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Structural Change and Poverty Reduction in Brazil: The Impact of the Doha Round

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Introduction

In their review of the relationship between trade liberalization and poverty, Winters, McCulloch and McKay (2004), conclude that trade liberalization "may be one of the most cost-effective anti-poverty policies available to governments" although they go on to note that it may not be the most powerful policy and its effectiveness is likely to vary substantially from case to case. In the medium to long run time horizon, economies adjust not only to trade policy reforms but also to many other changes, including technological progress, changes in the skill composition of the population, and varying consumption patterns. This chapter's main objective is to assess the role of trade liberalization in poverty reduction over a time horizon during which these other structural trends are operating. In particular, we assess the poverty impact of a Doha Round (and a Full Liberalization) scenario on Brazil against a baseline scenario that incorporates some of the main features of medium run structural change but no changes in trade policies.

Recent research has demonstrated that growth can differ tremendously in its potential to reduce poverty both across countries and over time.[1] In high-inequality countries such as Brazil, even a slight worsening of the income distribution can imply that growth has very little impact on poverty. Ascertaining how trade liberalization affects the pattern of income growth is therefore a core part of the analysis of the nexus of trade and poverty in the longer run. A key factor determining such impacts is the labor market. Both changes in relative factor prices, as well as changes in endowments, play an important role in the medium- to long run.

[1] See Bourguignon (2003), Ravallion (2001), Ravallion and Datt (1999) or Kappel, Lay and Steiner (2005).

Changes in sectoral employment can also contribute significantly to poverty reduction, as they may enable people to escape low-wage poverty traps. There is considerable evidence on the existence of such poverty traps that can arise in the presence of discrete occupational and technology choices and fixed costs (Barrett 2004). Moving out of agriculture where poverty rates are often much higher than in other sectors is one example of this type of occupational choice, and one which is of particular interest in the Brazilian context where there has been a massive reduction in agricultural employment in recent years. This reduction in agricultural employment may have contributed to poverty reduction, as poverty rates among agricultural households are considerably higher than among non-agricultural households.

Trade liberalization is expected to favor agriculture in Brazil. By retaining workers in agriculture, it may thus work against the "natural" forces of structural change with an adverse impact on poverty reduction. On the other hand, trade liberalization may also relieve some of the pressure on non-agricultural incomes resulting from out-migration from agriculture as incomes in that sector rise. This ambiguity in the poverty impacts of trade reform illustrates the necessity of quantifying each of these transmission channels to evaluate the overall poverty and distributional impact of trade reform. The methodology used here combines a dynamic computable general equilibrium model with a micro-simulation model for Brazil. Using a time horizon of 15 years, a business as usual scenario as well as two counterfactual trade reform scenarios are developed in the CGE model and aggregate results on relative factor prices and resource movements from agricultural to non-agricultural sectors are linked to a micro-simulation. This macro-

micro modeling framework enables us to analyze the medium to long-term poverty and distributional impact of different growth patterns.

The chapter is structured as follows. We first provide some background information on the Brazilian case and motivate our approach. Then, we describe the macro and micro modules of the model. The results of our simulations are reported and commented in the following section. The last section summarizes and concludes.

1. Background and Motivation

The main objective of this chapter is to assess whether trade reform favors the Brazilian poor. It is therefore important to know who the poor are, where they live, and especially how they earn their living. In addition, it should prove helpful to identify economic trends that have been particularly important for the poor. Brazil's per capita income has remained stagnate for much of the past 25 years and the very unequal distribution of income has remained more or less unchanged. Accordingly, poverty in Brazil has remained fairly constant over the past 25 years (Bourguignon, Ferreira, and Lustig 2005; Verner 2004). In light of the substantial structural changes that have occurred over this period, especially increasing urbanization, a massive decline in agricultural employment, increasing unemployment, educational expansion, and demographic changes, this outcome appears "paradoxical" in the words of Bourguignon et al. (2005). Ferreira and Paes de Barros (2005) explore this apparent paradox using a micro-simulation approach and show that these various features of structural change have tended to offset one another when it comes to poverty and inequality impacts.[2]

[2] Note that their analysis compares the distribution of 1976 with the 1996 distribution. For detailed results see Ferreira and Paes de Barros (2005).

Poverty in Brazil varies considerably between regions, rural and urban areas, and city sizes, with poverty rates being particularly high in rural areas, small and medium sized towns, and the metropolitan peripheries of the North and the Northeast (Ferreira, Lanjouw, and Neri 2001). In 1996, the North and the Northeast accounted for 55 percent of the poor and for 34 percent of the Brazilian population. At the national level, about 20 percent of the population lived in rural areas contributing 35 percent of total poverty.[3] The high poverty rates in rural areas, particularly in the North and the Northeast, are related to the predominance of agriculture employment in these regions. The Northeast had the highest share of agriculture in aggregate employment in the year 2001, with 34 percent compared to only 11.5 percent in the Southeast.[4] According to Ferreira, Lanjouw, and Neri (2001), 20 percent of all households had a household head employed in agriculture and these households contributed 34 percent to overall poverty in 1996.

Changes in poverty also differ widely across regions and activities. Verner's (2004) PNAD-based[5] figures suggest that the poverty headcount in the Northeast declined from almost 60 percent in 1990 to 42.3 percent in 2001, whereas poverty in Brazil's most populous state Sao Paulo rose slightly from 8.6 to 9.4 percent during the same period. For urban areas, Ferreira and Paes de Barros (2005) show that extreme poverty increased between 1976 and 1996. In contrast, Paes de Barros (2004) reports that the poverty incidence among both rural households and those households engaged in

[3] Poverty is measured by the headcount ratio. The poverty figures in this paragraph are taken from Ferreira, Lanjouw, and Neri (2001).
[4] The figures on agricultural employment are own calculations based on the PNAD 1997 and the PNAD 2001.
[5] The PNAD (Pesquisa Nacional por Amostra de Domicílios) is a regularly conducted representative household survey. The sample had a size of about 380 000 individuals in 2001.

agricultural activities declined from levels of about 60 percent to around 50 percent between 1992 and 2001.

One important factor for understanding these developments is the structural change in Brazilian agriculture in the 1980s and 1990s. This has had both a profound impact on rural livelihoods and poverty in Brazil, as well as living conditions in the urban areas through the migration of rural labor to the cities. With the exception of Paes de Barros (2004), research efforts in this direction however have focused on agricultural performance rather than on how this performance affects people's livelihoods.

In their assessment of the impact of sector-specific as well as economy-wide reforms on Brazilian agriculture, Helfand and Rezende (2004) conclude that agriculture became one of the most dynamic sectors in the Brazilian economy. Between 1980 and 1998 real GDP grew by about 40 percent and real agricultural output by about 70 percent. In many sub-sectors, agricultural yields increased significantly and more the area devoted to export crops, in particular soybeans and sugarcane, was expanded. Agriculture benefited from a favorable macroeconomic environment and trade reforms that led to less industrial protection coupled with elimination of taxes and quantitative restrictions on agricultural exports. In addition, specific agricultural reforms: the reform of agricultural credit and price support policies, an agrarian reform program which included land reform, and, finally, the deregulation of domestic markets for agricultural goods, were important drivers of the observed agricultural performance.[6]

The increase in agricultural productivity however was accompanied by a massive lay-off of hired labor and by important changes in the size distribution of farms. According to the agricultural census from 1996, the number of small farms declined

dramatically and agricultural employment shrank by 23 percent between 1986 and 1996 -- although these figures should be taken with some caution (Helfand and Rezende 2004).

Non-agricultural activities appear to have compensated for the loss in agricultural employment in rural areas, but unemployment rates in urban areas have risen in that period (Dias and Amaral 2002). Our analysis based on the 1997 and 2001 household surveys (PNAD) suggests that this decline in agricultural employment has continued after 1996. In 2001, agriculture accounted for 20.6 percent of employment in Brazil down from 24.2 percent in 1997. Unemployment in rural areas has stayed constant at about 2.5 percent during this period, whereas urban unemployment has risen from 9.44 to 10.6 percent -- an increase that may be related to the decline in agricultural employment.[7]

Fewer agricultural employment opportunities may also be one of the reasons for further urbanization in Brazil, although it is difficult to establish this link empirically, as we explain in more detail later. The rural population declined sharply in the past decade, falling from 24.41 percent in 1991 to 21.64 percent in 1996 (IBGE 1997) and 16 percent in 2001 (PNAD 2001). The trends in rural poverty mentioned above suggest that the described developments have improved rural livelihoods. Nevertheless, poverty rates in rural areas remain well above urban poverty rates.

Future developments in agriculture are a subject of some debate, but it is likely that many of the recent trends, in particular the decline in agricultural employment and the modest increase in incomes from agriculture, will continue. We therefore incorporate

[6] See Helfand and Rezende (2004) and Dias and Amaral (2002) for details.

[7] Data from employment histories in the PNAD reveal that in both 1997 and 2001 about 6 percent of those who became unemployed in the last year were employed in agricultural sectors before. Taking into account the fact that approximately 20 percent of the workforce are employed in agriculture, this figure is rather low and may be taken as a sign that the rise in urban unemployment is not causally linked to the decline in agricultural employment.

them in our Business as Usual (BaU) scenario, against which the trade reform scenarios are to be judged.

Our analysis addresses the poverty and distributional impact of some of the structural changes that we consider particularly relevant for Brazil. We focus particularly on structural change in agriculture, and how this interacts with trade policies. Of course, the reader should bear in mind the fact that more than two-thirds of the Brazilian poor either live in urban areas or derive their income from non-agricultural activities, and our model devotes relatively less attention to how structural change might affect them.

2. The Modeling Framework

Our analytical framework consists of a sequentially dynamic CGE model that is linked to a micro-simulation. The micro-simulation takes the changes in factor and goods prices as given; hence, there is no feedback between these two parts of the model. We consider this framework particularly well-suited for the questions at hand, as the CGE model captures some of the main features of structural change and the relative price changes accompanying them. The micro-simulation, in turn, then allows for a detailed empirical assessment of the household responses to these changes.

2.1 The Macro Model

A 1997 Social Accounting Matrix (SAM) has been used as the initial benchmark equilibrium for the CGE model. This SAM has been assembled from various sources including the 1997 Input Output table, the earlier SAM assembled by Harrison, Rutherford, Tarr, and Gurgel (2003), and the 2001 PNAD household survey. For purposes of this model, the full SAM – which includes 41 sectors, 41 commodities, 12

factors (skilled and unskilled labor by gender and by farm and non-farm occupation, agricultural and non-agricultural capital, land and natural resources), an aggregate household account, and other accounts (government, savings and investment, and rest of the world) – has been aggregated to a smaller size of 17 sectors/commodities and 7 factors (skilled and unskilled labor by farm and non-farm occupation, capital, land and natural resources).

The CGE model is a standard neoclassical, recursive-dynamic general equilibrium model and the following subsections describe its main features. Given our focus on labor markets and dynamic structural trends, we focus our exposition on the modeling of factor markets and growth.[8]

Production: Output is produced using nested CES (Constant Elasticity of Substitution) functions that, at the top level, combine intermediate and value added aggregates. At the second level, intermediate inputs are obtained by combining all products in fixed proportions (Leontief structure), while value added is produced by aggregating the primary factors. At this level, primary factors are a capital-labor bundle and an aggregate land input. Lower levels of the production function disaggregate capital and labor, and then labor into different categories.

Income Distribution and Absorption: Labor income and capital earnings are allocated to households according to a fixed coefficient distribution matrix derived from the original SAM. As we will see below, one of the main advantages of using the micro-module is to enrich this rather crude macro distribution mechanism. Private consumption demand is obtained through maximization of household specific utility functions following the Linear Expenditure System (LES). Private savings are a fixed proportion of

income. Once the total value of private consumption is determined, government and investment demands[9] are disaggregated into sector demands according to fixed coefficient functions.

International Trade: The model assumes imperfect substitution among goods originating in different geographical areas.[10] Import demand results from a CES aggregation function of domestic and imported goods. Export supply is symmetrically modeled as a Constant Elasticity of Transformation (CET) function. Producers decide to allocate their output to domestic or foreign markets responding to relative prices. The assumptions of imperfect substitution and imperfect transformability grant a certain degree of autonomy of domestic prices with respect to foreign prices and prevent the model from generating corner solutions.

In order to facilitate the incorporation of shocks from the global CGE model (recall Chapter 3), we have added export demand functions so that the increased market access accompanying multilateral trade liberalization scenarios can be simulated more precisely.[11] No international import supply functions have been added; Brazil is treated as a price taker for its imports. The balance of payments equilibrium is determined by the equality of foreign savings (which are exogenous) to the value of the current account.

Factor Markets: Two types of labor are distinguished: skilled and unskilled. These categories are considered imperfectly substitutable inputs in the production process; moreover, some degree of factor market segmentation is assumed: capital and

[8] An even more detailed documentation for the macro model is found in Bussolo et al (2005).
[9] Aggregate investment is set equal to aggregate savings, while aggregate government expenditures are exogenously fixed.
[10] See Armington (1969) for details.
[11] We follow the Horridge/Zhai approach to shifting export demand, for more details see the appendix to Chapter 3.

land are perfectly mobile across sectors, natural resources are sector specific, and labor markets for the unskilled are segmented between agriculture and non-agriculture, whereas skilled workers are fully mobile.

The labor market specification is a key element of our model and an important driver of poverty and distributional results. Therefore, its specification calls for some clarification and justification. The segmentation of the labor market by skill has become a standard assumption in CGE modeling and it is easily justifiable for the case of Brazil. The inequalities of its society in terms of educational endowments and, more importantly, access to education and on-the-job training, certainly support this assumption, even over a longer time horizon.

The assumption that the market for unskilled labor is further segmented into agricultural and non-agricultural activities is more controversial – and particularly so in light of its importance for the poverty and distributional results. To test the validity of this assumption, we check whether incomes in agriculture are still below incomes in other sectors once the following wage determinants are controlled for: education, experience, gender, racial dummies, and employment-status variables such as self-employment, seasonal employment and employment in the informal sector. Additionally, to take into account price differentials across space, geographical variables capturing differences among Brazilian regions as well as a rural/urban dummy variable are included in the wage estimation.

We take the largest non-agricultural sector (in terms of employment), which is "other services", as our reference group. Our regression analysis shows that, relative to this reference group, *agricultural* labor incomes are significantly lower for individuals in

similar circumstances[12]. Underreporting of income, externalities linked to working in agriculture, and other factors may partially explain this negative bias in agricultural incomes; however, we believe this earnings gap is also due to barriers to mobility between agricultural and non-agricultural employment which prevent individual from moving out of the agricultural sector. Our econometric analysis (see also section 2.3) identifies two such barriers that are relevant over a medium run time horizon: land ownership and the specificity of human capital acquired in agricultural occupations.

Having found empirical support to the hypothesis that the Brazilian labor market for unskilled labor is segmented into agricultural and non-agricultural employment, we model the dual labor market for *unskilled* workers following the standard Harris-Todaro specification whereby the decision to migrate is a function of the expected income in the non agricultural (urban) segment relative to the expected income in the agricultural (rural) segment.

Model Closure: The equilibrium condition on the balance of payments is combined with the other closure conditions so that the model can be solved for each period. The government budget surplus is fixed and the household income tax schedule shifts in order to achieve this predetermined net fiscal position for the government. Secondly, investment must equal savings, which originate from households, corporations, government and rest of the world. Aggregate investment is set equal to aggregate savings, while aggregate government expenditures are exogenously fixed.

Growth equations: Sectoral shifts among agriculture and non-agriculture, and human capital upgrading, are two of the main features that have characterized recent

[12] Regression results are reported in the World Bank Policy Research Working Paper version of this chapter.

growth processes in Brazil, and indeed in most developing nations. To capture these features in a transparent and simple dynamic framework, productivity growth rates are calibrated separately for the agriculture and non-agriculture sectors. Brazilian agriculture has recorded high productivity growth historically, and we impose this *exogenous* historical growth rate for productivity in agriculture uniformly across all factors in that sector. In contrast, the growth rate of productivity for non-agriculture sector is calibrated by imposing an exogenous growth path for real GDP. This dynamic calibration results in the observed labor savings in agriculture production trends of the past decade continuing in the forecasting period. [13] Other elements of simple dynamics include exogenous growth of labor supply, with skilled labor growing faster than unskilled labor, and investment driven capital accumulation.

2.2 The Microsimulation Model

The micro model is linked to the macro model through changes in the following set of endogenous variables: (a) changes in agricultural and non-agricultural labor income of unskilled labor (2 variables); (b) changes in labor income of skilled labor (1 variable); (c) changes in the sectoral (agriculture vs. non-agriculture) composition of the unskilled workforce (1 variable). In addition, we take into account the fact that unskilled and skilled labor supplies grow at different rates. In the micro-simulation, we do not produce a series of cross-sections through time, but only simulate one cross-section that reflects the cumulative changes in the aforementioned exogenous and endogenous variables over the entire period from 2001 to 2015. In accordance with the structure of the CGE model,

[13] Additional support for this treatment of productivity comes from a recent panel study on sectoral productivity growth in OECD and developing countries (Martin and Mitra, 1999). In this study, depending

the micro model simulates the decision to move from agriculture into non-agriculture sectors only for unskilled workers.

The micro-simulation module consists of a set of equations that describe the income generation process of the household. It includes logit equations for moving out of agriculture, estimated separately for household heads and non-heads. We also estimate wage/profit equations, separately, for unskilled agricultural, unskilled non-agricultural, and skilled labor using Ordinary Least Squares. Together, the mover-stayer model and the wage-profit equations provide the basis for the micro-simulation of household level outcomes. The left-hand side variable of the mover-stayer model is a dichotomous variable that assumes a value of 1 if an individual has moved out of agriculture during the past 12 months, and 0 otherwise. The model is estimated on a sample that includes stayers in agriculture along with last year's movers. We provide an overview of key estimation results below. The wage-profit equations explain between 30 and 50 percent of variability of log wages-profits using a relatively short list of explanatory variables, including education, work experience, gender, racial, and regional dummies. In the estimation of agricultural wages and profits, we also control for the number of non-remunerated household members.

The 2001-2015 micro-simulation involves three steps. First, households are re-weighted in order to reflect the change in the skilled/unskilled labor ratio, as predicted by the CGE model over this period. In a second step, unskilled labor moves out of agriculture until the new share of unskilled labor in agriculture given by the CGE is reproduced. Third, wages and profits are adjusted according to the CGE results, taking

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on the estimation method, the average growth rate for agriculture TFP in middle-income developing countries ranges from 1.78 to 2.91 (in % per year).

into account the changes in the skill composition of the workforce as well as the sectoral movements of unskilled labor from agriculture into non-agricultural sectors. In sum, by using the estimated equations, the micro-simulation is "forced" to reproduce the aggregate results for employment and wage changes generated by the CGE model. Technically, this requires changing the constants in each of the equations.[14]

To account for total household income, in addition to labor income, we consider transfer and capital income as reported in the PNAD. Transfer income is scaled up or down according to the GDP per capita growth rate and capital income is adjusted according to the change in the rental rate on capital as reported in the CGE model. The sum of all household members' individual incomes is divided by the number of household members to give the household income per capita. We develop regional poverty lines by taking the R$80 per capita poverty line (in current 2001 prices) for urban Rio de Janeiro as a basis and adjusting it for regional price differences following Paes de Barros (2004).

2.3 Who moves out of agriculture?

The "employment history" section of the PNAD is key to our analysis of the decision to move out of agriculture. This information, which is non-existent in most other countries' household surveys, offers the information that is needed for estimating the intersectoral migration choice model. In this section the PNAD provides additional data that allows us to identify the movers out of agriculture and, very important for our undertaking, the characteristics of these individuals at the time of moving. For example,

[14] A complete description of micro-simulation model, including the estimation of the wage\profit equations and the migration choice equations, as well as the reweighing procedure and the other steps is found in Bussolo et al (2005).

we know which type of land right they had and whether they were self-employed before they moved out of agriculture. To our knowledge, this information has not been previously exploited by researchers, and it is key to our findings.

Estimation of the mover-stayer model using these data allows us to highlight the main factors affecting the propensity to move out of agriculture. For both heads and non-heads of households, a higher level of educational attainment positively influences this propensity, whereas age is one of the most significant factors that negatively affects the choice of moving. As one would expect, older individuals are less likely to move out of agriculture. Owning land or other agricultural production factors, such as livestock, also appears to act as important barrier to intersectoral movements. Finally, household heads from the North are more likely to move out of agriculture than those elsewhere in Brazil.

Household heads appear to respond to intersectoral wage differentials to a lesser degree than other family members, thus showing a tendency to be "trapped" in agricultural activities, possibly due to factor market imperfections. Their decision to stay or move however is of great importance for the choice of other household members. For these individuals, the strongest determinant of moving out of agriculture is a dummy indicating whether the household head is employed in a non-agricultural sector. Furthermore, the decision on the part of the household head to leave agriculture also strongly influences the choice of the non-heads. Non-remunerated non-heads of households are less likely to move out of agriculture, a finding that points towards the importance of positive externalities associated to this type of agricultural employment.

3. Brazil in the Next Decade: A Baseline Scenario

A central question of this chapter is assessing the poverty effects of trade policy reforms over the longer run, when the forces of structural adjustment shape the income generation process. Our starting point is the CGE model which is used to build a business as usual scenario depicting the evolution of the Brazilian economy over the next decade. This baseline scenario should not be considered as a statistical forecast, but rather as a consistent "projection" of the economy in a future where inter-sectoral productivity growth differentials, skill upgrading, and migration of labor out of farming activities play major roles. This Business as Usual (BaU) scenario sets the backdrop against which we may evaluate the alternative scenarios involving trade policy reforms. In the following subsections, we describe in detail the macro and micro results for the BaU and trade scenarios.

3.1 Macroeconomic characteristics of the baseline

In the BaU scenario, real GDP for Brazil is projected to grow (from 2005 onwards) at the annual rate of 3.3%; this is optimistic when compared with the recent two decades' (1980-2000) rate of 2%. The projected GDP growth performance is supported by strong factor productivity growth rates. As explained above, productivity in the agriculture sector is assumed to be factor neutral and its growth rate is exogenously set at 2.9% per year; in the non-farm sectors, growth of labor productivity is calibrated at 1.02% per year and growth of capital productivity at 0.82% per year.

The changes in the structure of labor markets, shown in Table 9.1, are of particular relevance for poverty and income distribution trends. As can be seen, the differences in productivity growth rates across sectors, combined with faster growth in

the supply of skilled versus unskilled labor (education increases the supply of skilled workers which is growing at a 2.0% annual rate versus a yearly 1.6% growth rate for the unskilled labor supply), combine to generate structural adjustments in line with those observed for the last decade. This includes continued out-migration of unskilled workers from agriculture. The declining labor demand in agriculture is driven by three factors: the relatively higher rate of labor productivity growth in agriculture relative to the rest of the economy; an income elasticity of private consumption for agricultural commodities that is less than one; and, finally, international prices for traded agricultural products are decrease through time in our business as usual scenario.

These trends in the supply and demand for labor are equilibrated by movements in relative wages. Over the next decade, real wages of skilled labor are projected to increase at 1.3% annually. In non-agricultural sectors, wages for unskilled workers increase at the annual rate of 0.9%, however their upward trend is dampened by migration of unskilled workers from agriculture. The latter contributes to a five percentage point reduction in agricultural labor supply, leading to higher agricultural wages, which are grow at an annual rate of 1.7% over the baseline period, thereby narrowing the agr-nonagr wage gap.

The BaU macroeconomic market trends are linked to developments at the sectoral level shown in Table 9.2). Output growth rates are slightly lower for the agricultural sectors than for the non-agricultural ones. Agriculture exports grow at a slightly lower pace than non-agriculture exports due to falling primary commodity international prices in the BaU scenario. In addition, productivity gains dictate that fewer workers are needed to achieve the same output. Meanwhile, rising wages, in particular for unskilled workers, induce producers to substitute skilled workers for unskilled ones. The rightmost panel of

the table shows the relative skill intensities and employment sizes of each sector. Services are the largest employers of both skilled and unskilled workers but, on average, they use skilled labor more intensively. Agriculture employs almost a third of unskilled workers and uses this factor quite intensively, whereas manufacturing labor intensities fall in-between agriculture and services.

3.2 Distributional and Poverty Results for the BaU

Micro-simulation of these structural trends using the linking variables described above and Brazilian household data results in a moderate decrease in poverty between 2001 and 2015. Considering the full sample of households, the headcount poverty ratio (P0) declines by about 6 percentage points under the BaU scenario (see Table 9.3). The reductions in the average normalized poverty gap (P1) and the poverty severity index (P2) indicate that those who remain poor also become better off, thereby reducing the gap to the poverty line.[15] Inequality changes very little, as indicated by the 0.1 decrease in Gini coefficient. These indices all indicate that some progress in reducing aggregate poverty and inequality would be achieved in a Business as Usual scenario, but these aggregate measures may conceal relevant distributional changes at a more disaggregated level.

Perhaps the most obvious way to gather more detailed information is to analyze the poverty and inequality impacts separately for the agricultural and non-agricultural households. A household is classified as "agricultural" when its head or at least two of its

[15] A short note on the interpretation of the reported poverty measures: The income-gap ratio, i.e. average income shortfall (of the poor) divided by the poverty line, can be calculated as P1/P0. This ratio is 0.4 for all households in our case, i.e. the perfectly targeted cash transfer needed to lift every poor person out of poverty is 40 percent of the poverty line. Thus, 0.4 times the percentage point change in P0 (here 2.4) provides a percentage point change benchmark for evaluating the change in P1, as this would be the change

members are employed in agriculture. According to this classification, in 2001 agricultural households accounted for 18.2 percent of the Brazilian population, poverty incidence among them reached nearly 50 percent, and their contribution to total poverty was about 36 percent (see Table 9.3). Between 2001 and 2015, the share of agricultural households in the population is projected to shrink by 3.3 percentage points following the decline in agricultural employment of more than 5 percentage points. Poverty among agricultural households falls by more than 13 percentage points (of agricultural population), whereas poverty among non-agricultural households decreases by only 3.1 percent. Accordingly, the contribution of agricultural households to the headcount falls by almost 9 percentage points.

A more detailed analysis also shows that the lack of progress in aggregate inequality is due to the fact that the agricultural and non-agricultural groups' individual inequality indicators move in opposite directions. Among non-agricultural households, inequality rises because skilled labor earnings, a major source of income for these households, grows faster than earnings from unskilled labor. Conversely, inequality among agricultural households falls, mainly because richer agricultural households earn a higher share of their income from non-agricultural labor.

Another way of analyzing detailed distributional effects is to consider growth incidence curves. These curves plot per capita income growth at income percentiles (Ravallion and Chen, 2003) and are shown in Figure 9.1 for all households as well as for the agricultural and non-agricultural sub-groups.[16] Per capita income growth is much

in P1 that we would observe had the average income of the poor stayed constant while the headcount declined.

[16] The household category, i.e. agricultural or non-agricultural household, is the category the household belonged to in the base year 2001.

higher for agricultural households, reflecting the increase in unskilled agricultural wages from the CGE model's results,. In addition, the agricultural growth incidence curve illustrates a strong pro-poor distributional shift. The agricultural households' distributional shifts also explain the pro-poor changes in the national income distribution, since only minor distributional changes are registered in the non-agricultural distribution. However, richer non-agricultural households experience somewhat higher gains than poorer households. Incomes for the poor non-agricultural household increase by a meager 1 to 1.5 percent annually.

These more detailed analyses of the long term evolution of the Brazilian income distribution highlight the different roles played by changes in inequality and shifts in the growth rates of the average incomes. The following two questions then arise: if the current (2001) distribution of income were to remain unchanged, to what extent would the additional growth under the BaU contribute to reducing poverty? And, what is the role of the BaU sectoral differential in growth rates for agriculture and non-agriculture in reducing poverty?

Answering these questions requires performing two additional micro-simulations as follows. The first simulation generates a counterfactual distribution under the assumption that all incomes out of all sources grow by 1.5 percent annually. This implies shifting the entire income distribution "to the right" leaving its shape unchanged. Individuals do not change employment sectors and hence households retain their initial non-agricultural or agricultural classification. Results from this simulation are presented in Table 9.4 and changes are given as a percentage share of the BaU change (column I). In addition, we simulated a second set of counterfactual distributions for agricultural and

non-agricultural households separately with per capita incomes of the respective household types growing with the BaU rates, i.e. by 1.3 percent annually for non-agricultural and 2.4 percent annually for the agricultural households (column II).

Comparison of the counterfactual simulations of the "completely" distributionally neutral (column I) and the "separately" neutral (column II) scenarios shows that the growth bias in favor of agricultural households is poverty reducing. Yet, the difference between the BaU and the completely neutral scenario does not seem too pronounced. This is due to the fact that in the latter poverty among non-agricultural households is reduced much more than in the BaU, where the income distribution among these households worsens. This "slight" worsening of the income distribution significantly hampers the potential of growth to reduce poverty among non-agricultural households. In addition, the differences between the two neutral scenarios for non-agricultural households illustrate that a 0.2 percentage point difference in annual growth rates for 14 years can make a substantial difference in terms of poverty reduction.

The last two columns of Table 9.4 illustrate the importance of growth for reducing poverty among agricultural households as well. A 0.9 point percentage point difference in annual income growth rates for 14 years implies a reduction of about 5 percentage points in the headcount over this time period. In contrast to what we see for non-agricultural households, the impact of the pro-poor distributional shift for agricultural households observed in the BaU is relatively small. In other words, had the income distribution among agricultural households not improved, growth would have reduced poverty by only little less.

The poverty reductions recorded in the BaU scenario are due a combination of factors including: the change in skill endowments, the increase in real factor prices, and the inter-sectoral movement of workers. A main advantage of micro-simulation is the ability to decompose the total effect in different partial effects that can be attributed to single causes. A slight complication arises because of the interaction effect between these three factors since incomes increase at different rates in agricultural and non-agricultural sectors. By simulating counterfactual distributions, with only one or two of these changes included, it is possible to decompose the total effect into individual or joint (interactive) contributions and we turn now to such a decomposition.

Figure 9.2 displays the results of the poverty decomposition for the BaU scenario. Factor price changes account for the largest share of total poverty reduction. The change in the composition of the workforce (skill upgrading) does not contribute much to poverty reduction, whereas the sectoral shifts in the workforce are quite important, in particular for the poorest of the poor, as the higher contribution of the sectoral change component with regard to P2 indicates. This is because households with members moving out of the agricultural sector tend to escape poverty. The interaction component hampers poverty reduction (negative contribution in Figure 9.2) since people moving out of agriculture experience a lesser rate of increase in their incomes over the BaU timeframe.

In sum, our distributional and poverty analysis suggests that the BaU scenario leads to modest poverty reduction. Agricultural households fare relatively well and the poverty incidence and intensity among them is reduced quite substantially. Decomposition analyses show that sectoral change contributes quite significantly to

poverty reduction, although factor income growth is the most important source of poverty reduction. Micro-accounting exercises underline the importance of growth for poverty reduction, but we also illustrate that small increases in inequality can considerably reduce the poverty reduction potential of growth in the context of a high-inequality country, such as Brazil. With this background, we now turn to the central question of this book, namley: Can this rate of poverty reduction be enhanced by global trade reforms?

4. Macroeconomic Impacts of Trade Reforms

The trade shocks simulated in the dynamic CGE model consist of changes in Brazilian tariff protection against imports from the rest of the world and of exogenous changes of international prices of traded goods and export quantities demanded by foreigners.[17] The shocks are assumed to take place progressively through a gradual phasing-in starting in 2005 and lasting 6 years. Table 9.5 displays these shocks as percentage changes of the final year (2015) between the BaU and the trade reform scenarios. In keeping with the other chapters in this volume, we keep the government fiscal balance unchanged, so tariff revenue losses are compensated by a an equi-proportional direct tax paid by households. This tax is the least distortionary instrument that can be readily used in our model; however, in practice, the Brazilian government may chose other forms of compensatory taxes which may alter relative prices and have significant income distribution effects as explored in other chapters in this volume.

[17] It should be noted that to mimic the global model results for increased demand for Brazilian exports and changes in international prices, we introduce a downward sloping export demand function as shown in equation (1) above. During a shock, for obvious reasons, we cannot target both prices and quantities and the shock is implemented by modifying both the international price index (the price shock) and the intercept (the quantity shock). Our Brazil (single-country) model will then endogenously determine the quantity supplied. See footnote 11 for more detail.

The full liberalization scenario has the largest impacts: tariffs are completely eliminated and Brazil enjoys strong terms of trade gains; the Doha shocks generate almost no tariff cuts in Brazil due to the extensive binding overhang (recall Chapter 2) and they are accompanied by fairly muted global price effects. In order to fully anticipate their final effects, these shocks need to be mapped to the economic structure of Brazil.

Table 9.6 presents this structure. For instance, in the full liberalization scenario, export oriented sectors – those displaying high shares of export to domestic output – such as Oilseeds, Other Crops and the industrial sectors transforming agricultural products (*AgriIndustriesExp* which buys most of its inputs from agriculture) record considerable increases of their export prices. Conversely, import competing sectors, such as Chemicals and Oil derived products and capital goods, do not face high increases in their international prices. These combined export and import price movements result in strongly favorable terms of trade gains, inducing significant reallocation of resources towards export oriented sectors. Additional push for this reallocation comes from Brazil's own liberalization which entails a reduction of the anti-export bias implicit in the higher protection rates for manufacturing of the initial tariff structure. The sectoral effects project in the wake of trade reforms are detailed in the complete elimination of tariffs in the full liberalization case explains the large increase of imports (measured in volume) which, in the final year of this scenario, is 21% above the value in the same year of the BaU. Increases in imports of agricultural goods are much weaker: an aggregate 6% increase versus the 21% surge of the non-agriculture bundle. The combination of lower initial tariffs and stronger international price increases for agriculture, relative to non-

agriculture, explain the difference in import response of these two broad sectors of the Brazilian economy. Given the very limited scope of tariff reductions under the Doha scenario import changes are much smaller.

With a relatively high elasticity of substitution in demand (set uniformly at 4), cheaper imports have the potential to displace domestic production, especially for those goods whose demand is fulfilled by a large share of foreign supply. For Brazil, this is the case for the Chemicals, and Capital goods sectors. In the full liberalization scenario, domestic production experiences significant output reductions in these sectors; however this does not happen in the Doha scenario where Brazilian tariffs are hardly reduced. The competition from cheaper imports is also reflected – again only for the full liberalization case – in the decline of prices of domestic output.

These import/demand side effects are linked to the supply response to which we now turn. For producers of exportable goods, the reduction of prices in local markets combined with unchanged or rising export prices creates incentives to increase the share of sales to foreign markets. This export response (shown in the columns "Export Volumes") varies across sectors and it is linked to the pattern of Brazil's comparative advantage and to the increase in international prices. Brazil's comparative advantage can be ascertained by considering the export orientation (Exports/Dom. Output) column in Table 9.6, which highlights three sectors in particular: Oilseeds, Other Crops, and the Agricultural transformation industry. These sectors – which also enjoy large jumps in their international price – experience export surges. Due to the generally positive export price shocks, other sectors join in an overall expansion of supply to foreign markets. Rising export sales more than offset, or at least compensate, reductions of domestic sales

and lead to changes observed in the columns labeled "Domestic Output". Given the foreign closure rule for the Brazilian model, economy wide increases of import volumes are balanced by a comparable increase in exports.[18]

In summary, trade reforms promote a production structure specialized towards exportables, which in Brazil translates into a specialization towards primary or agricultural transformation sectors. This agriculture export-led boom is fully achieved only in the full liberalization scenario, where domestic tariffs are fully eliminated and we see strong international price changes.[19] Changes in factor markets are the most important aspect of the structural adjustment caused by trade reform – from the point of view of poverty and income distribution. Changes in wages and sectoral employment are linked to changes of goods prices through the production technology and the functioning of the factor markets. A key aspect of the different production technologies is the difference in factor intensity across sectors shown in Table 9.2. Recall that we seek to mimic realistic adjustment possibilities in the labor market by assuming that skilled workers can freely move across all sectors, whereas unskilled ones face two segmented markets and can just imperfectly migrate from the agriculture to the non agriculture segment. Due to the boom in agriculture, which is very intensive in unskilled labor, the full trade liberalization induces a significant increase in the wage rate for unskilled workers (Table 9.8). When

[18] Due to the closure rule of the external account, namely the fixing of foreign savings, and the full employment assumption, the slightly lower expansion of the volumes of exports, with respect to import volumes is compensated with a real exchange rate appreciation which originates from rising domestic resource costs.

[19] When they simulate analogous trade reforms, Harrison et al (2003), generate comparable sectoral reallocation results, as well as factor market outcomes, shown below. This consistency should not be surprising given that our model does not significantly differ from theirs and the initial sectoral bias in the Brazilian tariff structure as well as inter-sectoral factor intensities are very close in the two approaches.

It should be stressed that in our model trade opening only produces allocative efficiency gains and not other, potentially stronger dynamic productivity gains as are explored in the final chapter in this volume authored by Anderson, Martin and van der Mensbrugghe.

compared with the BaU, the yearly rate of growth of wage of unskilled workers in agriculture is 0.4 percentage points higher, and this results in a cumulative 14 year growth of 34% – much higher than the cumulative growth of 26% under BaU. Given higher agricultural wages, migration decreases. About 340 thousands workers who moved out of agriculture in the BaU scenario no longer do so in the full liberalization case. This has some effect on the aggregate distribution of unskilled workers between agriculture and non-agriculture, as shown in the last column of Table 9.8. The Doha effects are much weaker.

5. Distributional and Poverty Impacts of Trade Reform

Two fundamental results emerge from analyzing the micro impacts of the trade scenarios. Firstly, our initial hypothesis that trade liberalization, by working against the "natural" forces of structural change, might weaken long term poverty reduction has been soundly rejected. Although fewer people migrate towards higher paid non-agricultural jobs, poverty is further reduced in the trade liberalization scenarios -- largely through increased agricultural incomes. However, and this is the second fundamental result, trade reform as envisaged in the core Doha scenario for this book – but even in the hypothetical full liberalization one – is pales in importance in the fight against poverty in the face of the overall assumptions about productivity and economic growth that govern the BaU scenario. The full liberalization scenario leads to a further reduction in the headcount poverty index of 0.5 percentage points, whereas for the Doha scenario the effects are almost negligible. Of course such trade reforms may well affect the rate of productivity

growth -- and hence the fundamental determinants of the BaU outcome -- but this linkage is not explored here.

As for the BaU scenario, a thorough assessment of the trade scenarios needs to go beyond these aggregate indicators and should rely on more disaggregate poverty and distributional analyses. In search of trade-induced poverty effects, the remaining part of this section considers an array of indicators, from growth incidence curves to poverty statistics estimated on specific sub–samples of the survey data. In particular, poverty and distributional impacts are separately measured for the agricultural and non-agricultural groups, the movers and stayers, the rural and urban populations, the regional samples, and the groupings obtained by educational attainment, by land ownership, and by occupational status.

Figure 9.3 shows the growth incidence curves for the poorest thirty percent of all households under the three scenarios. The curve for the Doha scenario lies slightly above the BaU curve. The full liberalization reform also shifts the whole curve upwards, however this shift is larger than that of the Doha case, and it seems to favor the poorest among the poor; in other words, full liberalization appears to induce an additional pro-poor distributional shift, resulting from Brazil's own-liberalization in the Full-Lib package of reforms.

Table 9.9 shows the sectorally disaggregated results. Inequality for all households falls due to decreased inequality among agricultural households and lower inequality increase among non-agricultural households, although inequality between these two groups may have risen somewhat. Despite declining inequality and slightly higher per capita income growth, the rate of poverty reduction for agricultural households barely

changes. This is due to the lower migration levels induced by the trade shocks (see below). Indeed, in the Doha scenario, the reduction in the population share of agricultural households is only very slightly below that achieved in the BaU scenario. More remarkable is the additional poverty reduction for non-agricultural households that can largely be explained by a decrease in inequality, as per capita income growth is only marginally higher under trade reform.

Given its larger price and quantities shocks, the full liberalization scenario yields more significant poverty changes, as shown in the bottom panel of Table 9.9. In contrast to the Doha scenario, agricultural households gain considerably from full liberalization and their headcount index is reduced by almost 1.5 percentage points. These sector specific income gains more than compensate the further (albeit small) reduction of agricultural out-migration.

For non-agricultural households, the full liberalization scenario improves the income distribution, the Gini increases by only 72 per cent of the increase recorded in the BaU. Growth is only slightly higher for this group of households but, as shown above, minor distributional shifts accompanied by slightly higher growth can result in significant poverty reduction.

Trade shocks simultaneously increase agricultural incomes and reduce inter-sectoral migration and how these two contrasting forces affect poverty outcome depends on the income levels (and therefore on the socio-economic characteristics) of those who decide to stay instead of moving. Table 9.10 sheds some light on this issue. It shows the poverty levels and changes under the BaU and trade scenarios for agricultural households according to their migration decision. The top panel shows those who *remained* in

agriculture, i.e. the "stayers". First consider the BaU case. Having identified those households that will not move, it is possible to calculate the headcount for this group in the initial year (2001): their poverty headcount is equal to 44.1% -- more than 2 percentage points below the 46.2 level[20] calculated for all 2001 agricultural households (i.e., the combination of stayers and potential movers). This lower *level* of poverty implies that moving households are on average poorer than those who remain in agriculture. Accordingly, the *changes* in P0 are 12.1 instead of 13.7 percentage points. In 2015, about 15 percent of the population still reside in agricultural households under the BaU scenario.[21] The agricultural expansion following trade liberalization has only a minor effect on agricultural employment – not nearly enough to offset the reduction in agricultural employment under the BaU. Accordingly, the change in the share of agricultural households due to trade liberalization is only minor, in particular for the Doha scenario. Yet, when translated into actual migrating individuals, this small share change means that almost four hundred thousand individuals – those who would have become members of non-agricultural households in the BaU – remain in agricultural households under the full liberalization scenario. Despite the fact that these "potential mover households" are on average poorer than the typical "stayer household", as we illustrate below, poverty among agricultural households decreases compared to the BaU. Hence we can infer that the relatively poor stayers gain under both trade scenarios -- although this gain is very small for the Doha scenario.

[20] Shown in
Table 9.3.

[21] The initial poverty levels among those who stay in agriculture under the trade scenarios are almost identical to the initial levels among the BaU stayers, so we decided not to report them. The same holds for the movers, for whom we report results later.

As indirectly inferred by the analysis of the stayers, the group of movers are expected to experience the largest welfare gains. Indeed as illustrated in bottom panel of Table 9.9a., under BaU, agricultural households who become non-agricultural households record a 22.4 percentage points reduction in their headcount index, down from a considerably higher initial level of 53.4 percent. This is a critical insight uniquely available through the use of the micro-simulation approach. The predicted additional poverty reduction for this group of mover households under the trade scenarios is modest and attributable to the income increases trade reforms induce in the non-agriculture sectors as well as due to the fact that the households that still move out of agriculture under the trade scenarios are actually poorer, on average.

One final category needs to be examined: the non-agricultural stayers. This is a large group, representing 80 percent of the population; however, given the negligible migration out of the non-agricultural sector observed in the data, this group is explicitly excluded from the migration choice. For these households, full liberalization brings about an additional reduction in the poverty headcount of 0.4 percentage points[22], and the Doha scenario, through its favorable impact on non-agricultural unskilled wages, also makes a small but positive contribution.

6. Conclusions

Our analysis suggests that the economic effects of the Doha round are rather limited for Brazil, in part due to the lack of tariff cuts in Brazil itself. Yet, through a slight improvement in the urban income distribution, the Doha scenario has some positive

[22] The 0.4 percentage points are calculated using Table 9.9. figures: 0.4 = – 3.8 – (-3.8/100 x 110.7/100) x 100

effect on poverty. In contrast, by adding domestic trade reforms, and deepening reforms elsewhere, the full liberalization scenario implies quite substantial welfare gains that are concentrated among some of the poorest groups of the country, in particular those in agriculture. Consequently, the rural poor in Brazil benefit more than the average. This result is driven by the export boom in agriculture and agricultural processing industries, growing labor demand and associated higher wages. Following full liberalization, a smaller number of workers remain in agriculture compared to the BaU. Given that inter-sectoral migration substantially improves the income situation of many household under the baseline, one might conjecture that full liberalization would weaken poverty reduction. However, this is not the case, as the gain in agricultural incomes more than compensates for the reduced benefits from lower migration flows.

The positive impact of full liberalization is not limited to rural areas and non-agricultural activities. The urban poor gain from higher unskilled wages, even in non-agricultural sectors. This is reflected in the pro-poor shift in the urban income distribution. In addition, the urban poor benefit indirectly from the gains in agriculture, as the pressure on non-agricultural unskilled is relieved somewhat. Trade reform, and in particular domestic trade reforms, may particularly help the Brazilian poor farmers, but only broad-based high growth will eradicate urban poverty.

An important limitation of our analysis is that we do not consider the potential interactions between trade liberalization and the rate of productivity growth in Brazil. The latter is assume to be exogenous, and fixed at its BaU level for all scenarios. It is this growth rate that fuels the strong poverty reduction in the baseline scenario. Given the growing evidence of a beneficial impact of trade liberalization on productivity (Winters,

McCulloch, and McKay 2004; see also the chapter in this book by Anderson, Martin and van der Mensbrugghe), we must admit that our assessment of the potential for additional poverty reduction in the wake of a Doha round is on the conservative side. Nonetheless, significant reductions in poverty beyond that achieved in the BaU scenario will likely require additional, complementary reforms. Based on the mover-stayer analysis in this chapter, policies aimed at facilitating the movement of the poorest rural households out of agriculture could be particularly beneficial.

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Table 9.1: Medium term labor market structural adjustments

	Producti-vity of L	Income Elast of Demand	Employment		Wages		Unskilled Lab Migration as % of:		Cumulative Migration
			Skilled	Unskilled	Skilled	Unskilled	Sending Pop	Receiv-ing Pop	2001-2015
	Yearly gr	constant	Yearly growth rates				Yearly %		Millions
Agri	2.9	0.54		0.0		1.7	1.7		-4.0
Non-Agri	1.0	1.05		2.2		0.9		0.5	4.0
Economywide			2.0	1.7	1.3				

Source: Authors' calculations

Table 9.2: BaU's output and trade sectoral growth rates, and employment intensities

	Annual average growth rates					Employment percentages			
				Labor Demand		by sector		by skill	
	Output	Imports	Exports	Skilled	Unsk.	Skilled	Unsk.	Skilled	Unsk.
CerealGrains	3.2	2.5	2.3	0.3	0.1	0	5	2	98
OilSeeds	3.1	2.2	2.4	0.1	-0.1	0	1	6	94
RawSugar	3.2			0.2	0.1	0	1	4	96
OtherCrops	2.9	1.3	2.5	0.0	-0.1	1	12	3	97
Livestock	3.2	1.5		0.3	0.1	2	4	10	90
RawAnimalProducts	3.3	2.5	1.6	0.4	0.3	0	3	1	99
OilMinerals	3.3	3.0	2.9	1.5	1.7	0	0	15	85
LightManufacturing	3.3	0.8	3.7	1.0	1.2	1	2	16	84
AgriIndustriesExp	3.2	0.5	3.4	1.0	1.2	2	3	16	84
WoodProductsPaper	3.3	0.9	3.5	1.0	1.2	2	2	15	85
ChemicalsOilPr	3.3	1.8	2.9	1.1	1.3	2	1	30	70
MetalMineralProducts	3.5	1.8	3.3	1.2	1.4	2	2	17	83
MachineryEquipment	3.6	1.9	3.5	1.4	1.6	3	2	28	72
OtherServices	3.0	2.6	1.7	2.1	2.3	58	30	33	67
Construction	3.2			2.3	2.5	2	8	6	94
TradeCommunication	3.1	2.4	1.8	2.2	2.4	15	18	17	83
PublicServices	3.1	2.7	1.7	2.2	2.4	9	4	41	59
Agri	3.0	1.9	2.4		0.0	4	27	6	94
Non-Agri	3.2	2.0	3.1		2.2	96	73	26	74
Economywide	3.2	2.0	3.1	2.0		100	100	24	76

Source: Authors' calculations.

Table 9.3: Poverty and inequality in the BaU scenario, by sectors

	All households		Non-agricultural households		Agricultural households	
	2001 level	2001-15 change	2001 level	2001-15 change	2001 level	2001-15 change
PC income	314.9	1.5	351.9	1.2	148.3	2.3
Gini	58.6	-0.1	57.1	0.6	56.6	-0.7
P0	23.6	-5.6	18.6	-3.1	46.2	-13.8
P1	9.6	-3.0	7.1	-1.6	21.0	-8.0
P2	5.3	-1.8	3.7	-0.9	12.3	-5.2
Population %	100		81.8	3.3	18.2	-3.3
Contr. to P0			64.4	8.8	35.6	-8.8

Source: Authors' calculations. Note: PC income is per capita income in 2001 R$ and the change is given as annual growth rate. All levels are in percent and changes in percentage points.

Table 9.4: Poverty and inequality in a distributionally neutral scenario

	All households			Non-agricultural households			Agricultural households		
	2001 level	% of BaU change I	% of BaU change II	2001 level	% of BaU change I	% of BaU change II	2001 level	% of BaU change I	% of BaU change II
PC income	314.9	100.0	100.0	351.9	117.7	98.6	148.3	65.7	102.9
Gini	58.6	7.8	7.8	57.1	-6.6	-6.6	56.6	-1.8	-1.8
P0	23.6	91.7	102.4	18.6	139.8	133.3	45.9	56.5	90.5
P1	9.6	90.9	97.7	7.1	132.5	119.7	20.8	61.9	93.2
P2	5.3	86.8	97.9	3.7	125.6	114.3	12.1	62.6	93.4

Source: Authors' calculations. Note: this table shows results for two micro-simulations. The first simulation generates a counterfactual distribution under the assumption that all incomes out of all sources grow by 1.5 percent annually. This implies shifting the entire income distribution "to the right" leaving its shape unchanged. Individuals do not change employment sectors and hence households retain their initial non-agricultural or agricultural classification. Results are presented in column 'change I' as percentage share of the BaU change (where in fact households change occupations and experience different gains according to the structure of their income sources). In the second counterfactual, distribution for agricultural and non-agricultural households is shifted separately using per capita incomes growth rates of the respective household types (i.e. 1.3 percent annually for non-agricultural and 2.4 percent annually for the agricultural households), and results are shown in column 'change II'.

Table 9.5: Trade shock – Tariff reductions and international price changes (%)

	Own Tariff reductions		Change in import prices		Change in export prices	
	Full Liber.	Doha	Full Liber.	Doha	Full Liber.	Doha
CerealGrains	-100		8	2.1	16	6.0
OilSeeds	-100		6	2.5	14	4.9
RawSugar			2	1.0	14	5.4
OtherCrops	-100	0	2	0.9	13	4.8
Livestock	-100		2	1.1	25	9.8
RawAnimalProducts	-100		2	0.4	18	6.7
OilMinerals	-100		0	0.1	2	1.3
LightManufacturing	-100	0	1	1.2	9	4.0
AgriIndustriesExp	-100	-1	0	0.6	7	3.2
WoodProductsPaper	-100	-2	0	0.0	4	2.0
ChemicalsOilPr	-100	-3	-1	0.0	3	1.7
MetalMineralProducts	-100	-1	0	0.0	3	1.7
MachineryEquipment	-100	-2	0	0.0	2	1.7
OtherServices			0	0.0	5	2.2
Construction			0	0.0	4	1.9
TradeCommunication			0	-0.1	5	2.1
PublicServices			0	-0.1	5	2.3
Agri	-100	0	5	1.5	14	4.9
Non-Agri	-100	-2	0	0.1	4	2.1
Economywide	-100	-2	0	0.1	5	2.4

Source: Authors' calculations.

Table 9.6: Initial (year 2001) structure of the Brazilian economy (%)

	tariff rates	Sectoral Imports	Imports / DomDemand of Composite	Sectoral Output	Sectoral Exports	Exports / Dom Output
CerealGrains	7	1	15	1	0	1
OilSeeds	6	0	8	0	4	29
RawSugar	0	0	0	0	0	0
OtherCrops	9	2	3	4	8	7
Livestock	3	0	1	1	0	0
RawAnimalProducts	8	0	1	1	0	1
OilMinerals	4	7	33	1	7	25
LightManufacturing	17	4	5	5	3	2
AgriIndustriesExp	18	3	3	7	19	11
WoodProductsPaper	9	2	5	3	7	10
ChemicalsOilPr	9	15	10	9	8	3
MetalMineralProducts	12	5	6	5	13	11
MachineryEquipment	19	37	27	8	20	11
OtherServices	0	11	3	23	5	1
Construction	0	0	0	8	0	0
TradeCommunication	0	10	5	13	5	2
PublicServices	0	2	1	11	1	0
Agri	8	4	4	7	12	6
Non-Agri	11	96	6	93	88	4
Economywide	11	100	6	100	100	4

Source: Authors' calculations.

Table 9.7: Brazil's structural adjustment, per cent changes in the final year between BaU and trade shocks (%)

	Import Volumes		Domestic Demand of dom products		Price of domestic output in dom mkts		Export Volumes		Domestic Output		Price of domestic output	
	Full Liber.	Doha	Full Liber.	Doha	Full Liber.	Doha	Full Liber.	Doha	Full Liber.	Doha	Full Liber.	Doha
CerealGrains	-6	-3	4	1	-2	1	68	13	5	1	-2	1
OilSeeds	-18	-7	5	1	-6	0	60	8	20	3	-3	1
RawSugar			0	0	-2	1			0	0	-2	1
OtherCrops	23	2	1	0	-1	1	6	-3	1	0	-1	1
Livestock	-4	1	3	1	-2	1			3	1	-2	1
RawAnimalProducts	22	5	2	1	-2	1	5	-1	2	1	-2	1
OilMinerals	-6	1	1	-1	-5	1	26	1	7	0	-4	1
LightManufacturing	48	-3	0	1	-5	0	159	61	5	3	-4	1
AgriIndustriesExp	59	1	0	0	-4	1	30	4	3	1	-4	1
WoodProductsPaper	23	4	-1	0	-4	1	11	-1	0	0	-4	1
ChemicalsOilPr	18	3	-2	0	-4	1	9	-1	-2	0	-4	1
MetalMineralProducts	24	2	-4	-1	-5	1	15	-1	-2	-1	-4	1
MachineryEquipment	42	3	-12	-1	-6	1	11	-2	-10	-1	-5	1
OtherServices			1	0	-4	1			1	0	-4	1
Construction	-14	3	0	0	-3	1	8	-1	0	0	-3	1
TradeCommunication	-12	3	0	0	-3	1	6	-2	0	0	-3	1
PublicServices	-13	3	0	0	-3	1	7	-2	0	0	-3	1
Agri	6	-1	2	1	-2	1	22	0	3	1	-2	1
Non-Agri	21	3	-1	0	-4	1	21	2	0	0	-4	1
Economywide	21	3	-1	0	-4	1	21	2	0	0	-4	1

Source: Authors' calculations.

Table 9.8: Factor markets effects

	Employment		Wages		Unskilled Lab Migration as % of:		Cumulative Migration	Unskilled employment
	Skilled	Un-skilled	Skilled	Un-skilled	Sending Pop	Receiv-ing Pop	2001-2015	2015
	Yearly growth rates				Yearly %		Millions	%
Business as Usual:								
Agri		0.02		1.68	1.66		-4.04	21.51
Non-Agri		2.20		0.91		0.53	4.04	78.49
Economywide	2.0	1.7	1.26					
Full Liberalization:								
Agri		0.18		2.10	1.51		-3.71	21.99
Non-Agri		2.15		1.07		0.49	3.71	78.01
Economywide	2.0	1.7	1.32					
Deep Doha:								
Agri		0.06		1.78	1.62		-3.96	21.64
Non-Agri		2.19		0.93		0.52	3.96	78.36
Economywide	2.0	1.7	1.27					
Weak Doha:								
Agri		0.06		1.77	1.62		-3.96	21.63
Non-Agri		2.19		0.93		0.52	3.96	78.37
Economywide	2.0	1.7	1.26					

Source: Authors' calculations.

Table 9.9a: Poverty and inequality in the Doha scenario, by sector

	All households			Non-agricultural households			Agricultural households		
	2001 levels	2001-15 changes	% of BaU change	2001 levels	2001-15 changes	% of BaU change	2001 levels	2001-15 changes	% of BaU change
PC income	314.9	1.5	101.5	351.9	1.3	102.1	148.3	2.4	101.3
Gini	58.6	-0.2	194.4	57.1	0.5	81.8	56.6	-0.8	111.5
P0	23.6	-5.8	103.4	18.6	-3.3	106.5	46.2	-14.0	101.5
P1	9.6	-3.1	102.7	7.1	-1.6	104.6	21.0	-8.2	102.1
P2	5.3	-1.9	102.5	3.7	-0.9	104.3	12.3	-5.3	102.0
Population %	100.0			81.8	3.2	98.3	18.2	-3.2	98.3
Contr. to P0				64.4	8.6	96.0	35.6	-8.6	96.0

Table 9.9b: Poverty and inequality in the Full scenario, by sector

	All households			Non-agricultural households			Agricultural households		
	2001 levels	2001-15 changes	% of BaU change	2001 levels	2001-15 changes	% of BaU change	2001 levels	2001-15 changes	% of BaU change
PC income	314.9	1.6	106.4	351.9	1.3	106.8	148.3	2.6	109.8
Gini	58.6	-0.3	312.2	57.1	0.5	72.0	56.6	-0.9	117.0
P0	23.6	-6.1	109.2	18.6	-3.6	116.3	46.2	-14.9	108.0
P1	9.6	-3.2	108.2	7.1	-1.8	113.7	21.0	-8.6	107.4
P2	5.3	-1.9	107.8	3.7	-1.0	113.0	12.3	-5.6	107.2
Population %	100.0			81.8	3.1	93.0	18.2	-3.1	93.0
Contr. to P0				64.4	8.4	96.0	35.6	-7.6	96.0

Source: Authors' calculations.

Table 9.10a: Poverty impact of trade, by migration choices

	Households remaining in agri			
	2001 levels	BaU 2001-15 changes	Doha % of BaU change	Full % of BaU change
P0	44.1	-11.7	101.7	109.5
P1	20.0	-7.0	102.4	108.5
P2	11.7	-4.6	102.3	108.2
Population %		14.9	100.4	101.5

Table 9.10b: Poverty impact of trade, non-agri stayers

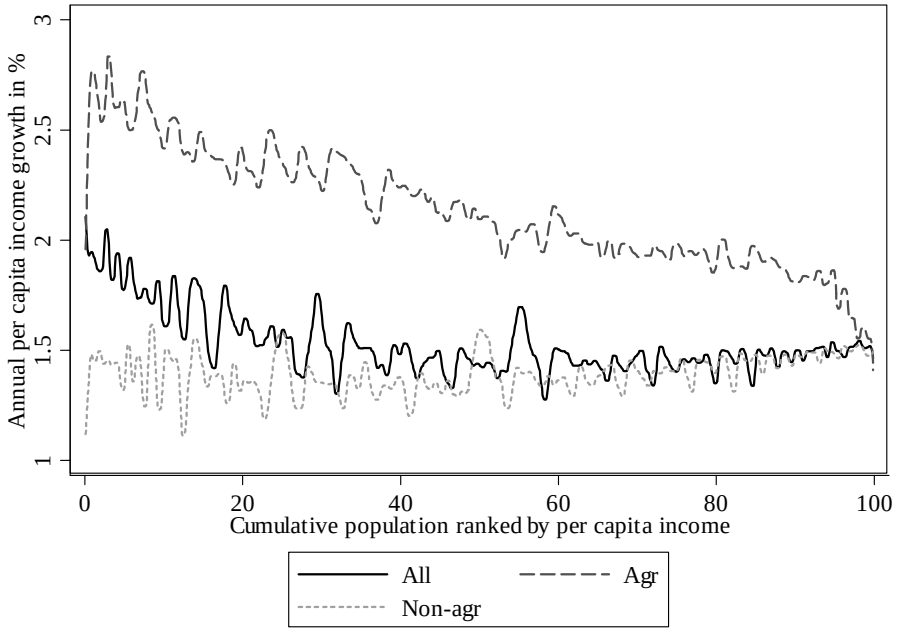
	Non-agri households before and after			
	2001 levels	BaU 2001-15 changes	Doha % of BaU change	Full % of BaU change
P0	18.6	-3.8	104.0	110.7
P1	7.1	-1.8	103.3	109.8
P2	3.7	-1.0	103.2	109.5
Population %	82.4			

Table 9.10c: Poverty impact of trade, sectoral movers

	Agri households who have become non-agri			
	2001 levels	BaU 2001-15 changes	Doha % of BaU change	Full % of BaU change
P0	56.6	-22.4	105.1	108.2
P1	26.0	-14.0	102.0	105.4
P2	15.2	-9.4	101.7	105.1
Population %		3.1	98.0	92.5

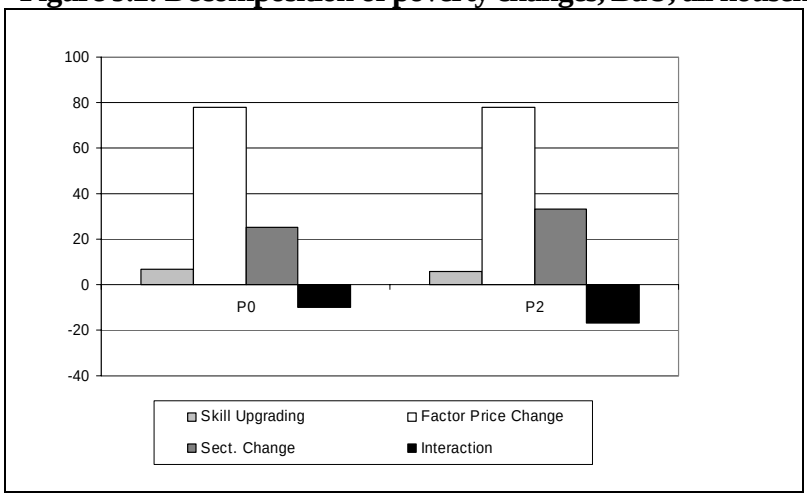
Source: Authors' calculations.

Figure 9.1: Growth incidence curves, BaU, all, agricultural, and non-agricultural households



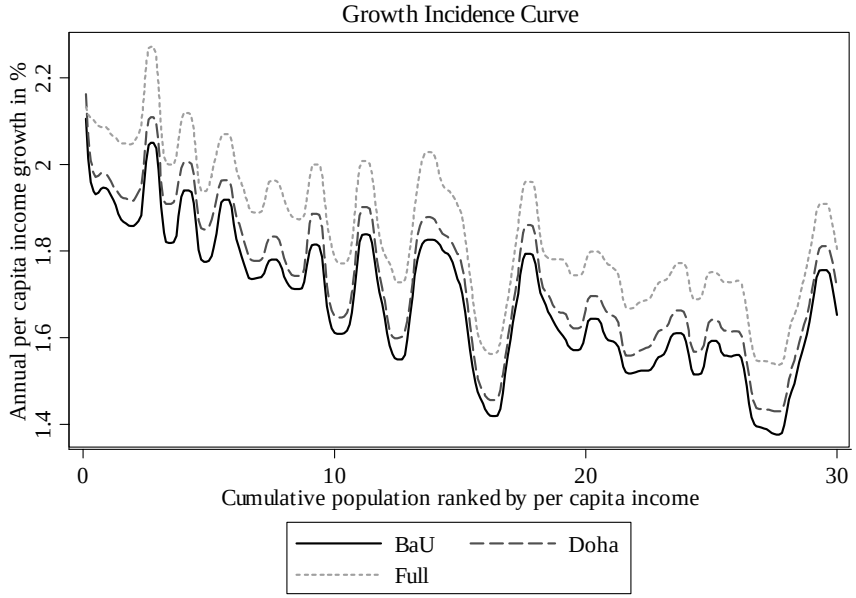
Source: Authors' calculations.

Figure 9.2: Decomposition of poverty changes, BaU, all households



Source: Authors' calculations. Note: The figure displays the contribution of the respective component to the total change in P0 and P2, respectively, in percent. The contributions add to 100. Contributions refer to reductions in the respective poverty indices.

Figure 9.3: Growth incidence curves for the BaU and Trade scenarios, poorest 30 percent of all households



Source: Authors' calculations.