authors use a "Swiss formula" approach for manufacturing tariffs, with a coefficient of 8 percent for developed countries, 20 percent for middle-income countries, and 30 percent for least-developed countries. They find an overall increase for Brazil of 0.3 percent in GDP under such an agreement. The authors also simulate a less ambitious agreement, with smaller tariff cuts, an exception for sensitive agricultural products of 8 percent of agricultural tariffs, no reduction in domestic agricultural support, and a Swiss formula coefficient of 10 percent for developed countries and 30 percent for developing countries. This simulation produces an increase of only 0.1 percent of GDP for Brazil.

These global studies paint a broadly similar picture of the macroeconomic impact that a Doha Round agreement is likely to have on Brazil. The least ambitious scenarios produce welfare gains of 0.1 percent of GDP for Brazil, whereas the World Bank's most ambitious scenario—one already ruled out in negotiations—estimates Brazil's gain at 0.55 percent in 2015. The finding of our study, a 0.2 percent welfare gain, is in the same range as the realistic scenarios simulated elsewhere.

There are also several Brazil-specific studies that use both global and country models to probe the effects of a Doha Round agreement on Brazil in more detail, as we do in the current study. A study by Azzoni and colleagues (2007)—including one of the authors of the current study—uses the same Doha scenario as the 2006 OECD study described above. After passing the results from the global simulation to a country model, the authors find that most households would gain at least slightly, although gains are unevenly distributed. Agricultural households generally gain more than urban households. Within the agricultural sector, gains are highest for commercial agriculture, followed by the richest family farms. Agricultural laborers also see income gains. The poorest households in both rural and urban areas see positive, but very small, gains of less than $1 per person per year. The reason that richer agricultural households and agribusiness gain more is that production and exports expand more for the commodities they produce than for the products of poorer households. Inequality among agricultural households increases.

The World Bank sponsored two studies that focus on the impact of a Doha Round agreement on poverty in Brazil. These studies find positive, but very modest, reductions in poverty. In one study, a group of researchers apply price and export demand changes derived from the World Bank simulation of Doha trade liberalization to a model of the Brazilian economy using 1997 data (Bussolo, Lay, and van der Mensbrugghe 2006). To examine the impact of trade policy changes over time, the authors first construct a "business-as-usual" scenario to estimate reductions in poverty that would arise over the decade to 2015 without further trade liberalization. As a result of overall economic and factor productivity growth, the authors estimate that the poverty head count would decline by 5.6 percent by 2015. The authors find that the

effects of a Doha scenario are "almost negligible," with the poverty head count falling by an additional 0.2 percent. Under a full free trade scenario, in which tariffs are reduced to zero worldwide, poverty would decline by an additional 0.5 percent by 2015.

A study by Ferreira Filho and Horridge (forthcoming) is instructive regarding the impact of agricultural trade liberalization on poverty in Brazil. The authors simulate a trade shock to the Brazilian economy derived from a World Bank model simulation of the removal of *all* agriculture-related trade and subsidy distortions imposed by countries outside Brazil. The authors use a country model with 2001 data and find that real GDP increases by 0.13 percent. The number of poor households declines by 3 percent, with declines in all regions except Rio de Janeiro and São Paulo, where major industries contract. The Gini index, a common measure of income inequality, declines by 1.6 percent.[6] The authors conclude that even large trade policy shocks, such as full global agricultural liberalization, would not generate very significant changes in Brazilian poverty and income distribution.

Notes

1. The welfare gain for the country as a whole from a full Doha Round is equivalent to the gain from a hypothetical rise in household income of 0.4 percent in the absence of implementation of the Doha Round. Technically, the welfare effect is measured by the Hicksian equivalent variation as a percent of benchmark consumer expenditure.
2. The simulated activity prices for U.S. oilseeds, other crops, and animal agriculture fall by 2.8 percent, 1.8 percent, and 0.5 percent, respectively, and the EU price for other crops falls by 2.6 percent.
3. There is a debate among economists about the appropriate way to introduce the results of a global policy shock obtained from a global computable general equilibrium model into a single country model. See, e.g., Horridge and Zhai (2006). One approach is to introduce only the new world prices generated by the global model into the country model. This approach was adopted by Robilliard and Robinson (2006). However, this approach tends to produce very small changes in exports and imports, in part because only the price changes are captured and income effects are ignored. Another approach is to also take the world demand changes generated by the global model and introduce them into the country model as shifts in export demand functions. There is theoretical support for this approach, and hence we employ it. In addition, many other simulations of the impact of the Doha Round on Brazil have taken this approach, and we can facilitate comparisons between our results and those from other models by using the same methodology. In the absence of a shift in the export demand curve, we would find smaller responses in Brazil's exports and production than those reported here.
4. The global model requires a database with comparable information for all countries in the world. We employ the widely used Global Trade Analysis Project (GTAP) database for that purpose. The country model can support a more detailed database on the Brazilian economy than is available in the GTAP database. Brazilian official data are used for this purpose. The data on tariffs in the GTAP database have been adjusted for comparability across countries and differ somewhat from Brazilian official data.
5. Welfare gains are measured by the Hicksian equivalent variation, as in the global model. In this case, the change in hypothetical income after the policy change is

calculated separately for each region and then compared to household income in that region in the absence of the policy change. A positive number indicates a welfare gain for that region, a negative number a welfare loss.

6. The Gini index represents how far a country's income distribution deviates from complete equality. The index ranges from 0 to 100 percent, with 0 representing a completely equal society (in which all households have the same income) and 100 representing a completely unequal society (in which one household has all the income and the rest have none). The index is calculated using a Lorenz curve, formed by lining up households in a population by ascending income order and plotting cumulative income. The Lorenz curve of a perfectly equal society will follow a 45-degree line. The Gini index is the percentage that the area below the 45-degree line and above the Lorenz curve represents of the entire area under the 45-degree line.

CHAPTER 5

The Impact of South–South Integration

Brazil is engaged in a number of current or proposed trade agreements outside the World Trade Organization and the Doha Round. In this chapter, we shift our focus toward the potential effects of further trade liberalization with other developing countries, in contrast to liberalization with the entire global community as represented by the WTO. Such a South–South approach also differs from earlier negotiations for trade pacts with wealthy countries, such as the now stalled negotiations for a possible Free Trade Area of the Americas or those between Mercosur and the European Union.

There has been substantial interest as to whether increased trade among developing countries could provide an alternate or additional path for expansion on more attractive terms than those achievable in multilateral or North-South trade agreements. One argument for this approach is a perception by some of a "new protectionism" in the North, in the form of nontariff trade barriers. Moreover, the approach of developed countries toward trade agreements with developing countries has been considered by some to be overly aggressive in opening developing countries' markets prematurely and thus eliminating their emerging industrial sectors as potential global competitors. Over and above these economic arguments is a political argument urging the South to seek its own development path. This argument may gain force in light of the current financial crisis that originated in developed countries.

We explore the potential of South–South trade agreements through a series of simulations using the global model. First, we conduct a simulation of a regional free trade agreement between Brazil, India, and the Southern African Customs Union (SACU). At a ministerial meeting in March 2005, the India–Brazil–South Africa Dialogue Forum (IBSA) envisaged the formation of a trilateral free trade area between these three countries. Brazil and South Africa are already members of customs unions, with South Africa a member of SACU. In recognition, the October 2007 summit meeting of the group affirmed its commitment to work toward a SACU–Mercosur–India FTA.

However, the enthusiasm of other Mercosur members for such an agreement appears to be limited at present, and Mercosur still has no comprehensive common external tariff system in place (see Inter-American Development Bank 2007). We therefore simulate an agreement between Brazil, India, and SACU involving the complete removal of tariffs on trilateral trade flows. Unlike the Doha Round simulation, this scenario does not include reductions in domestic or export subsidies for agriculture by Brazil or any of its trading partners. This reflects the practical reality that countries have not been willing to address their domestic agricultural subsidy programs in the context of bilateral or regional FTAs.

We then simulate an expansion of the IBSA trading bloc to include China, the largest and fastest growing developing country. This experiment is named with an acronym for India, Brazil, South Africa, and China—IBSAC. Finally, we extend the trading bloc to include an expanded Mercosur that incorporates Chile and Venezuela. This scenario includes the complete elimination of import duties that are still imposed on a limited range of "sensitive" products among the original Mercosur members and the full accession of new members Venezuela and Chile.[1] In this experiment, the whole enlarged Mercosur area, including Brazil, participates in the FTA with India, SACU, and China; this experiment is named with the acronym IMSAC.

The experiments are compared for the scale and pattern of their effects on Brazil.[2] It should be noted that these experiments use the currently available global trade database, GTAP 6, which is based on international trade information for 2001. Given the extensive growth of the developing world in general and China and India in particular since then, we expect that simulations using the forthcoming version of the GTAP database, GTAP 7, which incorporates data for 2004, would produce different and probably larger results.[3]

Simulation Results

The effects of the four simulation experiments on aggregate real trade flows and the terms of trade are reported in table 5.1 for the countries involved. Table 5.2 shows the resulting percentage changes in real absorption, gross domestic product, and welfare (equivalent variation) by region.

It is evident that the establishment of an India–Brazil–SACU FTA (IBSA) has very limited impact on Brazil and India. The two countries experience very small aggregate trade effects and welfare gains, while SACU gains slightly more. This is unsurprising, as the shares of the IBSA countries in their IBSA partners' total trade are small in the status quo ante and remain small post-IBSA. A glance at the respective aggregate export shares by destination and import shares by origin in tables 5.3 and 5.4 reveals that Brazil's exports to India and Southern Africa rise from 1.3 to 2.1 percent of its total exports, and

Table 5.1 Aggregate Real Trade Impacts of South–South Simulations

PERCENT CHANGE

Country or Group	Imports			Exports			Terms of Trade		
	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC
Brazil	0.37	2.23	2.23	0.25	1.24	1.66	0.10	0.57	0.48
Argentina	–0.04	–0.46	7.77	–0.02	–0.19	3.06	–0.02	–0.28	1.89
Uruguay	–0.01	–0.10	1.15	0.00	–0.12	1.65	0.00	–0.01	0.01
Chile	–0.04	–0.05	1.78	–0.01	–0.01	1.49	–0.02	–0.04	–0.22
Venezuela	–0.09	–0.24	2.56	0.00	0.00	1.21	–0.08	–0.21	1.06
China	0.00	1.28	1.87	0.00	1.03	1.47	0.00	–0.01	–0.11
India	0.93	1.90	2.61	1.45	2.95	4.57	–0.03	–0.11	–0.64
SACU	2.32	3.02	3.11	1.13	1.79	1.90	0.19	0.06	0.02

Source: Global model simulation results.
Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

its import share from these partners rises from 1.8 to 2.2 percent. In comparison, Brazil's trade shares with the EU, United States, and regional neighbors are much larger. Brazil's trade with the EU and United States accounts for more than half its exports and imports both before and after the IBSA simulation. The small decreases in exports experienced by Brazil's Mercosur partners suggest that the IBSA pact could cause mild trade diversion.

Table 5.2 Impact on Real Macroeconomic Measures of South–South Simulations

PERCENT CHANGE

Country or Group	Absorption			GDP			Welfare[a]		
	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC
Brazil	0.06	0.20	0.26	0.03	0.03	0.13	0.09	0.30	0.42
Argentina	0.00	–0.01	0.31	0.00	0.01	–0.07	0.00	–0.01	0.35
Uruguay	0.00	–0.01	0.12	0.00	0.00	0.13	0.00	–0.01	0.18
Chile	–0.01	–0.02	0.42	0.00	0.00	0.36	–0.02	–0.02	0.66
Venezuela	–0.02	–0.04	0.27	0.00	0.00	0.02	–0.02	–0.06	0.36
China	0.00	0.35	0.57	0.00	0.33	0.56	0.00	0.68	1.12
India	0.03	0.08	0.16	0.07	0.16	0.35	0.05	0.13	0.27
SACU	0.28	0.40	0.43	0.00	0.16	0.20	0.40	0.59	0.63

Source: Global model simulation results.
Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.
[a]Equivalent variation as a percentage of initial household consumption.

Table 5.3 Export Shares of Brazil, China, India, and SACU by Destination Before and After South–South Simulations

PERCENT

	Brazil				China				India				SACU			
Destination	Base	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC
Brazil					0.5	0.5	0.6	0.6	1.4	1.6	1.6	1.6	1.0	1.2	1.2	1.2
Argentina	7.4	7.4	7.1	8.0	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.2	0.2	0.2	0.3
Uruguay	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Chile	2.1	2.0	2.0	2.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Venezuela	1.6	1.6	1.5	2.3	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
China	4.3	4.3	8.1	6.7					5.1	5.1	5.9	5.9	3.4	3.3	3.7	3.7
India	0.6	1.2	1.2	1.1	0.7	0.7	1.2	1.2					3.3	7.5	7.2	7.1
SACU	0.7	0.9	0.8	0.8	0.3	0.3	0.5	0.5	0.7	0.9	0.9	0.9				
European Union	29.0	28.8	27.7	27.5	21.6	21.7	21.3	21.3	29.9	29.8	29.6	29.5	36.5	34.4	34.5	34.5
United States	23.5	23.3	22.3	22.1	27.0	27.0	26.6	26.5	20.1	20.1	20.0	20.0	12.8	12.4	12.4	12.4
Rest of the Americas	10.0	10.0	9.5	9.4	4.2	4.2	4.1	4.1	3.5	3.4	3.4	3.4	2.1	2.1	2.1	2.1
East and Southeast Asia	9.3	9.2	8.9	8.9	24.3	24.3	23.9	23.9	15.5	15.4	15.3	15.2	12.2	11.9	11.9	11.9
Rest of the world	10.5	10.4	10.0	9.9	7.9	7.9	7.8	7.8	23.1	23.0	22.8	22.7	18.2	17.3	17.3	17.3

Source: Global model simulation results.

Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Table 5.4 Import Shares of Brazil, China, India, and SACU by Origin Before and After South–South Doha Simulations

PERCENT

	Brazil				China				India				SACU			
Destination	Base	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC	BASE	IBSA	IBSAC	IMSAC
Brazil					0.8	0.8	1.5	1.2	0.7	1.4	1.4	1.2	1.3	1.7	1.7	1.6
Argentina	8.8	8.8	8.8	9.0	0.4	0.4	0.3	1.0	0.9	0.9	0.8	2.5	1.1	1.1	1.0	1.2
Uruguay	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Chile	1.4	1.3	1.3	1.6	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Venezuela	0.8	0.8	0.7	0.8	0.1	0.1	0.1	0.1	5.9	5.7	5.5	7.6	0.0	0.0	0.0	0.0
China	3.1	3.1	4.2	4.1					5.6	5.4	9.5	9.2	4.6	4.5	6.3	6.3
India	1.2	1.4	1.3	1.4	0.8	0.8	1.0	1.0					1.2	1.7	1.6	1.6
SACU	0.6	0.8	0.8	0.7	0.4	0.4	0.5	0.5	2.6	5.8	5.5	5.4				
European Union	32.0	31.9	31.6	31.2	17.7	17.7	17.4	17.3	27.2	26.1	25.1	24.4	36.0	35.8	35.2	35.1
United States	23.7	23.7	23.4	23.2	10.2	10.2	10.0	9.9	9.6	9.2	8.9	8.7	11.5	11.5	11.3	11.3
Rest of the Americas	5.6	5.6	5.5	5.5	2.5	2.5	2.4	2.4	4.5	4.3	4.1	3.9	1.7	1.7	1.7	1.7
East and Southeast Asia	11.3	11.2	11.1	11.0	40.4	40.4	39.7	39.6	22.3	21.4	20.5	19.4	12.4	12.3	12.0	12.0
Rest of the world	10.7	10.6	10.5	10.5	10.1	10.1	9.9	9.9	20.3	19.3	18.3	17.5	16.3	16.4	16.2	16.2

Source: Global model simulation results.

Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Although the aggregate effects of IBSA are small, the simulation suggests that there would be more substantial effects for a few sectors (see tables 5.5, 5.6, and 5.7). The removal of India's high applied import duty rate (on the order of 50 percent) on vegetable oils and fats triggers a large boost to Brazilian exports of these commodities to India. The increased export demand pushes production and employment up by about 2.8 percent in this sector and also generates a significant positive backward linkage by increasing demand for oilseeds production. The only other Brazilian sector that registers an export effect of more than 1 percent is motor vehicles and parts. Imports increase slightly across a range of sectors, with increases of 1 percent or more in oilseeds, textiles, and ferrous and other metals.

The picture changes substantially when China, the largest economy in the developing world, joins the FTA (in the IBSAC simulation). There are further gains if the other members of the enlarged Mercosur also become party to such an agreement (in the IMSAC simulation). Interestingly, the simulated welfare gains under the IMSAC scenario for Brazil are of a similar order of magnitude as its Doha Round gains, although the sources of these gains at the sectoral level are substantially different. Whereas, under Doha, Brazil sees small production gains across a broad range of sectors, IMSAC leads to large gains in some agricultural sectors, most notably oilseeds and vegetable oils, as China opens its market for these products. However, IMSAC leads to a small contraction of production for every Brazilian manufacturing sector except motor vehicles and parts and chemicals.

Gains for China, India, SACU, and the other Mercosur members are substantially better under the IMSAC scenario than under either IBSA or IBSAC and are comparable to their gains under a number of Doha Round simulations. These results suggest that in the wake of China's emergence as a major global player, the conventional wisdom that pure South–South regional integration arrangements are too small to produce real changes for the participating countries might be in need of a re-evaluation.

Employment Effects

The aggregate employment effects of the different trade agreements are presented in table 5.8. As noted earlier in this study, the simulations assume that there is unemployed unskilled labor in each of these regions, and therefore aggregate employment can increase or decrease in response to changes in labor demand. Brazil sees very small gains in unskilled employment under each scenario, with the largest gain, still only 0.4 percent, accruing from the IMSAC scenario. Only Chile and China enjoy gains of more than 1 percent, in both cases under the IMSAC scenario.

Table 5.5 Impact on Real Output by Commodity of South–South Simulations

PERCENT CHANGE

	Brazil			China			India			SACU		
Commodity	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC
Cereal grains	–0.07	–1.86	3.42	0.00	0.74	1.37	0.04	0.11	0.25	–1.11	–0.93	–2.18
Oilseeds	1.54	31.82	18.21	–0.05	–17.27	–34.68	–0.19	–0.08	–1.33	–1.77	–1.28	–1.94
Other crop agriculture	–0.03	–0.57	–0.11	0.00	0.47	0.82	0.15	0.27	0.47	–1.70	–1.39	–1.28
Animal agriculture	0.02	–0.04	0.02	0.00	0.58	1.07	0.06	0.05	0.18	–0.81	–0.70	–0.73
Minerals	–0.12	–0.86	–0.69	–0.02	0.29	0.42	–1.03	–0.58	0.39	3.20	3.71	3.78
All other extractive	–0.09	–0.53	–0.23	0.00	0.73	0.72	–0.14	–0.50	–2.07	–0.03	0.20	0.13
Vegetable oils and fats	2.75	6.48	3.80	0.05	2.08	4.28	–1.91	–1.51	–12.61	–0.73	–0.45	–2.83
Sugar	–0.04	–0.66	–0.46	0.08	–1.97	–0.96	0.03	0.15	0.30	–1.85	–0.95	–0.81
Animal products	–0.02	–0.85	–0.43	0.01	0.85	1.73	0.10	0.32	0.63	–1.17	–1.08	–1.13
Other food products	0.06	0.31	0.21	0.00	0.61	1.10	0.07	0.23	0.40	–0.40	–0.27	–0.25
Textiles	–0.09	–0.94	–0.50	–0.01	1.35	2.09	0.94	1.47	2.60	–4.25	–8.75	–8.70
Leather products	–0.11	–3.64	–2.50	0.01	1.16	2.26	1.49	3.00	4.58	–4.09	–14.08	–14.40
Wood and paper products	–0.03	–0.61	–0.18	0.01	0.43	0.78	0.38	0.65	1.22	–1.33	–1.03	–0.83
Petroleum and chemicals	–0.01	0.14	0.31	0.00	0.57	0.82	0.38	0.42	1.50	–0.34	–0.10	–0.05
Mineral products	0.00	–0.47	–0.14	0.00	0.18	0.28	0.31	–0.22	0.19	–1.69	–1.80	–1.71
Ferrous metals	–0.05	–1.42	–0.32	0.01	0.19	0.36	0.33	0.66	1.42	–3.20	–2.00	–1.57
Metals	–0.77	–3.49	–3.26	–0.08	0.45	0.59	–13.08	–13.02	–11.19	18.36	18.21	18.17
Metal products	0.00	–0.91	–0.22	0.00	0.30	0.52	0.42	0.39	0.75	–2.02	–1.72	–1.60
Motor vehicles and parts	0.56	0.71	1.84	0.01	–0.08	0.11	–0.23	0.00	0.22	–2.90	–2.31	–2.22
Transportation equipment	0.09	–1.14	–0.31	0.01	0.14	0.44	0.59	0.97	1.56	–4.25	–2.92	–2.55
Electrical/electronic equipment	–0.14	–2.20	–1.02	0.00	0.35	0.56	1.13	0.83	1.51	–4.16	–2.70	–2.45
All other manufactures	0.05	–0.93	–0.75	0.01	0.35	0.78	2.56	4.34	6.08	–9.27	–6.41	–6.21
Utilities	–0.03	–0.30	–0.08	0.00	0.54	0.82	–0.23	–0.03	0.43	1.59	1.91	1.99
Construction	0.00	0.00	0.01	0.00	0.03	0.04	0.03	0.06	0.09	0.13	0.20	0.21
Trade	0.09	0.21	0.33	0.00	0.53	0.89	0.13	0.28	0.53	0.01	0.24	0.29
Transportation	0.07	0.06	0.19	0.00	0.46	0.77	0.20	0.45	0.84	0.33	0.60	0.65
All other services	0.05	0.11	0.15	0.00	0.39	0.63	0.13	0.26	0.42	0.22	0.34	0.37

Source: Global model simulation results.

Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Table 5.6 Impact on Real Exports by Commodity of South–South Simulations

PERCENT CHANGE

	Brazil			China			India			SACU		
Commodity	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC
Cereal grains	–0.16	–4.74	0.01	0.01	0.57	1.58	0.63	1.43	3.09	–2.07	–1.84	–3.18
Oilseeds	0.89	55.28	32.20	–0.09	–13.14	–26.87	0.14	0.80	0.85	–2.52	–1.92	–2.02
Other crop agriculture	–0.11	–1.56	–0.44	0.01	0.76	1.29	0.51	1.17	2.17	–2.48	–2.01	–1.78
Animal agriculture	–0.11	–2.20	–1.45	0.00	1.62	2.48	0.39	1.33	2.40	–1.36	–1.07	–1.04
Minerals	–0.12	–0.88	–0.73	–0.10	0.43	0.50	–0.66	0.10	1.20	1.94	2.46	2.55
All other extractive	–0.27	–1.70	–0.33	–0.02	4.51	3.53	1.11	2.59	5.01	1.69	1.73	1.34
Vegetable oils and fats	20.76	34.48	20.92	0.09	5.51	10.53	–0.78	1.08	–7.15	1.87	2.36	–1.66
Sugar	–0.16	–1.77	–1.33	0.12	–1.36	–0.10	0.54	2.29	3.16	–2.65	–1.33	–1.15
Animal products	–0.20	–3.41	–2.04	0.02	1.37	2.97	0.72	2.43	3.86	–2.74	–2.41	–2.36
Other food products	0.00	–0.27	–0.11	0.00	0.83	1.58	0.46	1.55	2.33	–1.23	–0.94	–0.82
Textiles	–0.16	–2.10	0.41	–0.01	3.00	3.91	2.02	3.70	5.93	–4.94	–7.87	–7.69
Leather products	–0.11	–4.28	–2.86	0.01	1.29	2.54	2.37	4.99	7.52	–5.22	–12.91	–13.01
Wood and paper products	–0.16	–1.63	–0.49	0.02	0.67	1.06	1.02	2.37	3.75	–2.39	–1.81	–1.36
Petroleum and chemicals	0.09	–0.47	1.08	–0.01	1.97	2.28	1.32	3.59	6.08	0.17	0.60	0.67
Mineral products	0.34	–0.47	0.96	0.01	0.70	0.89	1.19	1.80	3.16	–2.55	–2.27	–2.02
Ferrous metals	–0.03	–1.91	–0.33	0.03	0.31	0.47	1.17	2.76	4.30	–3.29	–1.86	–1.25
Metals	–0.81	–4.21	–3.51	–0.49	2.18	2.24	–7.73	–5.28	–2.72	19.57	19.33	19.22
Metal products	0.10	–1.78	2.38	0.01	0.48	0.81	2.34	3.37	4.65	–3.15	–2.65	–2.40
Motor vehicles and parts	1.42	2.20	7.51	0.02	–0.10	0.07	1.13	2.16	3.19	–3.63	–2.86	–2.76
Transportation equipment	–0.16	–2.42	–1.59	0.01	0.09	0.76	2.31	4.14	6.70	–5.27	–3.59	–3.20
Electrical/electronic equipment	–0.01	–2.48	0.78	0.00	0.77	1.02	2.95	4.39	6.03	–5.08	–2.87	–2.53
All other manufactures	0.58	–1.55	–0.96	0.02	0.38	0.90	3.64	6.52	8.92	–9.80	–6.63	–6.42
Utilities	–0.21	–1.44	–1.26	0.02	0.39	0.61	0.37	1.39	2.72	–0.32	0.11	0.20
Construction	–0.12	–0.79	–0.79	0.00	–0.11	–0.11	0.39	0.89	1.38	–1.06	–0.80	–0.75
Trade	–0.05	–0.59	–0.49	0.00	0.34	0.65	0.35	0.86	1.45	–1.21	–0.86	–0.79
Transportation	–0.05	–0.64	–0.52	0.01	0.16	0.37	0.43	1.08	1.83	–0.85	–0.48	–0.40
All other services	–0.10	–0.74	–0.72	0.01	0.11	0.27	0.36	0.84	1.34	–1.03	–0.79	–0.73

Source: Global model simulation results.

Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Table 5.7 Impact on Real Imports by Commodity of South–South Simulations

PERCENT CHANGE

	Brazil			China			India			SACU		
Commodity	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC	IBSA	IBSAC	IMSAC
Cereal grains	0.41	5.50	–8.22	–0.01	0.38	0.12	0.74	13.83	18.39	2.83	3.10	12.54
Oilseeds	1.99	–12.36	–7.39	0.06	21.13	45.91	–0.50	–0.76	–2.34	1.13	0.95	–0.27
Other crop agriculture	0.60	4.88	2.10	–0.03	1.39	1.56	–0.20	0.03	–0.97	2.07	2.46	2.43
Animal agriculture	0.38	3.60	5.36	–0.01	0.02	–0.32	–0.28	7.87	7.14	0.37	0.30	0.19
Minerals	0.02	0.01	0.80	0.04	0.44	0.67	–0.79	–0.79	–0.56	4.30	4.52	4.57
All other extractive	0.19	1.57	1.58	–0.03	1.87	2.67	0.55	1.05	4.04	3.40	3.66	3.71
Vegetable oils and fats	–1.15	–11.90	–2.09	–0.19	–3.20	–7.16	3.61	3.08	25.21	2.70	2.42	9.04
Sugar	0.75	3.56	5.07	–0.06	2.78	2.81	5.36	5.52	4.67	1.93	1.59	1.54
Animal products	0.52	4.73	–0.61	–0.03	0.38	–0.08	–0.26	–0.95	–2.15	2.89	2.88	4.22
Other food products	0.22	1.34	1.68	–0.01	0.64	0.94	–0.18	1.43	1.50	1.53	1.77	1.92
Textiles	1.46	8.10	7.59	0.00	3.00	3.23	–0.96	6.15	4.57	5.35	14.89	15.11
Leather products	0.90	13.57	10.94	0.00	0.65	0.96	0.04	1.85	2.46	3.56	23.12	24.08
Wood and paper products	0.46	2.37	2.31	–0.02	0.99	1.12	–0.17	0.01	–0.85	1.78	2.16	2.08
Petroleum and chemicals	0.46	2.08	1.99	0.00	0.85	1.07	0.46	3.53	2.15	1.66	1.73	1.74
Mineral products	0.58	2.31	2.70	–0.01	0.76	0.86	–0.21	4.80	3.72	2.45	3.48	3.45
Ferrous metals	1.03	2.28	2.01	–0.04	0.67	0.85	1.57	1.12	0.88	0.85	1.00	0.95
Metals	1.70	2.99	5.89	0.04	0.81	1.21	18.24	19.27	18.97	6.75	6.95	6.48
Metal products	0.84	3.73	4.08	–0.01	0.95	1.11	–1.03	5.89	4.92	2.28	3.35	3.30
Motor vehicles and parts	0.01	1.06	5.17	–0.02	1.44	1.58	3.20	2.39	1.65	1.94	1.82	1.78
Transportation equipment	0.59	2.74	3.02	–0.01	0.58	0.69	–1.31	–1.84	–3.06	1.75	1.54	1.43
Electrical/electronic equipment	0.26	2.30	2.04	0.00	0.71	0.91	–1.57	–0.05	–1.02	1.87	1.76	1.72
All other manufactures	0.54	11.74	11.89	0.03	2.01	2.34	–1.74	–2.48	–3.57	3.47	3.41	3.40
Utilities	0.19	1.34	0.72	–0.03	0.68	0.95	–0.77	–1.52	–2.41	3.17	3.20	3.22
Construction	0.17	1.10	1.11	–0.01	0.19	0.22	–0.49	–1.12	–1.72	1.68	1.42	1.39
Trade	0.21	1.21	1.32	0.00	0.65	0.99	–0.29	–0.68	–1.02	1.77	1.70	1.74
Transportation	0.20	1.13	1.20	–0.01	0.62	0.87	–0.36	–0.90	–1.39	2.11	2.01	1.99
All other services	0.22	1.23	1.29	–0.01	0.50	0.69	–0.31	–0.77	–1.19	1.85	1.71	1.69

Source: Global model simulation results.

Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Table 5.8 Aggregate Unskilled Employment After South–South Simulations

PERCENT CHANGE

	IBSA	IBSAC	IMSAC
Brazil	0.10	0.16	0.41
Argentina	0.00	0.05	–0.26
Uruguay	0.00	0.00	0.63
Chile	–0.01	–0.01	1.21
Venezuela	0.00	0.01	0.09
China	0.00	0.68	1.15
India	0.22	0.49	0.98
SACU	0.00	0.40	0.50

Source: Global model simulation results.
Note: SACU = Southern African Customs Union; IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Notes

1. Chile acquired the notional status of associate membership in 1996, while Venezuela joined Mercosur officially as a full member in July 2007. However, at present, the tariff barriers between these two countries and the original Mercosur partners continue to exist. Tariffs between Venezuela and the original Mercosur members will only be gradually dismantled until 2014, according to the current timetable. See Inter-American Development Bank (2007) for detailed information on the policy background for these scenarios.
2. For detailed information on the policy background for this scenario, see Inter-American Development Bank (2007). We cannot model Paraguay's economy separately because data for the country are included in a grouping of small South American countries in the global database that we use.
3. See Dimaranan (2006). It should also be noted that the GTAP6 2001 benchmark equilibrium incorporates pre-WTO accession import duties for China, and hence the exploratory IBSAC and IMSAC scenarios reported here include, to some extent, tariff cuts associated with China's WTO accession.

CHAPTER 6

China and India Growth Scenario Results

The recent rapid growth of China and India, the two largest countries in the world in terms of population, has already had significant effects on the global economy. These effects have also been felt by the Brazilian economy in a variety of ways. On the one hand, the growth of China in particular has strongly stimulated demand for many of Brazil's exports, including soybeans and minerals. On the other hand, Brazil competes with the Asian countries in some products on world markets or in its own domestic markets, and this has raised concerns regarding the impact of their increasing productivity on employment and production structures in Brazil (McDonald, Robinson, and Thierfelder, forthcoming). Specific concerns have been raised about the impact of increased penetration of Chinese manufactured imports on the development of labor-intensive activities and hence employment in Brazil.

By way of context, the current top Brazilian imports from China are electric machinery and equipment, organic chemicals, optical equipment, photographic and precision instruments, iron and steel articles, toys, games and sports articles, vehicles, minerals, and apparel. The top imports from India are organic chemicals, pharmaceuticals, machinery and mechanical appliances, iron and steel, plastic articles, electrical machinery and equipment, cotton, apparel, and metal products.

Concern has also been expressed about the extent to which the growth of the Chinese and Indian economies will encourage the expansion of natural resource–based activities in Brazil at the expense of the manufacturing activities that have long been a focus for the country's development.[1] The concern is that a shift in sectoral specialization patterns toward lower-value-added activities with low human capital and technology intensity may adversely affect Brazil's long-run growth prospects.

To assess the potential implications for Brazil of continued rapid growth in China and India, independent of any further trade liberalization, we

Table 6.1. Macroeconomic Effects of Growth in Manufactures Total Factor Productivity in China and India

PERCENT CHANGE

Measure	Brazil	China	India
Real absorption	0.08	6.66	2.62
Real imports	0.35	4.97	1.13
Real exports	0.02	7.22	3.80
Real GDP	0.03	1.84	0.42
Unskilled employment	0.09	3.55	1.38
Terms of trade	0.33	–3.12	–2.41
Welfare[a]	0.12	12.21	3.62

Source: Global model simulation results.
[a]Equivalent variation as a percentage of initial consumption expenditures.

conducted simulations of additional efficiency gains in Chinese and Indian manufacturing. First we used the global model to simulate a gain of 20 percent in total factor productivity, which would reduce Chinese and Indian commodity prices relative to those of other regions. Table 6.1 presents the macroeconomic results for the three countries.

The main effects of the efficiency gains are experienced within the economies of China and India themselves, with marked increases in real domestic absorption, imports, and exports. The external effects are primarily realized through deteriorations in China's and India's terms of trade. This results in some leakage of the benefits to other countries, primarily through reductions in real prices of Chinese and Indian exports and terms-of-trade effects that allow for small increases in welfare for trading partners. The most notable of the small effects on Brazil is the increase in import volumes, and it is these that drive changes in the Brazilian economy.

Table 6.2 reports the sectoral results for Brazil, in which several patterns emerge. First, exports of most manufactured commodities decline while imports increase. Second, Brazilian exports of agricultural and processed food commodities increase while imports decline. Third, the structure of output shifts, such that most manufacturing sectors decline slightly, although only one, leather products, declines by more than 0.5 percent. The natural resource–intensive sectors expand to some extent. The net effect is positive and produces a small increase in the overall employment of unskilled labor. At the same time, the structural adjustment is not negligible and there are likely to be adjustment costs associated with the shifts in employment of labor and capital.

We also used the country model to simulate rapid TFP growth in China and India in order to probe more disaggregated and regional effects on the

Table 6.2. Sectoral Effects for Brazil of Growth in Manufactures Total Factor Productivity in China and India

PERCENT CHANGE

Commodity	Exports	Imports	Gross Output	Unskilled Labor Demand	Skilled Labor Demand
Cereal grains	0.04	–0.52	0.28	0.29	0.27
Oilseeds	2.01	0.15	1.11	1.09	1.06
Other crop agriculture	0.09	–0.13	0.05	0.06	0.04
Animal agriculture	0.00	–0.01	0.10	0.12	0.09
Minerals	0.71	–0.31	0.41	0.35	0.33
All other extractive	0.63	–0.17	0.06	0.04	0.02
Vegetable oils and fats	1.42	0.01	0.27	0.16	0.06
Sugar	0.04	0.07	0.04	0.08	–0.03
Animal products	0.38	–0.36	0.09	0.16	0.05
Other food products	–0.09	0.11	0.04	0.09	–0.02
Textiles	0.41	1.15	0.02	0.03	–0.09
Leather products	–1.41	0.88	–0.95	–0.90	–1.02
Wood and paper products	–0.49	0.39	–0.12	–0.09	–0.21
Petroleum and chemicals	–0.16	0.37	–0.04	0.00	–0.12
Mineral products	–0.25	0.41	–0.06	–0.05	–0.17
Ferrous metals	–0.49	0.13	–0.25	–0.23	–0.35
Metals	–0.72	0.08	–0.44	–0.43	–0.55
Metal products	–0.06	0.55	–0.12	–0.10	–0.22
Motor vehicles and parts	–0.10	0.19	–0.01	0.02	–0.10
Transportation equipment	–0.91	0.63	–0.42	–0.41	–0.53
Electrical/electronic equipment	0.07	0.43	–0.23	–0.21	–0.33
All other manufactures	1.44	2.16	0.01	0.04	–0.09
Utilities	0.29	0.16	0.00	0.04	–0.08
Construction	0.05	0.21	0.01	0.06	–0.07
Trade	1.11	0.35	0.11	0.15	–0.01
Transportation	0.43	0.30	0.12	0.16	0.02
All other services	0.20	0.32	0.07	0.14	0.02

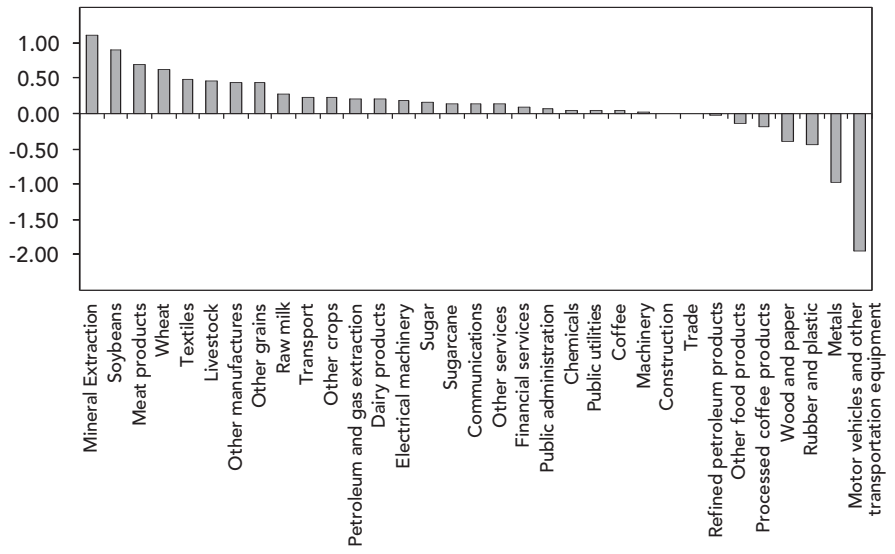
Source: Global model simulation results.

country. Because the effects of the simulation of a 20 percent increase in TFP using the global model produced such muted effects on Brazil, we simulated an even stronger shock using the country model. Here TFP grows by 33 percent in China and India.

As in the case of the smaller shock simulated with the global model, prices of the commodities that China and India export fall, and prices of some commodities they import increase. The prices of goods that Brazil imports from the two countries decline, including the prices of machinery, electrical machinery, motor vehicles and other transportation equipment, wood and paper, chemicals, rubber and plastics, and textiles, consistent with an increase in the supply of those exports from China and India. Brazil sees

Figure 6.1 Change in Brazilian Domestic Production After Growth in Manufactures Total Factor Productivity in China and India

PERCENT CHANGE



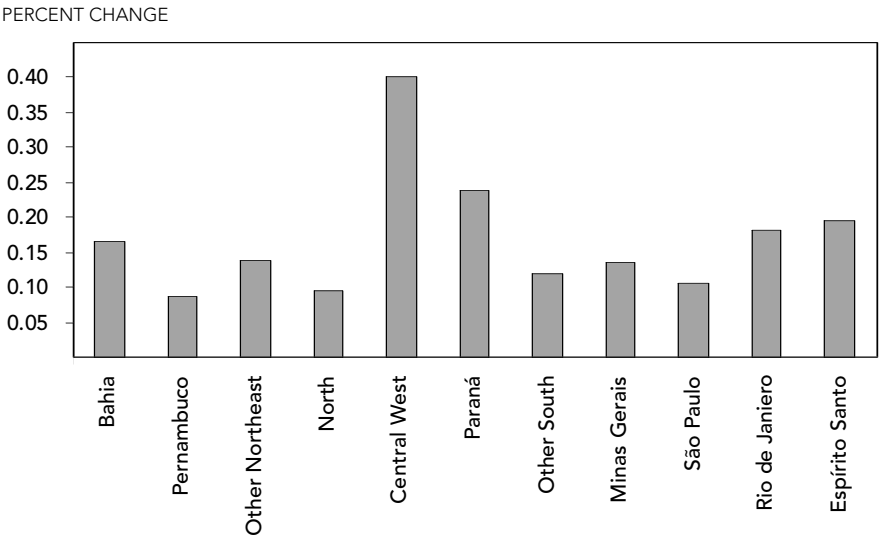
Source: Country model simulation results.

increases of just over 1 percent in the world price of its exports of soybeans, minerals, and the aggregate "other manufactures," and increases about half that large in the world price for meat and dairy products.

The decline in import prices translates in most cases into declines in purchaser prices and into a reduction in the weighted average prices of intermediate inputs. These result in increases in value added for most Brazilian sectors. They also drive changes in output that in turn generate changes in employment of factors.

Figure 6.1 presents the effects on Brazil's production structure. The larger shock produces a stronger negative impact on motor vehicles and other transportation equipment. (As noted earlier in this study, the sectoral aggregations are somewhat different in the global and country models due to the use of different databases. The motor vehicles category in the country model includes aircraft and other transportation equipment, whereas in the global model they are a separate sector.) As in the global model simulation, mineral extraction and soybean production increase, benefiting the regions of the country where they are produced. Demand for capital increases in the mineral sector in particular, which is capital intensive, and this drives up the return to capital. Some labor-intensive sectors, such as textiles, expand slightly because labor has become cheaper relative to the cost of capital.

Figure 6.2 Change in Welfare by Region After Growth in Manufactures Total Factor Productivity in China and India



Source: Country model simulation results
Note: The change in welfare is the equivalent variation as a percentage of initial consumer expenditures.

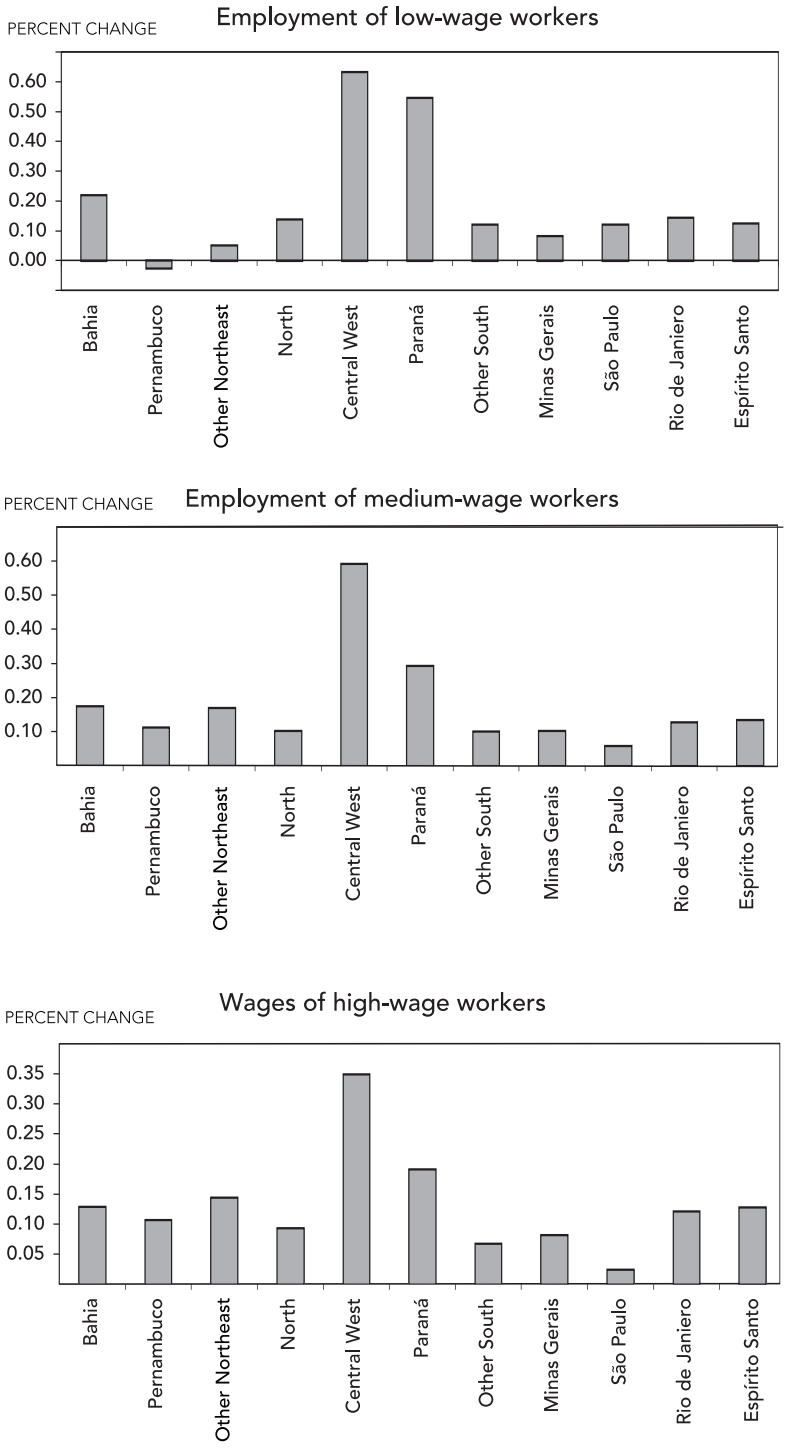
Figure 6.2 reports the overall welfare impact for different regions. All the regions experience small welfare gains, reflecting the net effects of several changes. Among the more significant are the lower prices of imported final goods and inputs and the improvements in Brazilian value added based on the lower cost of machinery and intermediate goods.

Small gains in employment or income are also reported for almost all types of labor in all regions, with the single exception being a slight loss to low-wage labor in Pernambuco (figure 6.3).

Note

1. See Mesquita Moreira (2006); de Paiva Abreu (2005). Dirk Willenbockel (2007) provides a CGE assessment of potential Dutch Disease impacts associated with China's booming demand for Brazilian agricultural and raw material exports.

Figure 6.3. Employment and Labor Incomes by Region After Growth in Manufactures Total Factor Productivity in China and India



Source: Country model simulation results.

CHAPTER 7

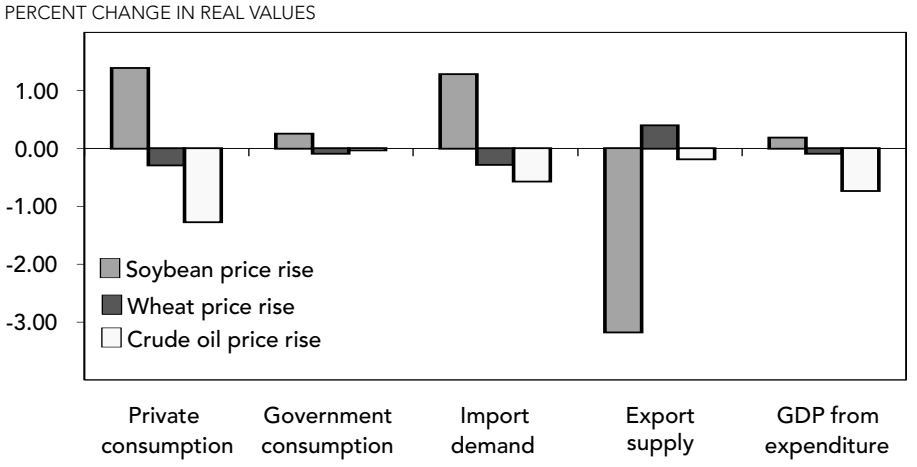
International Price Shock Results

The international prices of many commodities experienced strong growth in recent years, with a particular surge in the prices for petroleum, some minerals, and many agricultural commodities in the first half of 2008. Subsequently, some of these commodity prices have declined sharply, although they remain higher than their average levels for the past thirty years. This experience confirms the continued, and perhaps increasing, volatility of commodity prices. It also resurrects some of the concerns that led to earlier economic development theories that sought to shift developing economies away from reliance on primary products. This was a factor in the Brazilian development strategy for much of the last half century.

To gauge the effects on Brazil of recent commodity prices increases and volatility in world commodity prices, we used the country model to simulate increases in the world prices of petroleum, soybeans, and wheat compared with the prices in the base year, 2004. Soybeans are an important export commodity for Brazil, accounting for about 5 percent of total exports, and 34 percent of soybean production is exported. In contrast, Brazil is a net importer of wheat, with imports making up 51 percent of domestic wheat consumption and 1.2 percent of total imports. Petroleum is both imported and exported; however, imports were more important in the 2004 base period; crude oil accounted for 10.5 percent of total imports, while refined petroleum products accounted for an additional 9.3 percent of total imports. Though the future exploitation of recently discovered reserves of petroleum will eventually change these patterns, it is notable that together petroleum and refined petroleum products still account for one-fifth of all imports. They are also important intermediate inputs, affecting output prices and factor demand in other sectors.

The scenario we simulated entailed a 50 percent increase in the price of soybeans compared with the base price in the model; a 100 percent increase in

Figure 7.1 Macroeconomic Results for Global Commodity Price Increases



Source: Country model simulation results.

the price of wheat compared with the base price; and a 35 percent increase in the price of crude oil over the base price. These shocks were chosen to approximate the impact of increases seen in the recent price surges.

Figure 7.1 reports the summary macroeconomic effects of the price changes. Overall, the higher soybean price increases real private consumption by about 1 percent. The wheat and oil price shocks, which increase the country's import bill, generate declines in private consumption of 0.25 percent and 1 percent, respectively. It should be borne in mind that the changes in imports and exports shown in figure 7.1 are for overall imports and exports, not for the particular commodity experiencing the price shock.

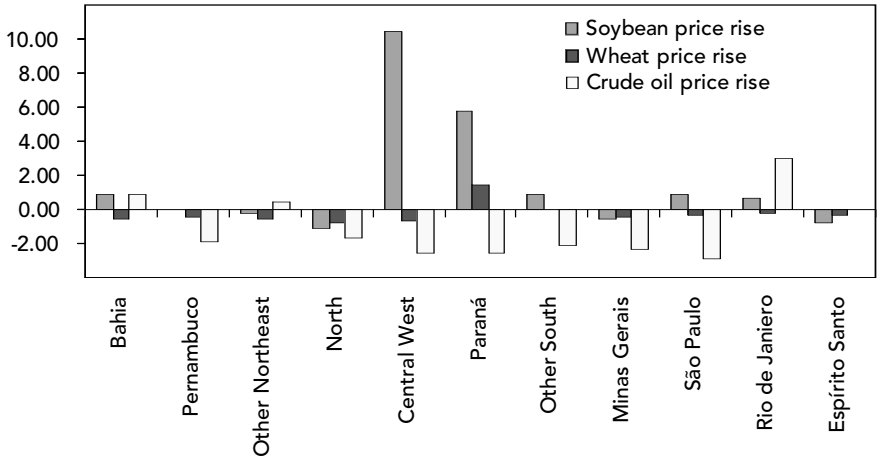
Welfare effects differ across regions, with the price shocks causing some degree of redistribution (figure 7.2). The higher soybean price translates into welfare increases in most regions, while the wheat and petroleum price shocks decrease welfare slightly in most regions.

A Soybean Price Shock

Overall, the effects of an increase in soybean prices are consistent with expectations. It boosts the agricultural sector through increased export demand. Soybeans are an important export commodity, and as the world price increases, exports increase in both value and volume. Exports of soybeans expand by 80 percent (figure 7.3). Though exports of other agricultural products also expand, in most cases this occurs from very small bases. However, exports of some other goods decline, a process driven in part by an appreciation of the exchange rate. Motor vehicles and parts and other transportation

Figure 7.2 Change in Welfare by Region as a Result of Global Commodity Price Increases

PERCENT CHANGE

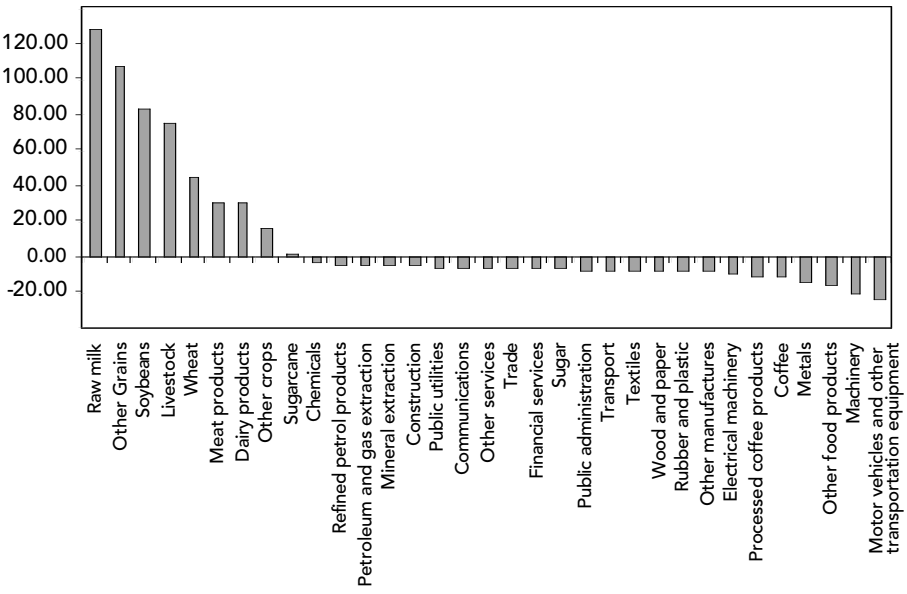


Source: Country model simulation results.
Note: The change in welfare is the equivalent variation as a percentage of initial consumer expenditures.

equipment, a sector heavily dependent upon exports, experiences an export decline of almost 23 percent. The machinery, other food products, and metals sectors also experience double-digit declines. The overall effect is an increase in total real imports and a decrease in total real exports.

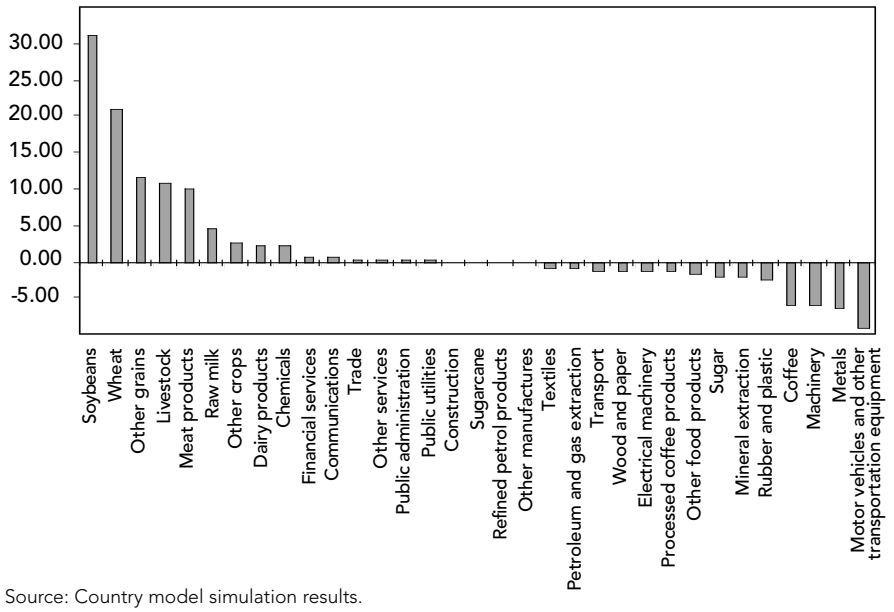
Figure 7.3 Changes in Exports After a Soybean Price Increase

PERCENT CHANGE



Source: Country model simulation results.

Figure 7.4 Changes in Domestic Production After a Soybean Price Increase



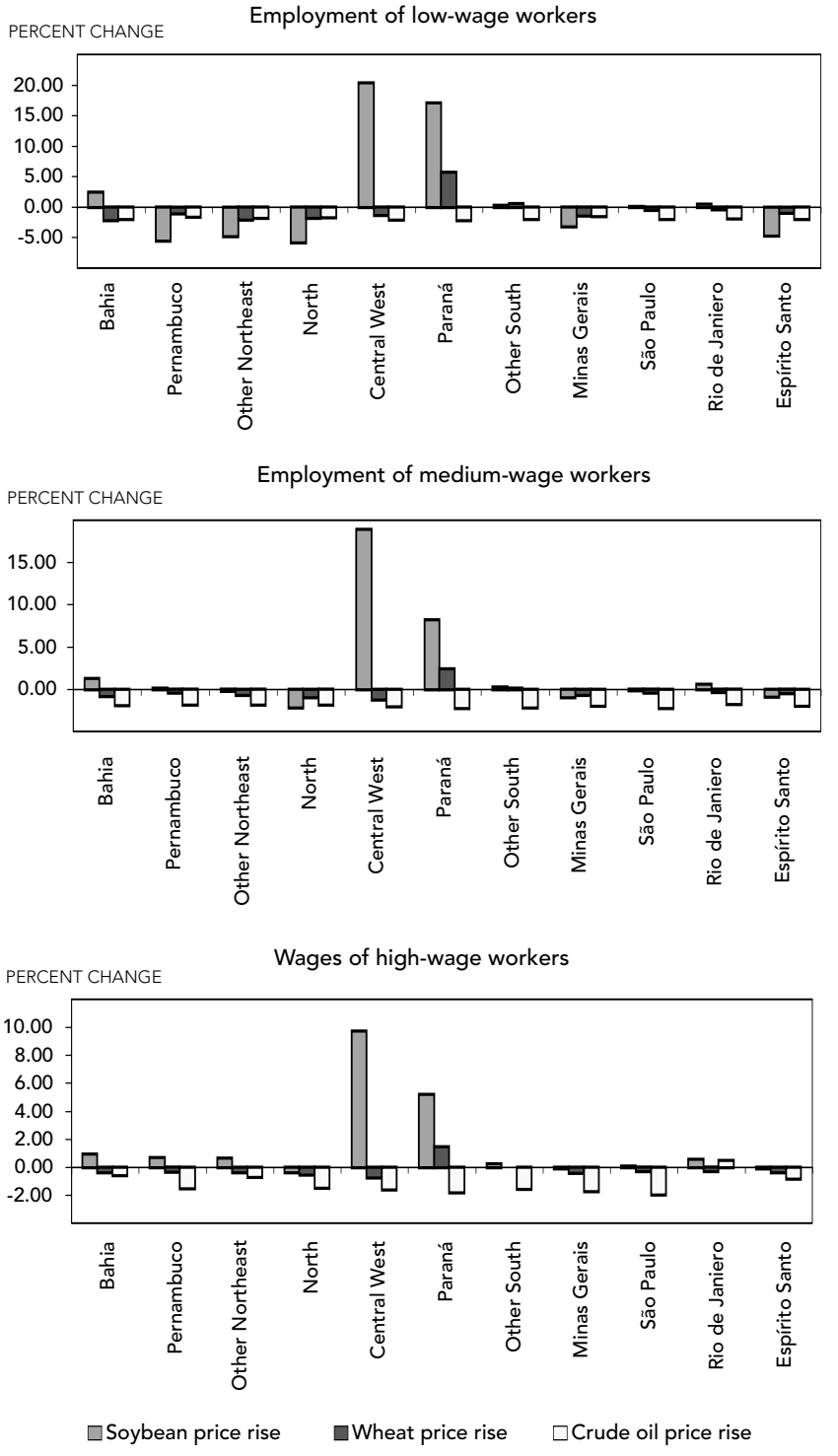
Source: Country model simulation results.

The strong growth in exports, combined with smaller changes in import volumes and domestic demand, triggers appreciable changes in domestic production (figure 7.4). Additional capital and labor are drawn to the expanding agricultural sectors, allowing production to increase even though land supply in the regions is fixed. Production of soybeans expands by more than 30 percent, and wheat by 21 percent, while other grains, livestock, and meat production each increase by more than 10 percent. Production declines by more than 5 percent in motor vehicles and parts, metals, machinery, and coffee.

The changes in production volumes induce substantial changes in the factor markets. Except for agricultural activities in the Central West region and Paraná, value added declines, which means that labor demand in negatively affected sectors will also decline, other things being equal. This produces decreases in employment of low- and medium-wage labor in all but those regions and Bahia (figure 7.5). For high-wage labor, which is assumed in the model to be fully employed, increased labor demand in the Central West region and Paraná leads to significant increases in wage rates there and induces migration to the two regions. Due to the full employment assumption, this also drives small wage gains for the group in most other regions. Hence the soybean price shock generates nontrivial redistribution across different types of labor and across regions.

The regional welfare changes reflect the changes in the structure of production and the changes in employment (figure 7.2). An increase in the world

Figure 7.5 Employment and Labor Income Changes After Price Shocks



Source: Country model simulation results.

price for soybeans increases welfare primarily in the Central West region and Paraná, which account for 48 and 22 percent of soybean production, respectively. The effects on low- and medium-wage employment in these regions are substantial—with employment rising almost 20 percent for both labor types in Central West. Welfare declines slightly in the North, Northeast, Minas Gerais, and Espírito Santo, as does employment of all labor types. In the other southern regions, employment changes do not move in the same direction for all labor types. There is an expansion of employment of low-wage labor and a slight decline in employment of medium- and high-wage labor. The net effect is a slight increase in welfare.

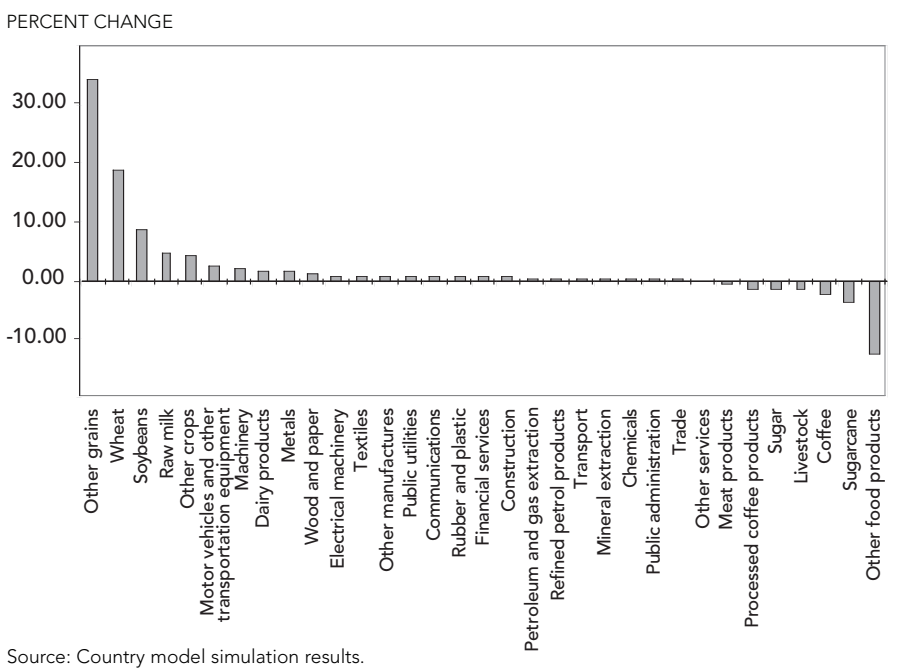
A Wheat Price Shock

Brazil is a net importer of wheat, with imports supplying 51 percent of consumption, much of it as an important food intermediate input. The consumer price for the aggregate category "other food products," which is the source of nearly 98 percent of domestic wheat demand, increases by 2.65 percent. As would be expected after an increase in the price of a staple commodity, there are small reductions in real private consumption (–0.25 percent), real GDP (–0.06 percent), and welfare in all regions except Paraná, the principal producer of wheat in the country (figures 7.1 and 7.2 above). Overall, real imports decline slightly, while real exports expand. This result would be consistent with a depreciation of the real; however the simulation results report a small appreciation of the currency (0.13 percent). It is interesting to trace why this result emerges. When the world price of wheat increases, the quantity of wheat imported declines by 8.8 percent. Domestic wheat production expands by 7.8 percent, and exports of wheat also expand (an 18.7 percent increase, although from a very low base). Exports of most manufactured commodities increase slightly. These changes also stimulate changes in production (figure 7.7), although the magnitude of those changes is small relative to those of exports (observe the different scales on the vertical axes in figures 7.6 and 7.7).

The causes of these seemingly anomalous results are relatively straightforward. Value added declines for all activities except for agriculture in Paraná and the other southern regions, that is, except for major wheat-producing areas. Even in those regions, the increase in value added is small (1.6 and 0.1 percent, respectively), given the large increase in the wheat price. This pattern of unfavorable changes in value added results in less employment for low- and medium-wage labor and falling wages for high-wage labor across most regions (figure 7.5). This puts downward pressure on household incomes, and consumption expenditures decline in all regions except for Paraná and other southern regions. Overall, there is a reduction in domestic demand and in real private consumption as a result of the income effect.

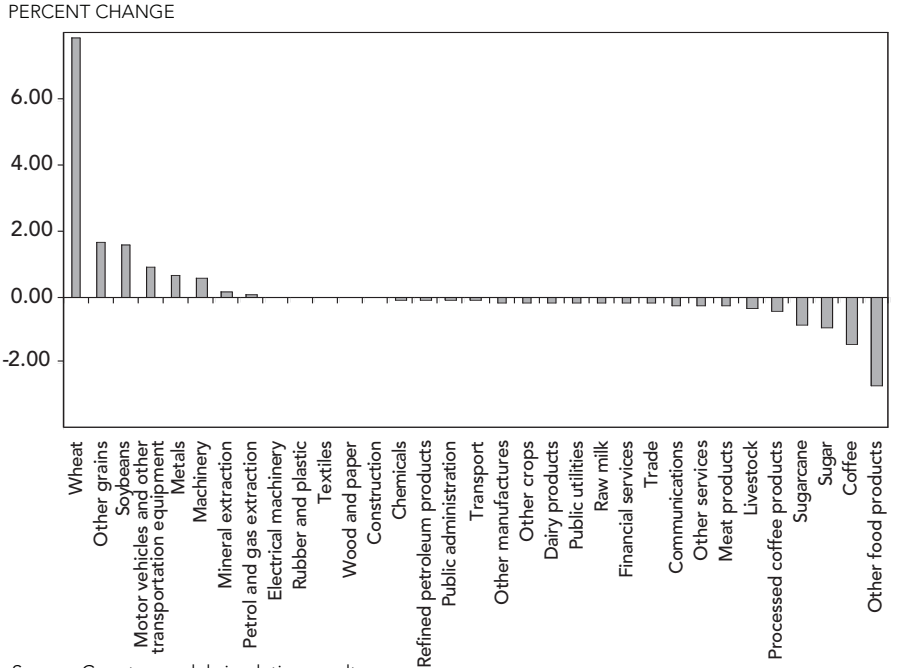
What is interesting is why exports of some commodities, including some manufactured goods, increase in the face of an appreciating exchange rate.

Figure 7.6 Change in Exports After a Wheat Price Increase



Source: Country model simulation results.

Figure 7.7 Change in Domestic Production After a Wheat Price Increase



Source: Country model simulation results.

The causal effect is that there is a terms-of-trade loss associated with the increase in the import price of wheat, and domestic demand declines. The domestic supply prices of most commodities fall by more than the export prices, which increases the attractiveness of exports to producers, and hence exports increase. For most commodities, the decline in domestic demand is not offset by increases in export demand, and hence domestic production declines; but for a few commodities, the increases in export demand are sufficient to generate increases in domestic production (figure 7.7). However, the changes in domestic production are all quite small, with the exception of the directly affected wheat and other food products categories.

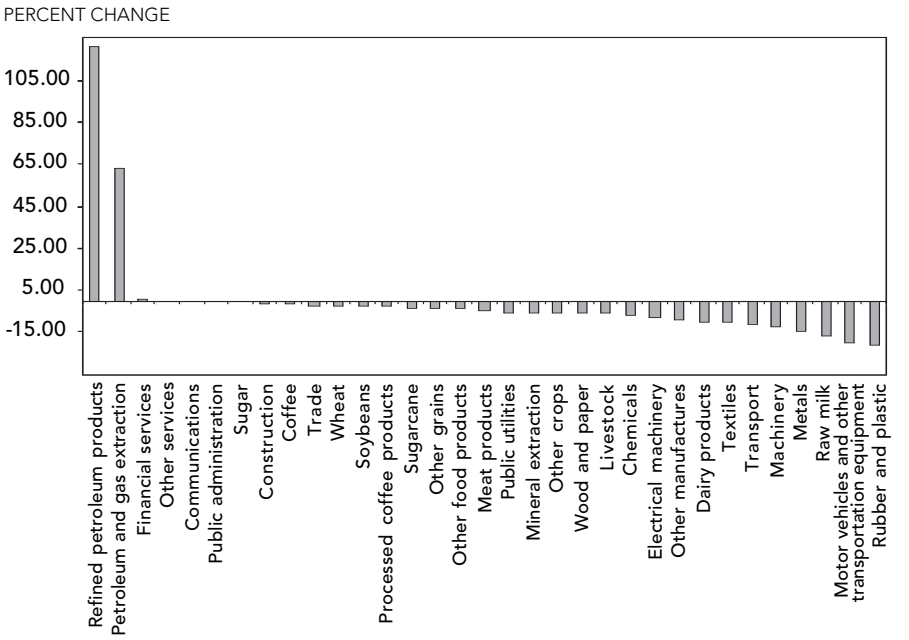
A Crude Oil Price Shock

In the model base year of 2004, Brazil was still a net importer of both crude oil and refined petroleum products, representing the fourth and fifth most important import commodities and together accounting for 20 percent of total imports. Moreover imports account for 37 percent of consumption of crude oil and 12 percent of consumption of refined petroleum. In combination, these data indicate that the Brazilian economy is likely to continue to experience, at least in the short term, substantial disruption following sustained increases in the price of imported oil. However Brazil's exports of oil-based commodities—currently crude oil accounts for 2.3 percent, and refined petroleum for 4.9 percent of total exports—are likely to grow over time, which suggests that the adverse implications of oil price increases will wane with future exploitation of petroleum reserves.

As would be expected, an increase in the world price of crude oil and refined petroleum expands exports and output in those sectors. Exports of petroleum products expand dramatically: by 121 percent for refined petroleum products and by 63 percent for crude oil (figure 7.8). Domestic crude oil output expands by 18.1 percent, and refined petroleum output expands by 10 percent (figure 7.9). Domestic production in other sectors shrinks, by more than 5 percent in the cases of rubber and plastic, metals, and motor vehicles and parts and other transportation equipment. This reflects the increased price of intermediate inputs, which reduces profitability in those sectors, leading to the exit of capital. Even more pronounced are the reductions in export volumes of nonpetroleum sectors. For manufactured commodities, export volumes decline by between 5 and 21 percent, while agricultural and food commodities experience declines of 1 to 16 percent. It is therefore unsurprising that real private consumption falls by 1.3 percent, and real GDP by 0.73 percent (see figure 7.1).

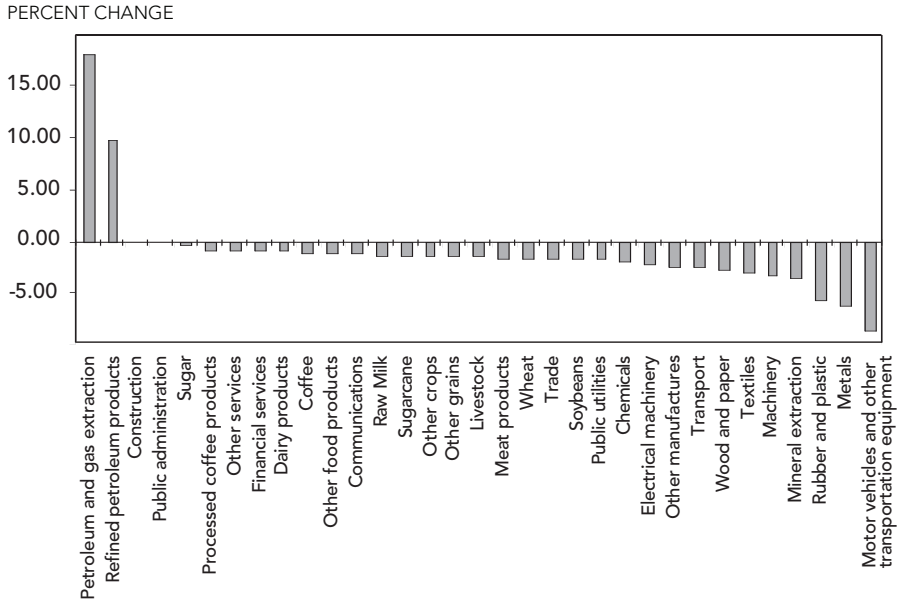
The reductions in domestic production lead to reductions in employment or wage rates for almost all workers (see figure 7.5). Employment of low- and medium-wage labor falls in every region, from about 1 percent to just over 2

Figure 7.8 Change in Exports After a Petroleum Price Increase



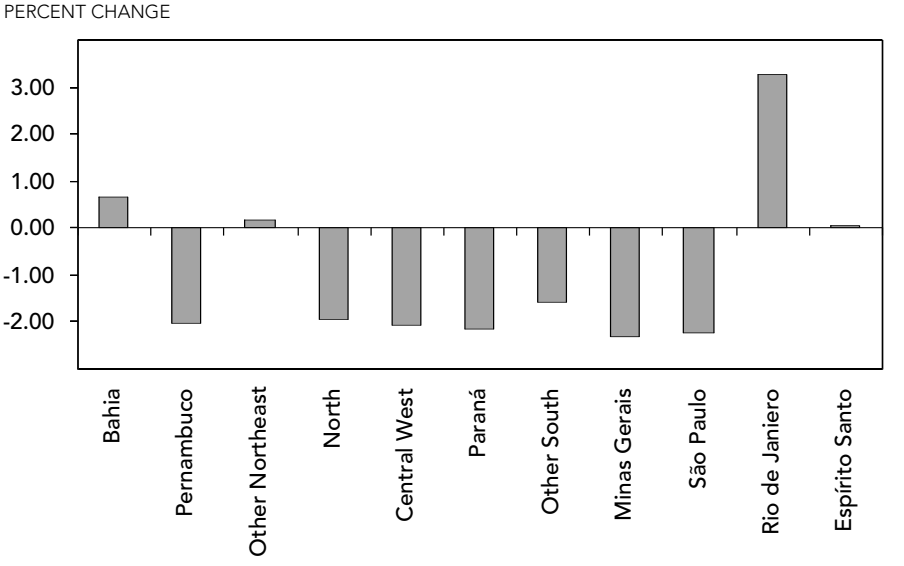
Source: Country model simulation results.

Figure 7.9 Change in Domestic Production After a Petroleum Price Increase



Source: Country model simulation results.

Figure 7.10 Change in Household Income After a Petroleum Price Increase



Source: Country model simulation results.

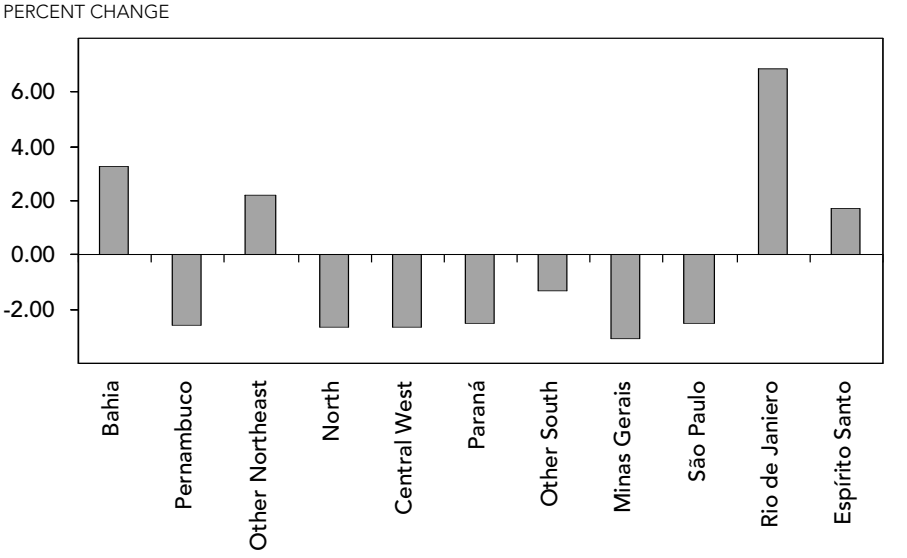
percent. The incomes of high-wage employees decline in most regions while they increase slightly in Rio de Janeiro.

At the household level, however, the income implications are more mixed. Household incomes fall by 1 to 2 percent or more in Pernambuco, the North, Central West, Paraná, "other South," Minas Gerais, and São Paulo. Household incomes increase slightly in Bahia, "other Northeast," and Espírito Santo, while they increase by 3.5 percent in Rio de Janeiro.

Thus, the broadly based reductions in employment and labor income seen in figure 7.5 do not translate into uniform reductions in household incomes. This comes about primarily because of increases in income to capital in Bahia, "other Northeast," Espírito Santo, and especially Rio de Janeiro (figure 7.11).

However, there is slightly more going on. The changes in wage rates induce migration of high-wage labor between regions, and hence there are changes in the numbers employed in each region. Rio de Janeiro experiences an influx of high-wage labor, which means that the factor income effects consist of both increases in the supply and the wage rate of this type of labor, which feeds through to household incomes. In contrast, the regions experiencing (relatively) falling wage rates also experience outflows of high-wage labor that compound the impact on household incomes. This illustrates the important point that when labor can migrate, income distribution is likely to be affected. Given the formulation of this model, the distributional effects will

Figure 7.11 Change in Income to Capital After a Petroleum Price Increase



Source: Country model simulation results.

be stronger because net migration will take place among the high-wage group but not among lower-wage workers, where unemployment persists in each region, and therefore wages do not increase. As a result, there is no new incentive for such workers to migrate (although existing migration by low- and medium-wage workers for other reasons would continue).

CHAPTER 8

The Effects and Policy Implications of Different Scenarios

As Brazil continues to integrate more deeply into the changing world economy, it is instructive to compare the relative impact of its different trade policy choices, as well as to assess the effects of the shocks it may experience as a result of its integration. Here, we compare the main macroeconomic, regional, and employment results of all the scenarios studied in this report and discuss the policy implications.

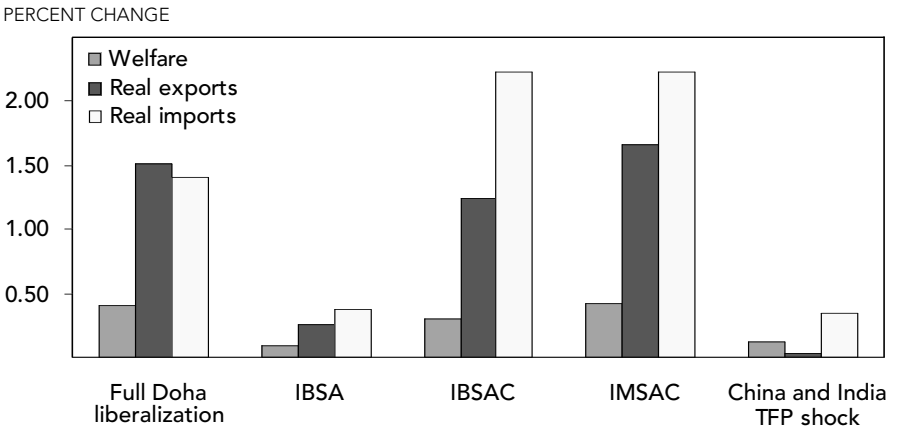
Macroeconomic Effects

Figure 8.1 presents the major results from the scenarios simulated with the global model. It is evident that Brazil's trade policy choices will have a larger impact on its exports and imports than will strong growth in China and India. This is unsurprising, because new trade agreements will require both Brazil and its partners to lower tariffs, providing a direct stimulus to exports and imports in addition to any world price effects. Nevertheless, the resulting growth in trade is quite modest, with exports growing less than 2 percent under any trade scenario, and imports growing slightly more.

In terms of overall welfare, a broad South–South agreement involving Brazil, India, China, and all of Mercosur produces the greatest improvement for Brazil, a gain of 0.42 percent. A Doha Round agreement produces comparable gains of 0.40 percent. More limited South–South agreements produce much smaller gains. This suggests that the developing world has become large and diverse enough to offer potentially significant gains from integration, provided it is undertaken on a sufficient scale. Contrary to fears that have been expressed, the rapid growth in Chinese and Indian productivity has a positive effective on Brazil, albeit an extremely modest one.

It is noteworthy that changes in world prices for key Brazilian exports, imports, and inputs can have larger macroeconomic effects on Brazil than its

Figure 8.1 Macroeconomic Results for Brazil of Different Scenarios



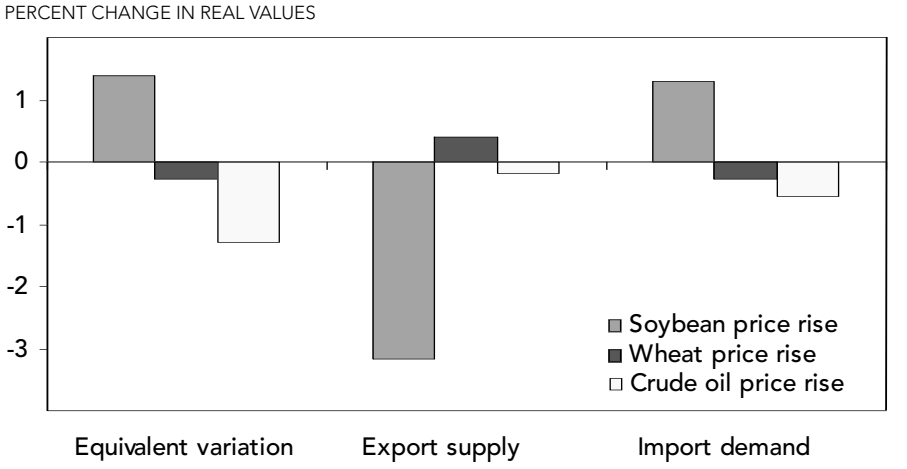
Source: Global model simulation results.
Note: The change in welfare is the equivalent variation as a percentage of initial consumer expenditures. IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China; TFP = total factor productivity.

own trade policy choices. Figure 8.2 presents the macroeconomic results of the price shocks simulated with the country model. (Due to differences in the two models and data, these results are not strictly comparable to those in figure 8.1.) Soybean and crude oil price shocks have positive or negative impacts on Brazilian welfare that are 3 times as large as those resulting from the trade simulations. The price changes simulated are not unrealistic: Shocks of this magnitude have been experienced in recent years, and volatility on this scale may become more common in the future. Though Brazil cannot control world prices, its increasing integration with the rest of the world leaves it more exposed to global price volatility. The reduction of its own tariffs, which would be required by new trade agreements, will also constrain the policy tools available for other purposes. For example, when evaluating future trade liberalization, policy makers should also take into account its effects on objectives such as agricultural price stabilization. The impact of the price shocks also suggests the need for improved social safety nets as Brazil continues its integration into the global economy.

Regional Effects

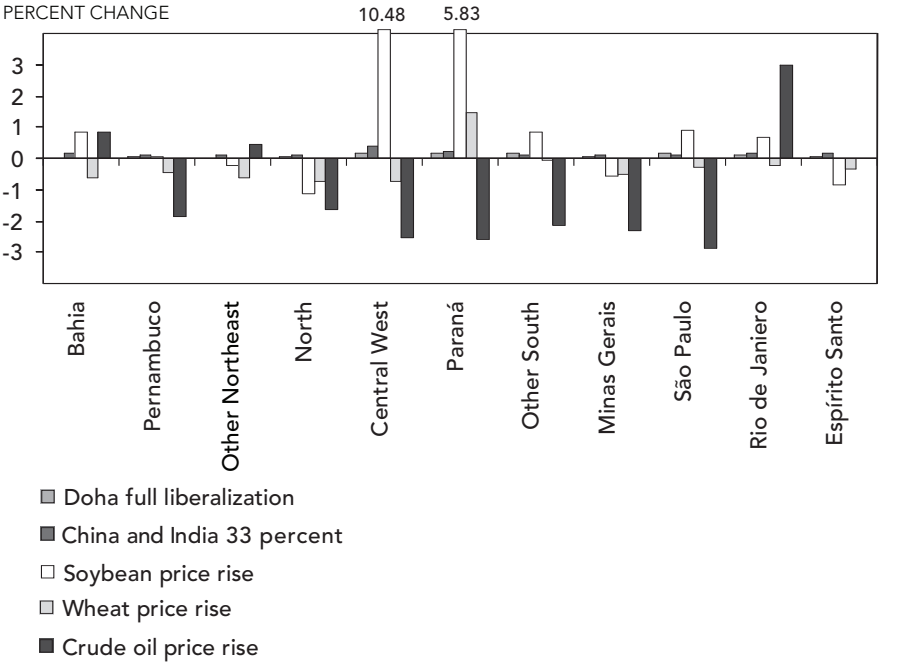
Both the direct trade policy choices and the external shocks we simulated have important distributional consequences for Brazil's regions that warrant policy makers' attention. Figure 8.3 compares the regional impacts of a Doha Round agreement; a one-third increase in total factor productivity in China and India; and global price changes for soybeans, wheat, and oil.

Figure 8.2 Macroeconomic Results for Brazil of Global Commodity Price Increases



Source: Country model simulation results.
Note: Equivalent variation as a percentage of initial consumer expenditures.

Figure 8.3 Change in Regional Welfare From the Doha Round, Growth in China and India, and Price Shocks



Source: Country model simulation results.

Again, it is clear that global price changes of a magnitude comparable to those seen in 2008 have larger effects in most regions than either a Doha Round agreement or rapid growth in China and India. The Doha agreement's very modest benefits mainly accrue to São Paulo, Rio de Janeiro, and the rest of the South and West. The small benefits from productivity growth in China and India are shared somewhat more evenly across regions, as the prices of most Brazilian imports from those countries decline and the prices of a number of Brazil's exports increase. Lower import prices also translate into lower prices for intermediate inputs, which increases Brazilian value added across several sectors.

In contrast, the impact of price changes for soybeans, wheat, and petroleum vary widely across regions, with pronounced winners and losers. Again, it is worth mentioning that Brazilian policy makers do not control global prices; however, their trade policy choices will influence Brazil's future exposure to price volatility. Thus the distributional consequences, effects on agricultural and food price stabilization, and social safety nets arise as important considerations in the formulation of trade policy.

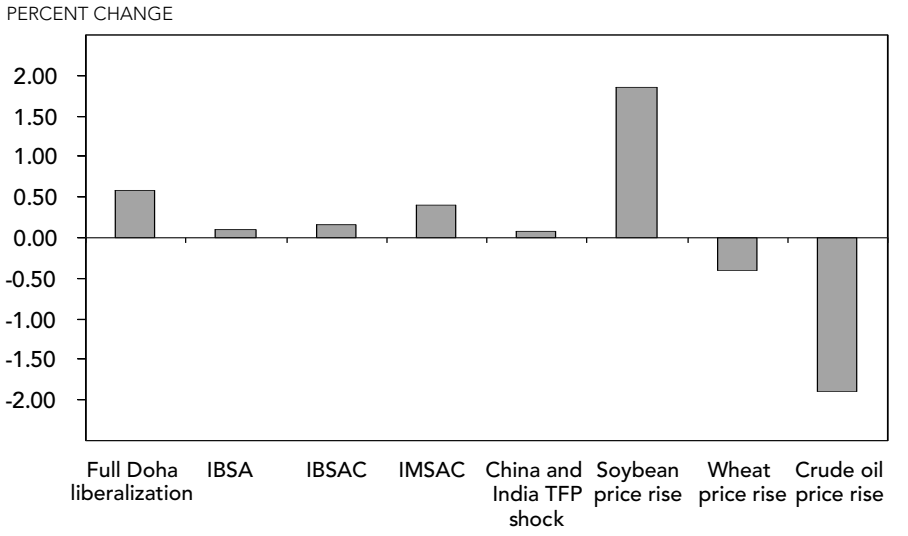
Effects on Labor

All of the trade policies modeled have a positive impact on labor in Brazil, although the effects are quite small. Global price changes generate larger employment effects, which are positive in the case of price increases for Brazilian exports and negative for increases in the price of imports. Productivity growth in China and India has a positive, but very limited, effect on labor in Brazil.

Focusing on unskilled labor, a Doha Round agreement increases employment of this group of workers by 0.6 percent, and an IMSAC free trade agreement increases it by 0.4 percent (figure 8.4). It is worth recalling that these two trade simulations produced almost identical overall welfare increases (0.4 and 0.42 percent, respectively), in contrast to these somewhat more differentiated employment results. Welfare is a global measure of household economic well-being that can include the effects of changes in prices or capital or land income, for example, in addition to changes in employment and labor income. If employment itself is a policy priority, it is important to examine the direct impact of different policies on labor. The Doha Round agreement would increase output in more sectors than would IMSAC, including a number of unskilled labor-intensive sectors.

The other trade pacts that were simulated generate smaller gains for unskilled labor. The employment gains from any of the trade policies, though minor, would be welcome in the context of the country's continued high unemployment rates. However, as noted in earlier chapters, the realization of the estimated gains from major trade liberalizations such as the Doha

Figure 8.4 Effects of Different Scenarios on Unskilled Employment in Brazil



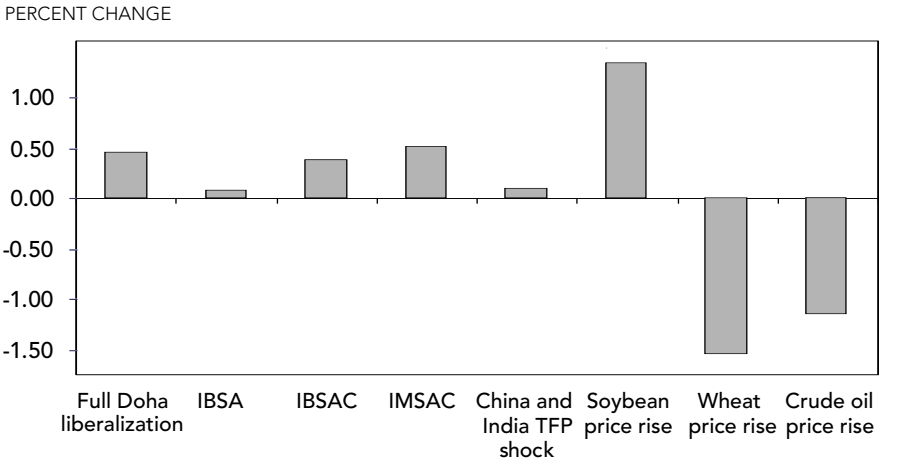
Source: Global model simulation results for Doha, IBSA, IBSAC, IMSAC, and China and India total factor productivity (TFP) shock; country model simulation results for soybean, wheat and petroleum price rises.
Note: This graph presents results for unskilled workers from the global model simulations and for low-wage workers from the country model simulations. IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Round or large South–South agreements could require considerable shifts of unskilled workers across sectors, a process that can be difficult and costly.

For skilled workers, several of the potential trade policy choices offer roughly similar overall income gains (figure 8.5). Strong growth of oilseed and vegetable oil exports under both the IMSAC and IBSAC scenarios leads to an increase in demand for skilled labor in those sectors, attracting skilled migrants to the regions that produce those commodities and driving up wages in sectors that face a loss of skilled labor (under the assumption of full employment of this group of workers). A Doha Round agreement results in similar overall gains for skilled workers, although the net gains are based on more modest gains and losses across many sectors. Skilled workers also share in the small gains from growth in China and India. Changes in the prices of Brazil's exports and imports have even stronger effects on skilled than on unskilled labor.

Overall, the simulations indicate that there are very small, but positive, gains for most Brazilian workers from greater engagement with the world economy. The question for policy makers is whether these net gains can be realized in practice; and if so, whether they outweigh the necessary adjustment costs. Shifting workers across economic sectors is not always easy.

Figure 8.5 Effects of Different Scenarios on Skilled Labor Income in Brazil



Source: Global model simulation results for Doha, IBSA, IBSAC, IMSAC, and China and India total factor productivity (TFP) shock; country model simulation results for soybean, wheat, and petroleum price rises.
Note: This graph presents results for skilled workers from the global model simulations and for high-wage workers from the country model simulations. IBSA = India–Brazil–South Africa Dialogue Forum; IBSAC = acronym for India, Brazil, South Africa, China; IMSAC = acronym for India, the Mercosur area (including Brazil), SACU, and China.

Under the full Doha Round scenario, for example, unskilled labor demand will increase most strongly in the sectors of cereal grains, animal products, and sugar, and it will fall in electrical and electronic manufacturing. Skilled labor demand (which will translate into increases or decreases in wages because of the assumption of full employment) will be strongest in cereal grains, animal products, and sugar but will fall in eleven of the twenty-seven sectors, most of which are in manufacturing. There will, therefore, be a shift of employment from the manufacturing sector to the agricultural sector. Wages and working conditions in these sectors are quite distinct. Production does not typically occur in the same areas or regions, and the tasks of the job are also likely to be quite different. It is, therefore, a legitimate question whether the displaced manufacturing worker will find new employment in the growing agricultural sectors.

Workers displaced as a result of trade liberalization can access unemployment insurance if they have a formal labor contract (*carteira de trabalho assinada*), which is the case for about 35 percent of the workforce, and if they have made contributions for a minimum of six months. This entitles them to receive benefits from three to five months. As discussed in chapter 2, various training and microcredit programs as well as job placement assistance are also offered by the government. These programs can ease the transition for workers financially, in terms of making job opportunities known and providing necessary training to qualify for new employment opportunities. At the same, time, these programs are costly for the government, and the cost

must be taken into account when evaluating the net impact and benefits of new trade liberalization. For those workers who do not qualify for these benefits, who do not avail themselves of them because they are unaware of their existence, or who live in localities without such programs, the costs of adjustment will be borne solely by the worker and his or her family and social networks.

After a careful analysis of the benefits and costs of trade policy shifts, it may well be the case that increased global economic engagement is still judged to be beneficial to the Brazilian economy and society in the long term. However, as policy is debated, it is important that the patterns of gains and losses and the resulting adjustment costs be taken fully into account. This study seeks to contribute to a balanced assessment of the effects of different types of trade liberalization, something that has not always been done in other studies simulating the gains from trade.

APPENDIX A

Short Description of the Global Model

This appendix describes the main features of the global model used in the study, called GLOBE. The GLOBE model is a member of the class of multicountry, computable general equilibrium (CGE) models that are descendants of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982); also see McDonald, Thierfelder, and Robinson (2007). The model is a social accounting matrix (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.[1] The implementation of this model, using 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.[2] The simulations were conducted using data from the Global Trade Analysis Project (GTAP) database, Version 6.

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.[3] 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 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.[4] 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 it yields more realistic behavior for international prices than models assuming perfect substitution on the export side.[5]

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).[6] The CIF prices are the "landed" prices expressed in global currency units. To these are added any import duties and other taxes, and the resulting price is converted into domestic currency units using the exchange rate to get the source-region-specific import price. 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, 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 Organisation for Economic Co-operation 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 1, then the trade balances are "real" variables defined in terms of the value of U.S. exports. If the global numéraire is a weighted exchange rate for a group of regions, as in this case, and it is fixed to 1, 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 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 also assumed to have fixed labor supplies that are fully employed. The model solves for equilibrium wages that clear the 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 case, we assume that the real wage of unskilled labor is fixed and that the supply of unskilled labor is infinitely elastic at that wage. So labor supply clears the market, and aggregate unskilled employment is endogenous rather than the real wage. In this specification, any shock that would otherwise increase the equilibrium wage will instead lead to increased employment. We applied this factor market clearing condition to unskilled labor in China, India, other East Asia, the rest of South Asia, the Southern African

Customs Union, and the rest of Sub-Saharan Africa. The results reported are for this closure.

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.

Notes

1. As such, the modeling approach has been influenced by Pyatt (1987).
2. The GLOBE model is described in more detail by McDonald, Thierfelder, and Robinson (2007). For examples of earlier models, see Robinson et al. (1993), and Lewis, Robinson, and Wang (1995). The World Bank's global CGE model, which has a common heritage, is described by van der Mensbrugghe (2005).
3. See de Melo and Robinson (1989); Devarajan, Lewis, and Robinson (1990).
4. The import shares defined as small are case-specific and defined by the model user.
5. Though the nested CET specification is widely used in both single-country and multi-country trade-focused CGE models, it is not used in the GTAP model.
6. 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.

Table A.1 Countries and Regions in the Global Model

Region	GTAP 6 Regions	Countries
Brazil	Brazil	Brazil
China	China	China
	Hong Kong	Hong Kong
India	India	India
Southern African Customs Union	Botswana	Botswana
	South Africa	South Africa
	Rest of Southern African Customs Union	Lesotho
		Namibia
		Swaziland
European Union	Austria	Austria
	Belgium	Belgium
	Denmark	Denmark
	Finland	Finland
	France	France
	Germany	Germany
	United Kingdom	United Kingdom
	Greece	Greece
	Ireland	Ireland
	Italy	Italy
	Luxembourg	Luxembourg
	Netherlands	Netherlands
	Portugal	Portugal
	Spain	Spain
	Sweden	Sweden
	Bulgaria	Bulgaria
	Cyprus	Cyprus
	Czech Republic	Czech Republic
	Hungary	Hungary
	Malta	Malta
	Poland	Poland
	Romania	Romania
	Slovakia	Slovakia
	Slovenia	Slovenia
	Estonia	Estonia
	Latvia	Latvia
	Lithuania	Lithuania
United States	United States	United States
Argentina	Argentina	Argentina
Uruguay	Uruguay	Uruguay
Chile	Chile	Chile
Venezuela	Venezuela	Venezuela
Rest of the Americas	Canada	Canada
	Mexico	Mexico
	Rest of North America	Bermuda
		Greenland
		Saint Pierre and Miquelon
	Colombia	Colombia
	Peru	Peru
	Rest of Andean Pact	Bolivia
		Ecuador

Table A.1 (continued) Countries and Regions in the Global Model

Region	GTAP 6 Regions	Countries
	Rest of South America	Falkland Islands (Malvinas)
		French Guiana
		Guyana
		Paraguay
		Suriname
	Central America	Nicaragua
		Belize
		Costa Rica
		El Salvador
		Guatemala
		Honduras
		Panama
	Rest of the Free Trade Area of the Americas	Antigua and Barbuda
		Bahamas
		Barbados
		Dominica
		Dominican Republic
		Grenada
		Haiti
		Jamaica
		Puerto Rico
		Saint Kitts and Nevis
		Saint Lucia
		Saint Vincent and the Grenadines
		Trinidad and Tobago
		U.S. Virgin Islands
	Rest of the Caribbean	Anguilla
		Aruba
		Cayman Islands
		Cuba
		Guadeloupe
		Martinique
		Montserrat
		Netherlands Antilles
		Turks and Caicos
		British Virgin Islands
East and Southeast Asia	Japan	Japan
	South Korea	South Korea
	Taiwan	Taiwan
	Rest of East Asia	Macau
		Mongolia
		North Korea
	Indonesia	Indonesia
	Malaysia	Malaysia
	Philippines	Philippines
	Singapore	Singapore
	Thailand	Thailand
	Vietnam	Vietnam
	Rest of Southeast Asia	Cambodia

Table A.1 (continued) Countries and Regions in the Global Model

Region	GTAP 6 Regions	Countries
		Brunei
		Laos
		Myanmar
Rest of the World	Australia	Australia
	New Zealand	New Zealand
	Rest of Oceania	American Samoa
		Cook Islands
		Fiji
		French Polynesia
		Guam
		Kiribati
		Marshall Islands
		Micronesia
		Nauru
		New Caledonia
		Norfolk Island
		Northern Mariana Islands
		Niue
		Palau
		Papua New Guinea
		Samoa
		Solomon Islands
		Tokelau
		Tonga
		Tuvalu
		Vanuatu
		Wallis and Futuna
	Bangladesh	Bangladesh
	Sri Lanka	Sri Lanka
Rest of South Asia		Pakistan
		Afghanistan
		Bhutan
		Maldives
		Nepal
	Switzerland	Switzerland
	Rest of European Free Trade Association	Iceland
		Liechtenstein
		Norway
	Rest of Europe	Andorra
		Bosnia and Herzegovina
		Faroe Islands
		Gibraltar
		Macedonia, the former Yugoslav Republic of
		Monaco
		San Marino
		Serbia and Montenegro
	Albania	Albania
	Croatia	Croatia

Table A.1 (continued) Countries and Regions in the Global Model

Region	GTAP 6 Regions	Countries
	Russian Federation	Russian Federation
	Rest of the former Soviet Union	Kazakhstan
		Kyrgyzstan
		Armenia
		Azerbaijan
		Belarus
		Georgia
		Moldova
		Tajikistan
		Turkmenistan
		Ukraine
		Uzbekistan
	Turkey	Turkey
	Rest of Middle East	Iran
		Bahrain
		Iraq
		Israel
		Jordan
		Kuwait
		Lebanon
		Palestinian Territory
		Oman
		Qatar
		Saudi Arabia
		Syrian Arab Republic
		United Arab Emirates
		Yemen
	Morocco	Morocco
	Tunisia	Tunisia
	Rest of North Africa	Egypt
		Algeria
		Libya
	Malawi	Malawi
	Mozambique	Mozambique
	Tanzania	Tanzania
	Zambia	Zambia
	Zimbabwe	Zimbabwe
	Rest of Southern African Development Community	Mauritius
		Angola
		Congo, Democratic Republic
		Seychelles
	Madagascar	Madagascar
	Uganda	Uganda
	Rest of Sub-Saharan Africa	Nigeria
		Senegal
		Benin
		Burkina Faso
		Burundi
		Cameroon
		Cape Verde
		Central African Republic

Table A.1 (continued) Countries and Regions in the Global Model

Region	GTAP 6 Regions	Countries
		Chad
		Comoros
		Congo
		Côte d'Ivoire
		Djibouti
		Equatorial Guinea
		Eritrea
		Ethiopia
		Gabon
		Gambia
		Ghana
		Guinea
		Guinea-Bissau
		Kenya
		Liberia
		Mali
		Mauritania
		Mayotte
		Niger
		Reunion
		Rwanda
		Saint Helena
		São Tomé and Príncipe
		Sierra Leone
		Somalia
		Sudan
		Togo

Table A.2 Sectors in the Global Model

Sector	Description
Agriculture	
Cereal grains	Paddy rice; wheat; cereal grains not elsewhere classified
Oilseeds	Oilseeds
Other crop agriculture	Vegetables; fruit; nuts; sugarcane and sugar beet; plant-based fibers; crops not elsewhere classified; forestry
Animal agriculture	Cattle, sheep, goats, horses; animal products, raw milk, wool silkworm cocoons, and fishing
Food	
Vegetable oils and fats	Vegetable oils and fats
Sugar	Sugar
Animal products	Meat: cattle sheep goats horse; meat products not elsewhere classified; dairy products
Other food products	Processed rice; food products not elsewhere classified; beverages and tobacco products
Manufactures	
Textiles	Textiles; wearing apparel
Leather products	Leather products
Wood and paper products	Wood products; paper products, publishing
Petroleum and chemical products	Petroleum coal products; chemical, rubber, and plastic products
Mineral products not elsewhere classified	Mineral products not elsewhere classified
Ferrous metals	Ferrous metals
Metals not elsewhere classified	Metals not elsewhere classified
Metal products	Metal products
Motor vehicles and parts	Motor vehicles and parts
Transport equipment not elsewhere classified	Transport equipment not elsewhere classified
Electrical and electronic machinery and equipment not elsewhere classified	Electrical and electronic machinery and equipment not elsewhere classified
All other manufactures	Manufactures not elsewhere classified
Natural Resources	
Minerals not elsewhere classified	Minerals not elsewhere classified
All other extractive	Coal; oil; gas
Services	
Utilities	Electricity; gas manufacture distribution; water
Construction	Construction
Trade	Trade
Transport	Transport not elsewhere classified; sea transport; air transport; communication
All other services	Financial services not elsewhere classified; insurance; business services not elsewhere classified; recreation and other services; public administration, defense, health, and education; dwellings

APPENDIX B

Short Description of the Country Model

The STAGE_LAB computable general equilibrium (CGE) model (McDonald and Thierfelder 2009) is a development of the STAGE model (McDonald 2007)[1] that provides a richer treatment of factor markets, particularly labor markets. The model has several distinctive features. First, the model allows for a generalized treatment of trade relationships by incorporating provisions for nontraded exports and imports. Second, it allows the relaxation of the small-country assumption for exported commodities. Third, it includes provision for multiple product activities. Fourth, value-added production technologies are specified as a generalized system of nested constant elasticity of substitution (CES) functions, which permits the endogenous modeling of unemployment for all factors and the ability for factors to migrate between regions/areas and/or factor "classification," for example, between semiskilled and unskilled labor. And fifth, household consumption expenditure is modeled using Stone-Geary utility functions. The model is a social accounting matrix–based CGE model, wherein the matrix serves to identify the agents in the economy and provides the database with which the model is calibrated.

Behavioral Relationships

Households are assumed to choose the bundles of commodities they consume so as to maximize utility where the utility function is Stone-Geary. The households choose their consumption bundles from a set of "composite" commodities that are aggregates of domestically produced and imported commodities. These composite commodities are formed as CES aggregates that embody the presumption that domestically produced and imported commodities are imperfect substitutes. The optimal ratios of imported and domestic commodities are determined by the relative prices of the imported and domestic commodities. This is the so-called Armington "insight" (Armington 1969), which 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.

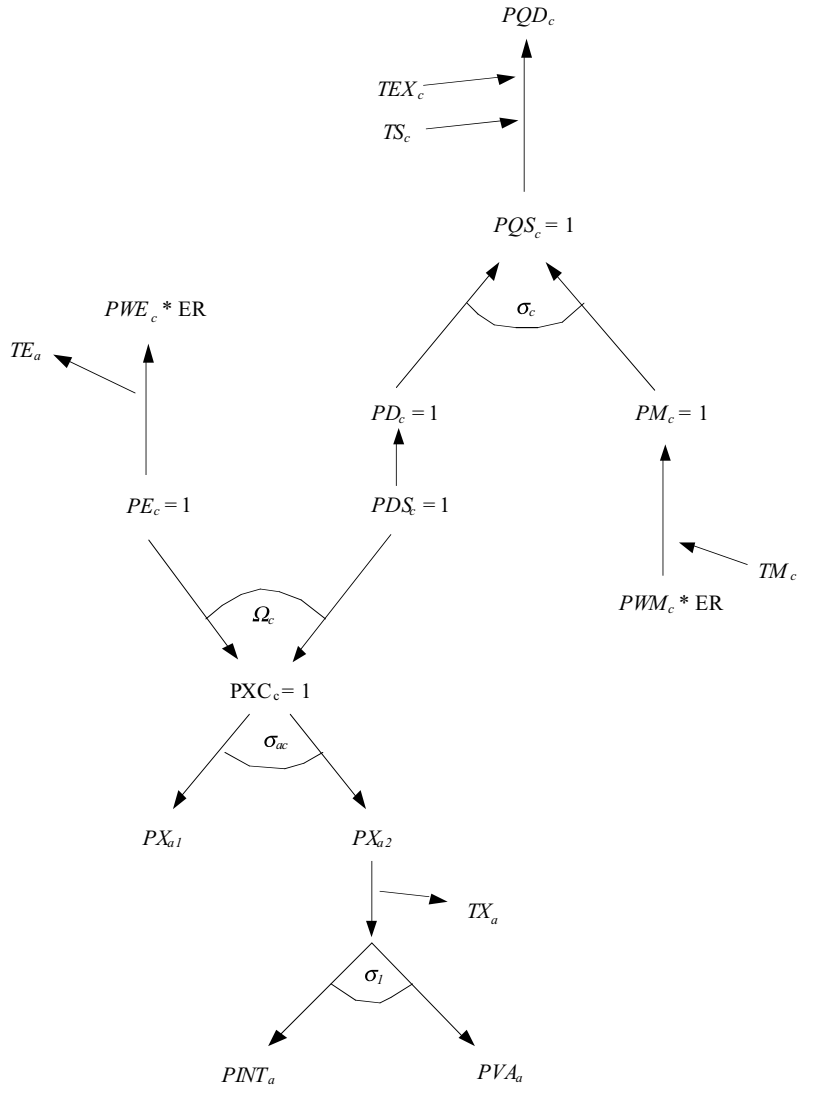
Domestic production uses a multistage production process (figure B.4). The vector of commodities demanded is determined by the domestic demand for domestically produced commodities and export demand for domestically produced commodities. Using the assumption of imperfect transformation between domestic demand and export demand, in the form of a constant elasticity of transformation (CET) function, the optimal distribution of domestically produced commodities between the domestic and export markets is determined by the relative prices on the alternative markets. The model can be specified as a small country—that is, a price taker—on all export markets, or selected export commodities can be deemed to face downward-sloping export demand functions—that is, a large-country assumption.

The other behavioral relationships in the model are generally linear. A few features do, however, justify mention. First, all the tax rates are declared as variables that can adjust endogenously to satisfy fiscal policy constraints. Similar adjustment mechanisms are available for a number of key parameters, for example, household and enterprise savings rates and interinstitutional transfers. Second, technology changes can be introduced through changes in the activity-specific efficiency variables—adjustment and/or scaling factors are also available for the efficiency parameters. Third, the proportions of current expenditure on commodities defined to constitute subsistence consumption can be varied. And fourth, the model is set up with a range of flexible macroeconomic closure rules and market-clearing conditions. Though the base model has a standard neoclassical model closure—for example, full employment, savings-driven investment, and a floating exchange rate—these closure conditions can all be readily altered.

Price and Quantity Relationships

Figures B.1 and B.2 provide detail on the interrelationships between the prices and quantities for commodities and activities. 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). These weights are updated in the model through first-order conditions for optima. The average prices exclude sales taxes, and hence must be uplifted by ad valorem sales taxes (TS_c) and excise taxes (TEX_c) to reflect the composite consumer price (PQD_c).[2] The producer prices of commodities (PXC_c) are similarly defined as the weighted averages of the prices received for domestically produced commodities sold on domestic (PQS_c) and export (PE_c)

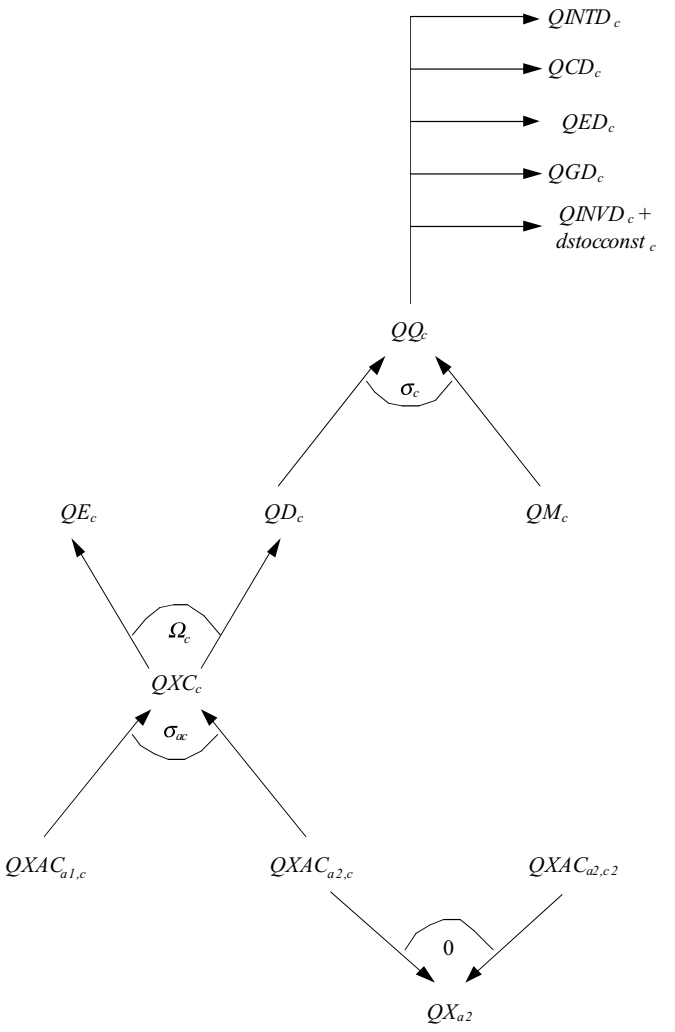
Figure B.1 Price Relationships for the STAGE_LAB Model



markets. These weights are updated in the model through first-order conditions for optima. The prices received on the export market are defined as the products of the world price of exports (PWE_c), and the exchange rate less any export duties due, which are defined by ad valorem export duty rates (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, where the weights are constant. After paying indirect/production/output taxes (TX_a), this is divided between payments to aggregate value added (PVA_a), that is, the amount available to pay primary inputs, and aggregate intermediate inputs ($PINT_a$).

Figure B.2 Quantity Relationships for the STAGE_LAB Model



Total payments for intermediate inputs per unit of aggregate intermediate input are defined as the weighted sums of the prices of the inputs (PQD_c).

Total demand for the composite commodities (QQ_c) consists of the demand for intermediate inputs ($QINTD_c$); consumption by households (QCD_c), enterprises (QED_c), and government (QGD_c); gross fixed capital formation ($QINVD_c$), and stock changes, ($dstocconst_c$). The supply from domestic producers (QDD_c) plus imports (QM_c) meets this total demand; equilibrium conditions ensure that the total supply and demand for all composite commodities equate. Commodities are delivered to both the domestic and export (QE_c) markets, subject to equilibrium conditions that require all domestic commodity production (QXC_c) to be either domestically consumed or exported.

The presence of multiproduct activities means that domestically produced commodities can come from multiple activities; that is, the total production of a commodity is defined as the sum of the amount of that commodity produced by each activity. Hence, the domestic production of a commodity (*QXC)* is a CES aggregate of the quantities of that commodity produced by a number of different activities (*QXAC*), which are produced by each activity in activity-specific fixed proportions; that is, the output of *QXAC* is a Leontief (fixed-proportions) aggregate of the output of each activity *QX*.

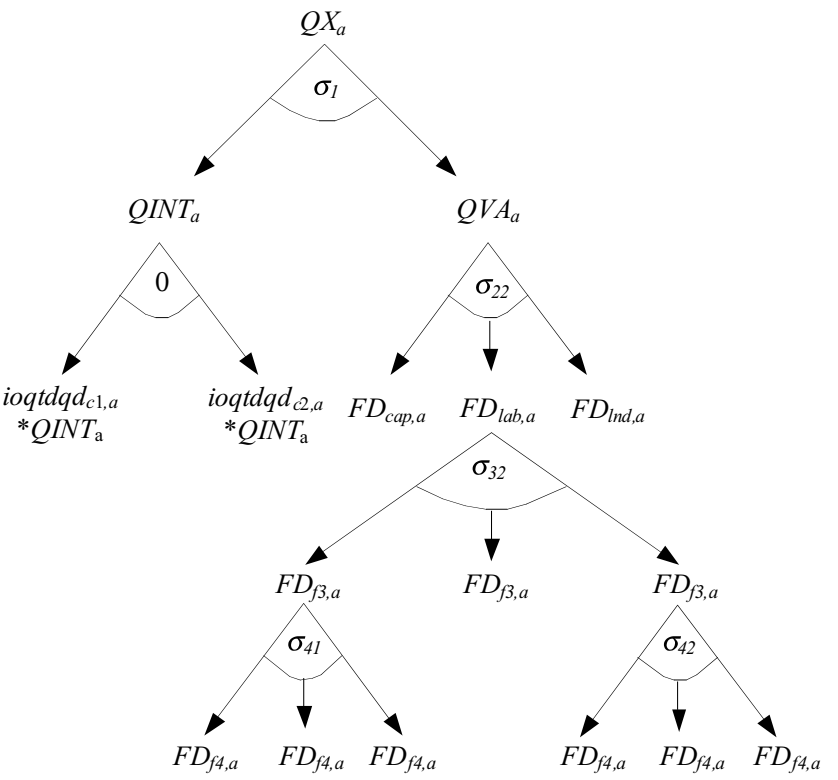
Production relationships by activities are defined by a series of nested CES production functions.[3] Mathematically, the limit on the number of levels of nests is only constrained by the number of different factor types included in the database. However, there are additional limits imposed by economic meaningfulness and the availability of empirical data that allow for the inclusion of information (elasticities of substitution) about the possibilities for substitution between and within subgroups of factors. Figure B.4 shows a four-level production nest, in quantity terms; to simplify exposition, two intermediate inputs, nine natural/actual primary inputs, and three aggregate primary inputs are identified, and only the labor accounts are nested beyond the second level.

Activity output is a CES aggregate of the quantities of aggregate intermediate inputs (*QINT*) and value added (*QVA*), whereas the aggregate intermediate inputs are a Leontief aggregate of the (individual) intermediate inputs, and the aggregate value added is a CES aggregate of the quantities of "primary" inputs demanded by each activity (*FD*), where the primary inputs can be natural factors—types of labor, capital, and land that exist—and aggregate factors that are aggregates of natural factors and/or other aggregate factors. Any factor at the end of any branch in figure B.3 is by definition a natural factor; that is, it is not an aggregate. Thus, all the factors $FD_{f4,a}$ are natural factors, as are $FD_{f3,a}$, $FD_{cap,a}$, and $FD_{lnd,a}$, whereas all $FD_{f3ag,a}$and $FD_{lab,a}$ are aggregates. In the model, the set *ff* is defined as the set of all natural factors and aggregates, while the set *f*, a subset of *ff*, is defined as the set of all natural factors; other subsets of *ff* define the level of each factor—natural or aggregate—in the nesting structure.

Starting from the bottom of the value-added nests in figure B.3: The six types of natural labor (*f4*) form two groups of labor that can be substituted within the subgroup to form two aggregates ($FD_{f3ag,a}$). These two aggregates, along with another natural factor ($FD_{f3,a}$), are also substitutes that form an aggregate labor factor ($FD_{lab,a}$), which combines with the natural factors capital ($FD_{cap,a}$) and land ($FD_{lnd,a}$) to generate aggregate value added (*QVA*). The optimal combinations of each natural and/or aggregate in each CES aggregate are determined by first-order conditions based on relative prices.

The advantage of using such a nesting structure is that it avoids making the assumption that all natural factors are equally substitutable in the generation

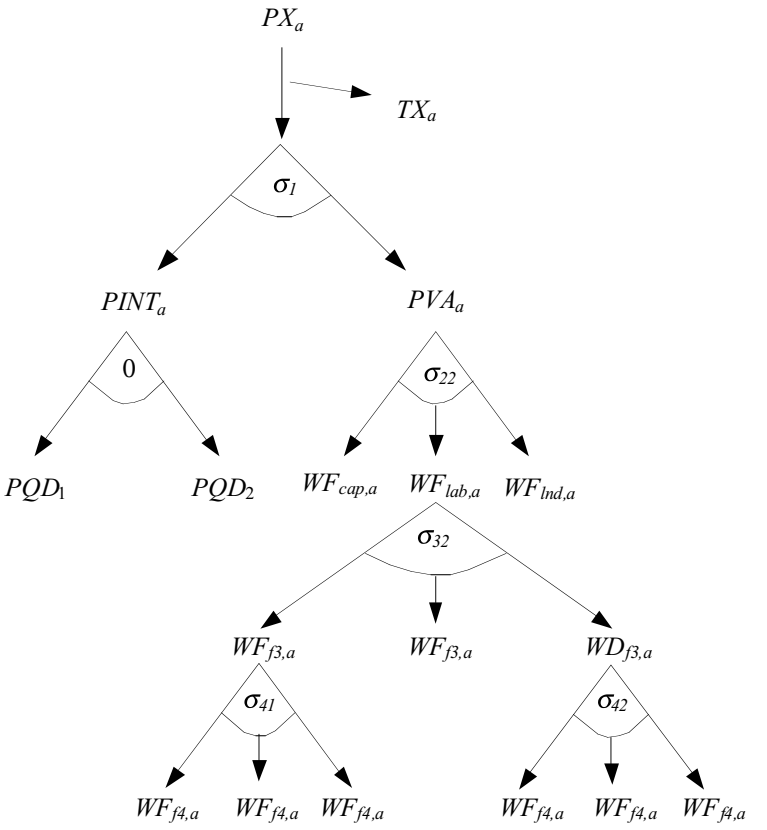
Figure B.3 Production Relationships for the STAGE_LAB Model: Quantities



of value added. In the case illustrated by figure B.3, the implicit presumption is that different types of labor are not equally substitutable but that aggregate labor, capital, and land are equally substitutable. For instance, the level 3 labor aggregates, $FD_{f3ag,a}$, may be defined as the aggregate labor employed by an activity class in a specific region, which is made up of three types of labor that have different sets of skills but can only be employed in the specific region. However, the activity class may choose to "substitute" labor from different regions by altering the balance of production taking place in different regions.

This highlights an important consideration. The adoption of a nesting structure carries with it the presumption that factor markets are segmented; that is, while unskilled labor from a region can be part of that region's aggregate labor factor, unskilled labor from another region cannot. Implicit to this structure, therefore, is the presumption that labor cannot migrate between regions, whereas in reality there is strong evidence that people are prepared to migrate in search of improved employment opportunities. To address this consideration, STAGE_LAB includes a series of migration functions that allow net migration of factors of production between the subnests of the production structure; for example, unskilled labor can migrate between different

Figure B.4. Production Relationships for the STAGE_LAB Model: Prices



regions in response to employment opportunities. The incentives to migrate are determined by the changes in the relative wages received by the factors in different subnests.

The model includes a constant elasticity supply function for each factor type. If the relative wage of the factor in a subnest increases or decreases, the supply of that factor to a subnest can increase or decrease, subject to the condition that the total supply of that factor type in the economy is fixed. The resultant migrations represent a partial adjustment in response to changes in relative wages and, combined with the constraint, ensure market clearing without any increase in labor supply. The degrees of mobility are controlled by the supply elasticities, which can vary for each and every factor; for example, unskilled labor in one region may be more or less mobile than unskilled labor in other regions. In practice, this version of the model operates a pooling system; the labor supply functions either as supply or demand to or from a series of pools rather than as bilateral migration between subnests; thus, only net migration is modeled. Full bilateral tracking of labor migration could be readily achieved, but this would require

the imposition of many more supply elasticities, for which there is limited information.[4] The choice of the pooling mechanism is accordingly driven by the decision to achieve a balance between detail and the imposition of exogenous information that has limited empirical basis.

The operation of the migration functions requires the specification of which types of labor can supply labor from a specific pool. This requires the association of factors with particular pools, and it is important to ensure that these associations are meaningful. In the regionalized examples given above, it is clearly potentially valid to assume that labor of the same skill types employed in different regions might be able to move between regions. Furthermore, it may be reasonable to argue that there may be some migration between skill types within a region, for example, between semiskilled and unskilled labor, although the ease of migration may depend upon the direction. Semiskilled may be easily able to become unskilled, but unskilled may be much less easily transformed into semiskilled. But other migrations may not be appropriate.

Consider a scenario where there is discrimination in labor markets on the basis of some readily observable characteristic—race, gender, religion, and the like—and labor in a skill class is subdivided according to the characteristic used in discrimination. In such a scenario, migration between subnests is clearly not straightforward because the characteristic used in discrimination cannot be transformed. Consequently, care needs to be exercised when defining the possible channels for migration.

Until now, it has been assumed that labor supplies are fixed. However, STAGE_LAB allows for the possibility of unemployment for every natural factor. This is achieved by defining the supply of each factor by reference to current total demand plus the stock of the factor currently unemployed. In the case of labor, if there is current unemployment for a class of labor—for example, unskilled—the real wage of that class is fixed until all the stock of unemployed unskilled workers has been absorbed by the labor market; thereafter, the real wage of the factor is flexible.[5] This form of regime switching is attractive because it increases the realism with which the labor markets are modeled, but it does have some implications for the modeling of labor migration. Given that labor migration decisions depend on changes in relative wage rates, there can only be net migration when a factor within a migration pool is fully employed, because only then can relative wages change.

In the Brazil application, labor types are categorized by skill category and region. Thus, the model options selected allow migration across regions by common skill categories, that is, unskilled labor can migrate from Bahia to São Paulo where it will join the supply of unskilled labor. The option selected allows for no labor migration across skill categories.

The price relations for the production system are illustrated in figure B.4. Note how the prices paid for intermediate inputs (*PQD*) are the same as paid for final demand; that is, a "law" of one price relationship holds across all domestic demand. Note also that factor prices are factor, and activity, specific ($WF_{ff,a}$), which means that the allocation of finite supplies of factors (*FS*) between competing activities depends upon relative factor prices via first-order conditions for optima.

These extensions to the representation of the labor market increase the degree of realism achieved in the modeling of labor market transactions. One dimension of this increased realism is that the model reduces the degree of factor market response to changes in prices. This is achieved in several ways. First, the nested structure reduces the extent of substitution possibilities. Second, the ease of substitution between factors is damped down by the nested structure. And third, the migration functions further reduce substitution possibilities through the partial adjustment to changes in wage rates.

Notes

1. The STAGE_LAB model is a member of the class of single-country computable general equilibrium (CGE) models that are descendants of the approach to CGE modeling described by Dervis, de Melo, and Robinson (1982).
2. For simplicity, only one tax on domestic commodity sales is included in this figure.
3. Peroni and Rutherford (1995) demonstrate that nested CES function can approximate any flexible functional form, e.g., translog.
4. It could be argued that migration between regions that are "geographically" close would be greater than between regions that are far apart. However, it is also possible that there will be a series of migration decisions whereby labor simultaneously enters and leaves the same region.
5. In terms of the model, this requires that the model operates with one regime when there is unemployment, and another regime when there is full employment. This regime switching is achieved by specifying the model as mixed complementarity problem. The variant used here generates a two segments labor supply function—horizontal until full employment and then vertical—but more complex options are possible, e.g., three segments: horizontal until unemployment rates fall below some level, upward-sloping until full employment, and thereafter vertical.

APPENDIX C

Social Accounting Matrix for the Brazil Country Model

This appendix describes the steps used to generate the Brazilian social accounting matrix (SAM), which was used to conduct simulations with the country model, as well as the data sources used.

Construction of the Input-Output tables for Brazil in 2004

The Instituto Brasileiro de Geografia e Estatística (IBGE), which is the Brazilian official statistical agency, recently changed the national accounting system of the country with the aim of updating the weights of the economic activities in gross domestic product. A new classification of goods and services and new data sources were also incorporated into the new national accounting system.

This change was made taking 2000 as the reference year. It brought more detail on the commodities and activities classifications in the Use Matrices and of the institutional sectors in the Integrated Economic Accounts, reflecting changes toward a new system that references annual sources of data at current prices. The IBGE, in the same way as is done in other countries, releases the results in different versions, due to the availability of information sources used in the construction of the national accounts. The most recent information available is for 2004, and this was recently partially published. This is the data source for this study.

The Brazilian National Accounting System is based on six matrices that show the financial flows between sources and uses of goods and services. These matrices are organized with information about production, supply, imports, intermediate consumption, final demand, and value added. These matrices, as published presently, are valued at purchasers' prices and had to be trans-

formed to basic prices, splitting the correspondent use, margins, and taxes, including tariffs.

The estimation of the Brazilian Input-Output (IO) tables at basic prices is done through many different steps, described as follows:

- The generation of the IO tables at basic prices for 2004. For this purpose, a "seed" SAM is generated based on shares derived from the 1996 IO tables at basic prices, the last published at this level of valuation by the IBGE. These matrices are then updated and balanced to match the values of the 2004 matrices at purchasers' prices. This process generates an IO table for Brazil with fifty-two commodities and forty-two activities, where only the agriculture sector produces more than one commodity (eleven commodities).

- The IO tables mentioned above are national tables. These national tables must be further disaggregated for the twenty seven regions of Brazil (twenty-six states plus the Federal District). For this step, production shares from different sources are used. For the nonagricultural sectors, regional production shares were gathered from the *Cadastro Geral das Empresas* (IBGE 2004a), a survey on the economic activity of producing sectors, which includes data about the number of employees and wages by sector and region. The wage bill was used as a proxy for the production shares. As for the agricultural products, the source of information was the *Pesquisa Agrícola Municipal* (IBGE 2004b), a yearly survey of agricultural and livestock production. With this information, an initial regional production matrix was generated for the twenty-seven regions.

- The next step consisted of the regional splitting of household consumption. For this purpose, consumption shares were computed from the *Pesquisa de Orçamentos Familiares* (POF)—the Brazilian Expenditure Survey—for 1995 and 1996 (IBGE 1998). The POF data also allow the calculation of the consumption pattern according to each decile of household income. These expenditure patterns were assigned to each of the households in the data from the Pesquisa Nacional por Amostragem de Domicílios (PNAD)—the National Household Survey—and the regional expenditures were calculated according to each household income class (ten), commodity (fifty-two), and region (twenty-seven).

- With these initial production and expenditure matrices for 2004, a trade matrix linking all the regions was created, using a gravitational method to balance supply and demand at regional levels. (There is no information about the interstate trade matrices in Brazil.)

- The regional IO tables described so far have no information on different labor types. The split of each labor bill, by sector and region, into ten different wage classes (OCC1, the lowest, to OCC10, the highest) was done with information gathered from the PNAD for 2004. The limit values for each wage class (in monthly 2004 reais) were OCC1, from R$1 to R$130; OCC2, from R$130 to R$230; OCC3, from R$230 to R$260; OCC4, from R$260 to R$300; OCC5, from R$300 to R$390; OCC6, from R$390 to R$480; OCC7, from R$480 to R$600; OCC8, from R$600 to R$800; OCC9, from R$800 to R$1,500; and OCC10, from R$1,500 to R$120,000.

Database

The use of the above-mentioned data sources and methods allowed the estimation of the 2004 Brazilian Interregional database, which consists of the matrices and sets presented in table C.1.

Table C.2 presents the commodities/activities, sectors, and regions as aggregated in the social accounting matrix.

Table C.3 provides an overview of the Brazilian economy as represented in the model.

Table C.1 Sets and Data Matrices in the 2004 Brazilian Interregional Database

Header	Dimension	Coefficient	Name
COM	52		Commodities
MAR	2		Margins
IND	42		Industries
OCC	10		Occupations
REGD	27		Destination regions
REGS	27		Sourcing regions
REGP	27		Producing regions
MAKE	COM*IND*REGDST	MAKE	Production matrix
BSMR	COM*SRC*USER*REGDST	BASMAR	Basic flows plus margins
UTAX	COM*SRC*USER*REGDST	TAXES	Indirect taxes
TRAD	COM*SRC*REGSRC*REGDST	TRADE	Trade matrix
MARS	MAR*REGSRC*REGDST*REGPRD	SUPPMAR	Margins supplied by REGPRD on goods transferred from REGSRC to REGDST
TMAR	COM*SRC*MAR*REGSRC*REGDST	TRADMAR	Margins on trade matrix
PURI	COM*IND*REGDST	INVEST	Investment at purchaser price
STOK	IND*REGDST	STOCKS	Stock variation
LABO	IND*OCC*REGDST	V1LAB	Wage bill
CAPT	IND*REGDST	V1CAP	Capital rents
LAND	IND*REGDST	V1LND	Land rents
PTAX	IND*REGDST	V1PTX	Production taxes
SLAB	IND	SIGMA1LAB	Elasticity of substitution between labor occupations
SPRI	IND	SIGMA1PRIM	Elasticity of substitution between primary factors
SCET	IND	SIGMAOUT	Elasticity of transformation (multiproduction)
SMAR	MAR	SIGMAMAR	CES substitution between margins origins
EXEL	COM	EXP_ELAST	Export elasticities
SGDI	COM	SIGMADOMIMP	Armington substitution elasticities
FRSH	REGDST	FRISCH	Frish parameter
XPEL	COM*REGDST	EPS	Expenditure elasticities

Table C.2. Commodities, Sectors, and Regions in the 2004 Brazilian Interregional Database

Sector and Commodity	Description
Agriculture	
Coffee	Coffee
Sugarcane	Sugarcane
Wheat	Wheat
Other grains	Rice (raw), corn
Soybeans	Soybeans
Other crops	Cotton, other agricultural products
Livestock	Livestock, poultry
Raw milk	Raw milk
Food	
Processed coffee products	Processed coffee products
Sugar	Sugar
Meat products	Meat products
Dairy products	Dairy products
Other food products	Vegetable processing products, vegetable oils, other food products
Manufactures	
Metals	Iron, nonferrous metals, other metals
Machinery	Machinery and tractors
Electrical machinery	Electrical machinery and equipment, electronic equipment
Motor vehicles and other transportation equipment	Automobiles, other vehicles, aircraft, railroad equipment, and parts
Wood and paper	Wood and furniture, paper, and printing
Refined petroleum products	Refined petroleum products
Chemicals	Chemical elements, pharmaceuticals, other chemicals
Rubber and plastic	Rubber products, plastics
Textiles	Textiles, apparel, leather products
Other manufactures	Toy products, jewelry and jewel products, sewing products, other industrial products, and services supporting industrial production
Natural resources	
Petroleum and gas extraction	Petroleum and gas extraction
Mineral extraction	Mineral extraction, nonmetallic metals
Services	
Public utilities	Public utilities
Construction	Civil construction
Trade	Trade
Transportation	Transportation
Communications	Communications
Financial services	Financial services
Other services	Services to families, services to enterprises, housing, non-mercantile private services
Public administration	Public administration

Table C.2 (continued) Commodities, Sectors, and Regions in the 2004 Brazilian Interregional Database

Region	Description
Bahia	Bahia
Pernambuco	Pernambuco
Other Northeast	Maranhao, Piaui, Ceara, Rio Grande do Norte, Paraiba, Alagoas, Sergipe
North	Rondonia, Acre, Amazonas, Roraima, Para, Amapa, Tocantins
Central West	Mato Grosso do Sul, Mato Grosso, Goias, Districto Federal
Paraná	Paraná
Other South	Santa Catarina, Rio Grande do Sul
Minas Gerais	Minas Gerais
São Paulo	São Paulo
Rio de Janeiro	Rio de Janeiro
Espírito Santo	Espírito Santo

Table C.3. Overview of the Brazilian Economy in the Model

DOMESTIC PRODUCTION BY INDUSTRY IN MILLIONS OF 2004 REAIS, AND PERCENT SHARE

Commodity	Millions of 2004 Reais	Share of Total Production
Agriculture	**203,131.99**	**5.91**
Coffee	8,278.68	0.24
Sugarcane	12,041.01	0.35
Wheat	2,586.22	0.08
Other grains	22,406.72	0.65
Soybeans	34,955.98	1.02
Other crops	67,271.23	1.96
Livestock	43,442.21	1.26
Raw milk	12,149.94	0.35
Food	**251,897.00**	**7.33**
Processed coffee products	6,177.00	0.18
Sugar	24,356.00	0.71
Meat products	55,408.00	1.61
Dairy products	20,592.00	0.60
Other food products	145,364.00	4.23
Manufactures	**935,570.00**	**27.23**
Metals	131,577.00	3.83
Machinery	57,477.00	1.67
Electrical machinery	87,625.00	2.55
Motor vehicles and other transportation equipment	136,058.00	3.96
Wood and paper	106,199.00	3.09
Refined petroleum products	156,487.00	4.56
Chemicals	121,272.00	3.53
Rubber and plastic	44,388.00	1.29
Textiles	83,080.00	2.42
Other manufactures	11,407.00	0.33
Natural Resources	**113,194.00**	**3.29**
Petroleum and gas extraction	52,241.00	1.52
Mineral extraction	60,953.00	1.77
Services	**1,931,552.00**	**56.23**
Public utilities	121,900.00	3.55
Construction	157,372.00	4.58
Trade	260,582.99	7.59
Transportation	147,884.00	4.30
Communications	84,989.00	2.47
Financial services	166,475.99	4.85
Other services	615,576.00	17.92
Public administration	376,772.01	10.97
Total	3,435,344.99	100.00

Table C.4 Average Earnings by Region and Labor Group

2005 REAIS

	Low-Wage	Medium-Wage	High-Wage	All Labor
North	2,620	5,861	18,838	7,229
Other Northeast	2,040	4,118	21,054	5,372
Pernambuco	2,248	4,873	20,996	5,843
Bahia	2,210	4,515	17,094	5,707
Minas Gerais	2,746	5,882	19,622	8,362
Espirito Santo	2,711	6,116	19,593	8,635
Rio de Janiero	3,624	7,154	26,624	12,665
São Paulo	3,426	7,110	24,225	13,314
Other South	2,214	5,822	20,148	10,196
Paraná	2,523	6,019	21,452	10,096
Central West	2,889	6,023	22,612	11,173
Total	2,591	5,960	22,039	9,437

Source: Authors' tabulations from microdata, IBGE Pesquisa Nacional por Amostra de Domicílios, 2006

APPENDIX D

Detailed Results of Doha Round Simulations of Agricultural Subsidy Reductions

This appendix presents the detailed results of the Doha Round simulations of agricultural subsidy reductions or elimination that were conducted using the global model. In the simulation, export subsidies were completely eliminated, as tentatively agreed in the Doha Round. Domestic agricultural subsidies were reduced by one-third from applied rates in the 2001 baseline data. For the reader's convenience in comparing the relative magnitude of effects, we also show here the results of tariff reductions on agricultural commodities, processed food, manufactured goods, and the full Doha simulation. Those tariff reductions are discussed and evaluated in chapter 4.

Removal of Agricultural Export Subsidies

Table D.1 shows the benchmark subsidy rates applied by different exporting regions for major agricultural commodity groups in the benchmark equilibrium. It indicates in particular the strong distortionary price wedges imposed by EU subsidies on exports of sugar, animal products, and cereal grains.

The complete elimination of these export subsidies has already been agreed in principle in the Doha Round negotiations, as noted above. Ending the subsidies raises the world market prices for these commodities directly and will also indirectly affect the prices of goods that use them as inputs. From a national welfare perspective, net exporters of the directly affected commodities gain, while net importers are adversely affected. Brazil is a net exporter of sugar and animal products but a net importer of cereal grains. The aggregate results for domestic real absorption and welfare[1] (reported as simulation 1 in table D.2) suggest that the positive effects dominate for Brazil, although they are extremely small.

Brazil's exports of animal products rise by 2.7 percent as a result of the elimination of export subsidies, while sugar exports increase by 0.9 percent, and

Table D.1 Export Subsidy Rates on Agricultural and Food Commodities by Origin

PERCENT

Commodity	East and Southeast Asia	European Union	Rest of the World	United States
Cereal grains		–0.23		
Other crop agriculture	–0.00	–0.01	–0.01	
Animal agriculture		–0.01	–0.00	
Vegetable oils and fats			–0.01	
Sugar		–0.59	–0.00	
Animal products	–0.00	–0.29	–0.03	–0.04
Other food products		–0.02	–0.00	

Source: GTAP database Version 6 (Dimaranan 2006).

cereal grains exports by 0.4 percent (simulation 1 in table D.3). The expansionary effects on the export demand side for these sectors are reinforced by domestic substitution effects as domestic users switch from imports to goods of domestic origin in response to the rise in import prices. Simulation 1 in table D.4 reports a drop in animal product imports by 5.4 percent, and sugar product imports by 6.6 percent (albeit from a small base).

Correspondingly, the strongest positive effect on gross output and employment occurs in the animal products sector, which entails in turn a positive backward-linkage effect on output and employment in animal agriculture,

Table D.2. Doha Round Scenarios: Macroeconomic Results for Brazil

PERCENT CHANGE

	Simulation						
Result	1	2	3	4	5	6	7
Real absorption	0.03	0.04	0.14	0.00	0.21	0.03	0.23
Real imports	0.11	0.18	0.52	–0.01	0.81	0.60	1.41
Real exports	0.02	0.03	0.12	0.00	0.16	1.36	1.52
Real GDP	0.01	0.01	0.07	0.00	0.09	0.11	0.20
Terms of trade	0.11	0.16	0.43	–0.01	0.69	–0.78	–0.09
Unskilled employment	0.03	0.05	0.21	0.00	0.29	0.31	0.59
Equivalent variation[a]	0.04	0.06	0.22	–0.00	0.31	0.09	0.40

Source: Global model simulations

[a]Equivalent variation in the percentage of initial consumer expenditures.

Note: Simulation 1: removal of agricultural export subsidies; simulation 2: reduction of applied agricultural tariffs; simulation 3: reduction of applied food processing tariffs; simulation 4: reduction of domestic agricultural subsidies; simulation 5: full Doha food liberalization; simulation 6: reduction of import duties on manufactures; simulation 7: full Doha Round scenario.

Table D.3 Doha Round Scenarios: Change in Brazil's Real Exports by Commodity

PERCENT CHANGE, EXCEPT BASE LEVEL, WHICH IS IN BILLION DOLLARS

Commodity	Base Level	Simulation 1	2	3	4	5	6	7
Cereal grains	0.73	0.36	9.31	–0.68	2.22	11.19	1.39	12.81
Oilseeds	2.86	–0.33	0.53	–0.56	0.52	0.07	1.33	1.41
Other crop agriculture	3.28	–0.25	0.99	–0.59	–1.18	–1.03	1.23	0.18
Animal agriculture	0.26	–0.09	0.19	0.12	–0.09	0.11	0.32	0.43
Minerals	3.84	–0.07	–0.08	–0.26	0.01	–0.41	0.69	0.28
All other extractive	0.49	–0.09	–0.04	–0.26	0.05	–0.34	0.77	0.42
Vegetable oils and fats	0.61	–0.18	–0.55	–0.46	0.02	–1.20	1.55	0.35
Sugar	1.48	0.88	–0.27	3.72	–0.09	4.26	1.19	5.52
Animal products	2.99	2.65	–0.44	7.28	0.18	9.66	1.66	11.51
Other food products	4.10	–0.03	–0.10	1.47	0.03	1.35	0.82	2.19
Textiles	1.16	–0.03	0.06	–0.02	0.02	0.03	0.81	0.83
Leather products	2.62	–0.27	–0.46	–1.12	0.02	–1.81	4.33	2.41
Wood and paper products	4.79	–0.18	–0.23	–0.57	–0.05	–1.03	1.92	0.86
Petroleum and chemicals	5.60	–0.10	–0.07	–0.31	0.01	–0.48	1.24	0.75
Mineral products	1.30	–0.09	–0.10	–0.32	0.01	–0.51	1.54	1.02
Ferrous metals	3.29	–0.16	–0.22	–0.60	0.01	–0.97	1.76	0.76
Metals	2.21	–0.33	–0.45	–1.20	0.01	–1.96	3.02	0.98
Metal products	0.76	–0.11	–0.10	–0.35	0.02	–0.54	1.98	1.41
Motor vehicles and parts	5.22	–0.08	–0.08	–0.27	0.01	–0.42	2.36	1.92
Transportation equipment	3.64	–0.32	–0.39	–1.02	0.01	–1.71	2.98	1.21
Electrical/ electronic equipment	7.83	–0.07	–0.04	–0.18	0.02	–0.27	0.18	–0.09
All other manufactures	0.68	–0.02	0.00	–0.05	0.01	–0.06	0.22	0.16
Utilities	0.01	–0.01	0.00	0.00	0.01	0.01	0.20	0.21
Construction	0.03	0.01	0.00	–0.01	0.00	0.00	0.00	0.00
Trade	0.71	–0.01	0.00	–0.01	0.01	0.00	0.01	0.01
Transportation	2.70	–0.02	0.02	0.03	0.01	0.04	0.19	0.23
All other services	6.00	–0.02	–0.04	–0.09	0.01	–0.15	0.25	0.10

Source: Global model simulations.
Note: Simulation 1: removal of agricultural export subsidies; simulation 2: reduction of applied agricultural tariffs; simulation 3: reduction of applied food-processing tariffs; simulation 4: reduction of domestic agricultural subsidies; simulation 5: full Doha food liberalization; simulation 6: reduction of import duties on manufactures; simulation 7: full Doha Round scenario.

and in sugar processing (simulation 1 in table D.5). However, all sectoral output and employment effects remain well below 1 percent.

Reduction of Domestic Agricultural Subsidies

The effort to limit domestic agricultural subsidies, particularly by developed countries, continues to be a major stumbling block for progress in the Doha Round negotiations. In the model, domestic subsidies enter in the form of negative ad valorem factor taxes on land and capital. The subsidy rates in

Table D.4. Doha Round Scenarios: Change in Brazil's Real Imports by Commodity

PERCENT CHANGE, EXCEPT BASE LEVEL, WHICH IS IN BILLION DOLLARS

Commodity	Base Level	Simulation 1	2	3	4	5	6	7
Cereal grains	1.22	0.12	–0.64	0.47	–0.23	–0.27	0.24	–0.02
Oilseeds	0.15	0.18	–0.01	0.87	–2.12	–1.09	–0.64	–1.72
Other crop agriculture	0.86	0.13	1.24	0.87	0.54	2.80	–0.72	2.07
Animal agriculture	0.15	0.30	1.10	1.21	–0.09	2.54	–0.38	2.18
Minerals	0.55	–0.02	–0.01	0.00	0.01	–0.03	0.37	0.33
All other extractive	3.64	0.11	0.23	0.58	–0.02	0.92	–0.76	0.13
Vegetable oils and fats	0.16	0.20	0.21	2.39	–0.20	2.64	–0.90	1.69
Sugar	0.02	–6.64	0.20	2.52	0.13	–4.04	–1.01	–4.99
Animal products	0.34	–5.39	0.13	0.86	–0.09	–4.78	–0.54	–5.27
Other food products	1.21	–0.28	0.15	1.50	–0.03	1.33	–0.50	0.82
Textiles	1.49	0.20	0.26	0.70	0.00	1.16	2.72	3.91
Leather products	0.35	0.15	0.20	0.65	–0.03	0.98	1.65	2.64
Wood and paper products	1.36	0.19	0.22	0.63	0.05	1.10	1.11	2.23
Petroleum and chemicals	15.06	0.13	0.19	0.48	0.00	0.81	0.69	1.50
Mineral products	1.31	0.16	0.19	0.52	–0.01	0.87	1.03	1.91
Ferrous metals	0.78	0.12	0.12	0.35	0.00	0.59	1.49	2.08
Metals	1.37	0.11	0.13	0.43	0.01	0.69	0.81	1.50
Metal products	1.01	0.19	0.22	0.60	–0.01	1.01	2.74	3.76
Motor vehicle and parts	5.17	0.14	0.11	0.41	–0.02	0.65	2.47	3.13
Transportation equipment	3.36	0.22	0.27	0.69	–0.01	1.17	–1.06	0.09
Electrical/ electronic equipment	23.46	0.15	0.18	0.49	–0.01	0.80	1.23	2.04
All other manufactures	0.78	0.23	0.29	0.77	0.01	1.31	3.06	4.41
Utilities	1.96	0.13	0.15	0.45	–0.01	0.73	–0.64	0.08
Construction	0.03	0.11	0.16	0.39	0.00	0.66	–0.82	–0.17
Trade	1.21	0.13	0.18	0.48	0.00	0.79	–0.83	–0.05
Transportation	3.92	0.13	0.16	0.45	0.00	0.75	–0.67	0.07
All other services	8.72	0.13	0.17	0.46	0.00	0.77	–0.78	–0.02

Source: Global model simulations.
Note: Simulation 1: removal of agricultural export subsidies; simulation 2: reduction of applied agricultural tariffs; simulation 3: reduction of applied food processing tariffs; simulation 4: reduction of domestic agricultural subsidies; simulation 5: full Doha food liberalization; simulation 6: reduction of import duties on manufactures; simulation 7: full Doha Round scenario.

the benchmark equilibrium are reported in table D.6. The figures clearly reflect the use of strongly distortionary protective measures in the European Union and the United States. To interpret the general equilibrium effects, it is also important to pay attention to the variation in subsidy rates across different agricultural commodities and sectors. In the EU, domestic support for other crop agriculture and animal agriculture is relatively less pronounced than support for cereal grains and oilseeds. In the United States, domestic support is heavily geared toward cereal grains.

Table D.5 Doha Round Scenarios: Change in Brazil's Output by Commodity

PERCENT CHANGE, EXCEPT BASE LEVEL, WHICH IS IN BILLION DOLLARS

Commodity	Base Level	Simulation 1	2	3	4	5	6	7
Cereal grains	3.79	0.15	2.22	0.21	0.53	3.10	0.50	3.67
Oilseeds	6.22	–0.16	0.27	–0.23	0.31	0.16	0.85	1.01
Other crop agriculture	14.61	–0.02	0.19	0.05	–0.32	–0.10	0.50	0.40
Animal agriculture	13.81	0.41	–0.01	1.02	0.03	1.45	0.32	1.81
Minerals	6.83	–0.06	–0.07	–0.23	0.00	–0.37	0.60	0.23
All other extractive	8.93	–0.08	–0.07	–0.27	0.01	–0.41	0.66	0.26
Vegetable oils and fats	6.71	–0.02	–0.01	0.02	0.01	0.00	0.35	0.35
Sugar	4.85	0.38	–0.08	1.55	–0.04	1.83	0.54	2.40
Animal products	20.93	0.56	–0.07	1.36	0.03	1.89	0.35	2.28
Other food products	36.02	0.02	0.04	0.31	0.01	0.37	0.20	0.58
Textiles	18.23	0.01	0.02	0.08	0.00	0.11	–0.04	0.07
Leather products	4.98	–0.17	–0.30	–0.71	0.02	–1.15	2.82	1.59
Wood and paper products	23.94	–0.05	–0.06	–0.10	–0.02	–0.22	–0.58	0.34
Petroleum and chemicals	60.04	–0.02	0.01	–0.03	0.00	–0.04	0.22	0.18
Mineral products	11.24	–0.03	–0.04	–0.09	0.00	–0.16	0.22	0.05
Ferrous metals	17.03	–0.11	–0.13	–0.34	0.01	–0.57	0.64	0.06
Metals	7.00	–0.22	–0.28	–0.77	0.00	–1.27	1.18	–0.13
Metal products	14.99	–0.06	–0.07	–0.16	0.01	–0.28	0.22	–0.07
Motor vehicles and parts	17.81	–0.03	–0.02	–0.08	0.01	–0.12	0.47	0.34
Transportation equipment	14.76	–0.17	–0.19	–0.49	0.01	–0.83	1.51	0.66
Electrical/ electronic equipment	39.59	–0.10	–0.11	–0.30	0.01	–0.51	–0.55	–1.06
All other manufactures	10.63	–0.01	0.00	0.02	0.00	0.01	–0.04	–0.03
Utilities	24.66	–0.01	–0.01	0.00	0.00	–0.02	0.39	0.36
Construction	68.89	0.00	0.00	0.01	0.00	0.01	0.01	0.02
Trade	67.94	0.03	0.05	0.19	0.00	0.27	0.13	0.39
Transportation	37.07	0.02	0.04	0.15	0.00	0.21	0.20	0.41
All other services	292.43	0.02	0.03	0.12	0.00	0.16	0.05	0.21

Source: Global model simulations.

Note: Simulation 1: removal of agricultural export subsidies; simulation 2: reduction of applied agricultural tariffs; simulation 3: reduction of applied food-processing tariffs; simulation 4: reduction of domestic agricultural subsidies; simulation 5: full Doha food liberalization; simulation 6: reduction of import duties on manufactures; simulation 7: full Doha Round scenario.

These sectoral variations help to explain the nontrivial price, trade, and employment effects triggered by the simulated reduction in subsidy rates. For cereal grains, EU and U.S. supply prices unambiguously rise in response to the drop in support. Demand by domestic consumers, food processors, and exporters declines, and hence production shrinks in both regions. The same direction of effects occurs in the EU for oilseeds and animal agriculture. The drop in demand for land by the shrinking sectors causes a substantial drop in the rental price of land; in the EU, the equilibrium price of land use falls by 39 percent, and in the United States, by 19 percent.[2] For less heavily subsidized commodities, this general equilibrium land price effect

Table D.6 Domestic Agricultural Subsidy Rates

PERCENT

Factor	Sector	East and Southeast Asia	European Union	Rest of the Americas	Rest of the World	United States
Land	Animal agriculture		–0.08	–0.05	–0.05	–0.12
Land	Cereal grains	–0.01	–0.83	–0.39	–0.02	–0.66
Land	Other crop agriculture	–0.03	–0.14	–0.07		–0.21
Land	Oilseeds	–0.09	–0.78	–0.39	–0.01	–0.12
Capital	Animal agriculture		–0.44	–0.01	–0.03	
Capital	Cereal grains	–0.07	–0.11	–0.01		
Capital	Other crop agriculture	–0.02	–0.04			
Capital	Oilseeds		–0.05			

Source: GTAP database Version 6 (Dimaranan 2006).

dominates the rise in costs due to the subsidy cut, so that—counter to partial equilibrium intuition—total production costs and equilibrium prices actually fall.[3] As a consequence, all U.S. agricultural sectors except cereal grains actually raise their equilibrium exports to world markets to some extent after the reduction in domestic subsidies, as does the EU's other crop agriculture sector. These results clearly highlight the need for a general equilibrium perspective in evaluating subsidy reductions, and they need to be borne in mind as we turn to the implications of this scenario for the Brazilian economy.

The impact on Brazil of the reduction of global domestic agricultural subsidy rates (simulation 4) is presented in tables D.2 through D.5. The subsidy cuts and resulting world price changes stimulate Brazilian exports of cereal grains (primarily to the EU) and, to a lesser extent, exports of oilseeds. However, exports of other crops are negatively affected as a result of the lower world market prices for goods of U.S. and EU origin (table D.3). In line with the changes in export demand, production in the cereal grains and oilseeds sectors expands moderately, while other crop agriculture contracts and animal agriculture production stays virtually unchanged (table D.5).

The effects of this policy scenario on macroeconomic aggregates, including the net change in unskilled employment, are virtually nil (table D.2). The slightly negative impact on consumer welfare is partially due to the fact that Brazil is a net importer of some cereal grains, for which import prices rise due to the cut in domestic subsidies, particularly in the United States and EU.

In sum, among the Doha Round agricultural liberalization scenarios considered in this study, the reduction of domestic agricultural subsidies appears

least important from the perspective of the overall Brazilian economy. This result may surprise some and appears at odds with Brazil's stance in the Doha Round negotiations, where it has placed particular emphasis on the need for progress in this area. This highlights the importance of recognizing the complex general equilibrium effects of changes in the factors and policies that affect world commodity prices.

Notes

1. This is defined as the Hicksian equivalent variation.
2. Most studies that explore the Doha Round in detail with respect to factor prices find similar results. The major changes in land prices shed light on the political economy considerations that constrain the countries required to make the largest subsidy reductions.
3. The simulated prices for U.S. oilseeds, other crops, and animal agriculture fall by 2.8 percent, 1.8 percent, and 0.5 percent, respectively, and the EU price for other crops falls by 2.6 percent.

References

Abache, Jorge Saba. 2001. Unions and the Labor Market in Brazil. University of Brasília, Brasília.

Anderson, Kym, Will Martin, and Dominique van der Mensbrugghe. 2006. Market and Welfare Implications of Doha Reform Scenarios. In *Agricultural Trade Reform & the Doha Development Agenda*, ed. Kym Anderson and Will Martin. New York and Washington, D.C.: Palgrave Macmillan and World Bank.

Armington, Paul S. 1969. *A Theory of Demand for Products Distinguished by Place of Production.* IMF Staff Papers 16: 159–178.

Azzoni, Carlos R., Jonathan Brooks, Joaquim Guilhoto, and Scott McDonald. 2007. Who in Brazil Will Gain from Global Trade Reforms? *The World Economy* 30, no. 10: 1568–1593.

Bouet, Antoine, Simon Mevel, and David Orden. 2007. More or Less Ambition in the Doha Round? Winners and Losers from Trade Liberalization with a Development Perspective. *The World Economy* 30, no. 8: 1253–1280.

Bussolo, Maurizio, Jann Lay, and Dominique van der Mensbrugghe. 2006. Structural Change and Poverty Reduction in Brazil: The Impact of the Doha Round. In *Poverty and the WTO: Impacts of the Doha Development Agenda*, ed. Thomas W. Hertel and L. Alan Winters. New York and Washington, D.C.: Palgrave Macmillan and World Bank.

Caldentey, Esteban Pérez, and Matías Vernengo. 2008. *Back to the Future: Latin America's Current Development Strategy*. Working Paper 07/2008. New Delhi: International Development Economics Associates.

Carneiro, Francisco Galrao, and Jorge Saba Arbache. 2002. *The Impacts of Trade Openness on Employment, Poverty, and Inequality: The Case of Brazil*. Working Paper 09/02. Brasília: Catholic University of Brasília.

Coady, David, Margaret Grosh, and John Hodinott. 2004. *Targeting of Transfers in Developing Countries: Review of Lessons and Experience*. Washington, D.C.: World Bank.

Comisión Económica para America Latina y el Caribe (UN Economic Commission for Latin America and the Caribbean). 2008. CEPALSTAT Databases and Statistical Publications, Social Indicators and Statistics Database, Millennium Development Goals. http://www.eclac.cl/estadisticas/bases/default.asp?idioma=IN.

Comisión Económica para America Latina y el Caribe (UN Economic Commission for Latin America and the Caribbean), United Nations Development Program, and International Labour Organization. 2008. *Emprego, Desenvolvimento Humano e Trabalho Decente: A Experiência Brasiliera Recente*. Brasília: Comisión Económica para America Latina y el Caribe, United Nations Development Program, and International Labour Organization.

De Melo, Jaime, and Sherman Robinson. 1989. Product Differentiation and the Treatment of Foreign Trade in Computable General Equilibrium Models of Small Economies. *Journal of International Economics* 27: 47–67.

De Paiva Abreu, Marcelo. 2005. *China's Emergence in the Global Economy and Brazil*. Texto para Discussao 491. Rio de Janeiro: Departamento de Economia, Pontifícia Universidade Católica.

Dervis, Kemal, Jaime de Melo, and Sherman Robinson. 1982. *General Equilibrium Models for Development Policy*. Cambridge: Cambridge University Press.

Devarajan, Shantayanan, Jeffrey D. Lewis, and Sherman Robinson. 1990. Policy Lessons from Trade-Focused Two-Sector Models. *Journal of Policy Modeling* 12: 625–657.

Devlin, Robert, Antoni Estevadeordal, and Andres Rodriguez-Clare. 2006. *The Emergence of China: Opportunities and Challenges for Latin America and the Caribbean*. Washington, D.C.: Inter-American Development Bank.

Dimaranan, Betina V., ed. 2006. *Global Trade, Assistance and Production: The GTAP 6 Data Base*. West Lafayette, Ind.: Center for Global Trade Analysis, Purdue University.

Economist Intelligence Unit. 2008. Country Data for 2007, Brazil.

Ferreira, Francisco H. G., Philippe G. Leite, and Martin Ravallion. 2007. *Poverty Reduction without Economic Growth?* Policy Research Working Paper 4431. Washington, D.C.: World Bank.

Ferreira Filho, Joaquim Bento, and Mark Horridge. Forthcoming. Would World Agricultural Trade Liberalization Help the Poor of Brazil? In *Agricultural Price Distortions, Inequality and Poverty*, ed. Kym Anderson, John Cockburn, and Will Martin. Washington, D.C.: World Bank.

Greenaway, David, and Chris Milner. 1991. Fiscal Dependence on Trade Taxes and Trade Policy Reform. *Journal of Development Studies* 27: 95–132.

Hertel, Thomas, and Alan Winters, eds. 2006. *Poverty and the WTO: Impacts of the Doha Development Agenda*. Washington, D.C.: World Bank.

Horridge, Mark, and Fan Zhai. 2006. Shocking a Single-Country CGE Model with Export Prices and Quantities from a Global Model. In *Poverty and the WTO: Impacts of the Doha Development Agenda*, ed. Thomas Hertel and Alan Winters. Washington, D.C.: World Bank.

IBGE (Instituto Brasileiro de Geografia e Estatística). 1998. *Pesquisa de Orçamentos Familiares 1995–1996*. Brasília: IBGE.

———. 2004a. *Cadastro Geral das Empresas*. Brasília: IBGE.

———. 2004b. *Pesquisa Agrícola Municipal*. Brasília: IBGE.

———. 2005. *Pesquisa Nacional por Amostra de Domicílios 2005*. Brasília: IBGE.

———. 2006. *Pesquisa Nacional por Amostra de Domicílios 2006*. Brasília: IBGE.

IMF (International Monetary Fund) 2008. IMF World Economic Outlook Database. http://www.imf.org/external/pubs/ft/weo/2008/01/weodata/index.aspx.

Inter-American Development Bank. 2007. *Mercosur Report No. 11*. Buenos Aires: Instituto para la Integración de América Latina y el Caribe / Inter-American Development Bank.

Kilkenny, Maureen. 1991. *Computable General Equilibrium Modeling of Agricultural Policies: Documentation of the 30-Sector FPGE GAMS Model of the United States*. USDA Economic Research Service Staff Report AGES 9125.

Lewis, Jeffrey D., Sherman Robinson, and Zhi Wang. 1995. Beyond the Uruguay Round: The Implications of an Asian Free Trade Agreement. *China Economic Review* 6, no. 1: 35–90.

Martin, Will, and Aaditya Mattoo. 2008. *The Doha Development Agenda: What's on the Table?* World Bank Policy Research Working Paper 4672. Washington, D.C.: World Bank.

McDonald, Scott. 2007. *A Static Applied General Equilibrium Model: Technical Documentation*. Mimeo. *http://www.cgemod.org.uk/stage.pdf*.

McDonald, Scott, Sherman Robinson, and Karen Thierfelder. 2007. *GLOBE: A SAM-Based Global CGE Model Using GTAP Data*. USNA Working Paper 14. Annapolis: U.S. Naval Academy. http://ideas.repec.org/s/usn/usnawp.html.

———. Forthcoming. Asian Growth and Trade Poles: India, China, and East and South East Asia. *World Development*.

McDonald, Scott, and Karen Thierfelder. 2004. *Deriving a Global Social Accounting Matrix from GTAP Version 5 Data*. Global Trade Analysis Project Technical Paper 23. West Lafayette, Ind.: Center for Global Trade Analysis, Purdue University.

———. 2009. *STAGE_LAB: An Applied General Equilibrium Model with Enhanced Labour Markets: Technical Documentation*. Mimeo. *http://www.cgemod.org.uk/stage_lab.pdf*.

Mesquita Moreira, Mauricio. 2006. *Fear of China: Is There a Future for Manufacturing in Latin America?* INTAL-ITD Occasional Paper 36. Buenos Aires: Instituto para la Integración de América Latina y el Caribe / Inter-American Development Bank.

Nassar, Andre Meloni, Cinthia Cabral da Costa, and Luciane Chiodi. 2008. *Implications for Brazil of July 2008 Draft Agricultural Modalities*. Geneva: International Centre for Trade and Sustainable Development.

OECD (Organisation for Economic Co-operation and Development). 2005. *OECD Review of Agricultural Policies: Brazil*. Paris: OECD.

———. 2006. *Agricultural Policy and Trade Reform: Potential Effects at Global, National and Household Levels.* Paris: OECD.

Perroni, Carlo, and Thomas F. Rutherford. 1995. Regular Flexibility of Nested CES Functions. *European Economic Review* 39, no. 2: 335–343.

Pyatt, Graham. 1987. A SAM Approach to Modeling. *Journal of Policy Modeling* 10: 327–352.

Robilliard, Anne-Sophie, and Sherman Robinson. 2006. The Social Impact of a WTO Agreement in Indonesia. In *Poverty and the WTO: Impacts of the Doha Development Agenda*, ed. Thomas Hertel and Alan Winters. Washington, D.C.: World Bank.

Robinson, Sherman, Mary E. Burfisher, Raul Hinojosa-Ojeda, and Karen E. Thierfelder. 1993. Agricultural Policies and Migration in a US-Mexico Free Trade Area: A Computable General Equilibrium Analysis. *Journal of Policy Modeling* 15: 673–701.

Robinson, Sherman, Maureen Kilkenny, and Kenneth Hanson. 1990. *USDA/ERS Computable General Equilibrium Model of the United States*. USDA Economic Research Service Staff Reports AGES 9049.

Saboia, João. 2007. Salário Mínimo e Distribuição de Renda no Brasil no Período 1995/2005: Fatos e Simulações. Paper presented at Seminar II of the Analysis of Results of the National Research for Sample of Households, Centro de Gestão e Estudos Estratégicos, Instituto de Pesquisa Econômica Aplicada, Ministério da Educação, and Ministério do Trabalho e Emprego, Brasília.

Soares, Sergei, Rafael Guerreiro Osorio, Fabio Veras Soares, Marcelo Medeiros, and Eduardo Zepeda. 2007. *Conditional Cash Transfers in Brazil, Chile, and Mexico: Impacts upon Inequality*. Working Paper 35. Brasília: International Poverty Center.

South Centre. 2008. *Mercosur's Experience and Progress Towards True Regional Integration: Analytical Note*. Geneva: South Centre.

United Nations Statistics Division. 2008. *United Nations Commodity Trade Statistics Database (COMTRADE)*. New York: United Nations.

Van der Mensbrugghe, Dominique. 2005. Linkage Technical Reference Document: Version 6.0. World Bank, Washington, D.C.

Van der Mensbrugghe, Dominique. 2006. *Global Merchandise Trade Reform: Comparing Results with the Linkage Model*. Paper prepared for the Ninth Annual Conference on Global Economic Analysis of the Global Trade Analysis Project (GTAP), *https://www.gtap.agecon.purdue.edu/network/member_display.asp?UserID=415*.

Willenbockel, Dirk. 2007. The Impact of China's Import Demand Growth on Sectoral Specialization in Brazil: A CGE Assessment. In *Proceedings International Conference on Policy Modeling: ECOMOD2007 São Paulo*, ed. A. Bayar. Florence, Mass.: EcoMod Press.

World Bank. 2008. *World Development Indicators 2008*. http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:21725423~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html.

WTO (World Trade Organization). 2008a. Committee on Agriculture Special Session, July 2008 Revised Draft Modalities for Agriculture. http://www.wto.org/english/tratop_e/dda_e/meet08_texts_e.htm.

———. 2008b. Negotiating Group on Market Access, July 2008 Draft Modalities for Non-Agricultural Market Access. http://www.wto.org/english/tratop_e/dda_e/meet08_texts_e.htm.

Zepeda, Eduardo, Diana Alarcón, Fabio Veras Soares, and Rafael Guerreiro Osorio. 2007. *Growth, Poverty, and Employment in Brazil, Chile, and Mexico*. Working Paper 42. Brasilia: International Poverty Centre.

———. Forthcoming. *Changes in Earnings in Brazil, Chile, and Mexico*. Working Paper. Brasília: International Poverty Center.

About the Authors

Joaquim Bento de Souza Ferreira Filho is a professor in the Escola Superior de Agricultura "Luiz de Queiroz" of the Universidade de São Paulo, São Paulo.

Janine Berg is an employment specialist with the International Labour Office, Brasília.

Scott McDonald is a professor in the Department of Economics and Strategy, Oxford Brookes University, Oxford.

Sandra Polaski is a senior associate and director of the Trade, Equity, and Development Program at the Carnegie Endowment for International Peace, Washington, D.C.

Karen Thierfelder is a professor in the Economics Department, United States Naval Academy, Annapolis, Maryland.

Dirk Willenbockel is a research fellow at the Institute of Development Studies, University of Sussex, Brighton.

Eduardo Zepeda is a senior associate at the Carnegie Endowment for International Peace, Washington, D.C., and a senior policy adviser in the Bureau for Development Policy of the United Nations Development Program, New York.

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