CHAPTER 7

Trade Liberalization and Active Labor Market Policies

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Trade liberalization will boost Brazil's productive potential and growth prospects, but it will also affect labor markets, including employment and wages. Using a computable general equilibrium model with labor frictions and heterogeneity in productivity, this chapter examines the effects of trade liberalization on regional labor markets. Labor markets in regions that now enjoy higher trade protection are more likely to suffer from trade liberalization. Given the limited mobility of labor in Brazil's domestic market, trade liberalization must be accompanied by active labor market policies and a skills enhancement program, so that workers hurt by trade can acquire new skills for sectors and industries that benefit from the economy's opening.

INTRODUCTION

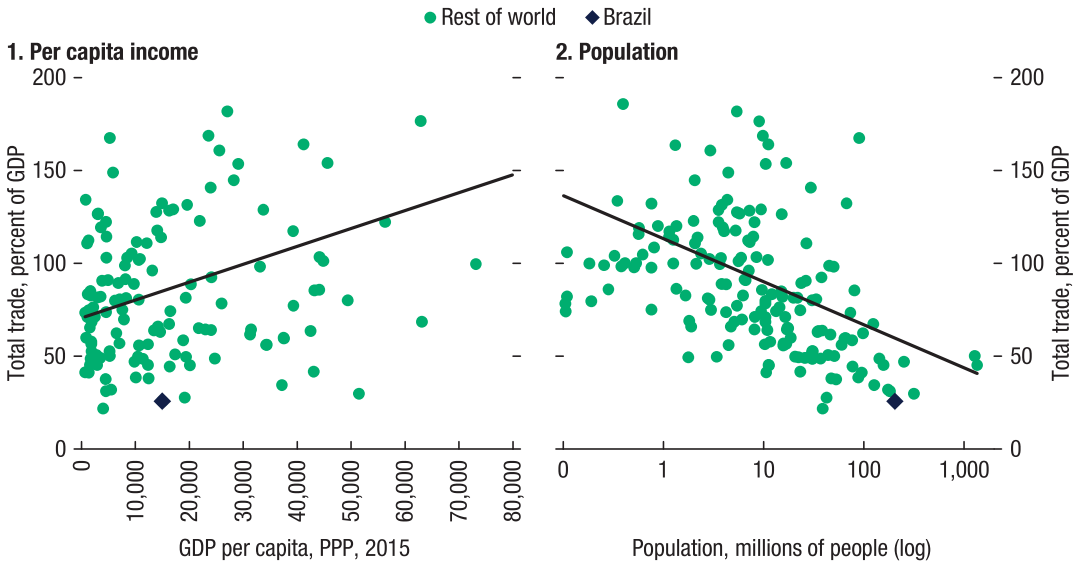
The trade liberalization that took place in Brazil in the 1990s increased aggregate productivity in manufacturing both directly, through the pressure of foreign competition that materialized with the greater availability of imported goods, and indirectly, through the lower cost of machinery, equipment, and inputs for Brazilian firms (Rossi and Ferreira 1999; Lisboa, Menezes-Filho, and Schor 2002).

Trade liberalization affected the regions within Brazil differently. This regional disparity occurred because sectors are geographically concentrated, so the scale of a relative price shock varied from one region to another, and the adjustments in the labor market occurred much more slowly than the accepted consensus on the effect of trade shocks.

This chapter investigates the extent of the relative price shocks across regions and the labor market adjustment, using estimates of heterogeneous regional effects of liberalization on the labor market, and analyzes the implications of that heterogeneity for policymaking for the labor market.

This chapter summarizes the results presented in SAE (2018) and Góes, Messa, and Leoni (forthcoming).

Figure 7.1. Brazil: Relationship between Total Trade and Structural Variables



Source: World Bank, World Development Indicators.
Note: PPP = purchasing power parity.

Consistent with conclusions by Dix-Carneiro and Kovak (2017), this chapter finds that regions facing greater price shocks because of trade liberalization would suffer relatively greater impacts on their labor markets. So, despite low levels of permanent variation in employment, the outcomes indicate regional differences in the effect of trade on the labor market.

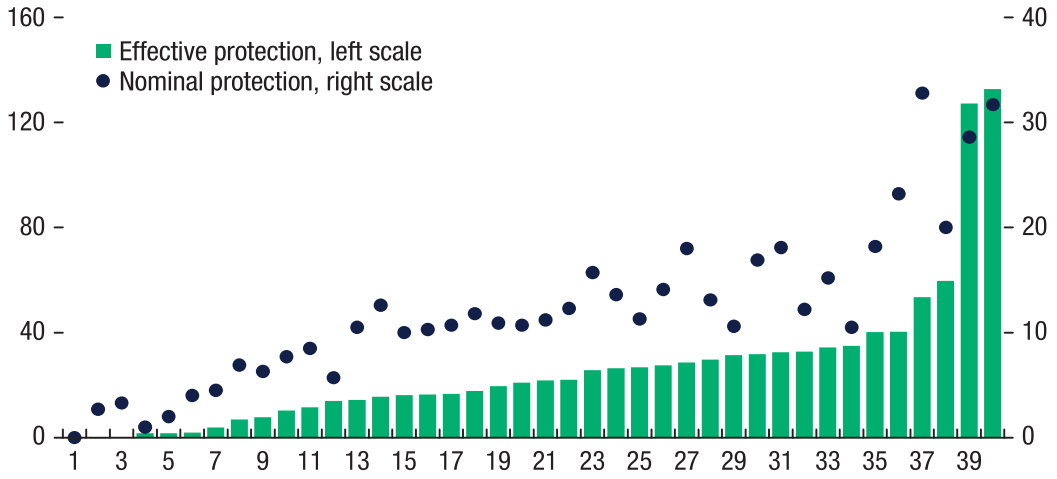
Public policies can ease the inclusion into the labor market of workers exposed to transitional negative impacts of the trade shock, offsetting the limited mobility of labor in Brazil's domestic market. These policies would maximize the gains from trade while avoiding disproportionate losses concentrated in a minority of workers.

Active labor policies can build on the current programs. An efficient active labor market policy must incorporate information on three essential issues: (1) which regions are most likely to be affected by the trade shock, (2) which productive sectors are likely to experience growth (or decline) in employment after the trade opening, and (3) which skills are in demand, and their dynamic evolution, in each region. This chapter gives a first contribution to answer these questions.

CONTEXT: TRADE PROTECTION IN BRAZIL

Brazil's international trade flows amount to about 25 percent of its GDP, making it one of the world's most closed countries. In terms of trade, Brazil was the second most closed country in the world from 2012 to 2015, surpassed only by Sudan. In terms of income and population brackets, Brazil is also closed to international trade compared with countries with similar features (Figure 7.1).

Figure 7.2. Brazil: Nominal and Effective Protection, by Sector, 2014
(Percent)

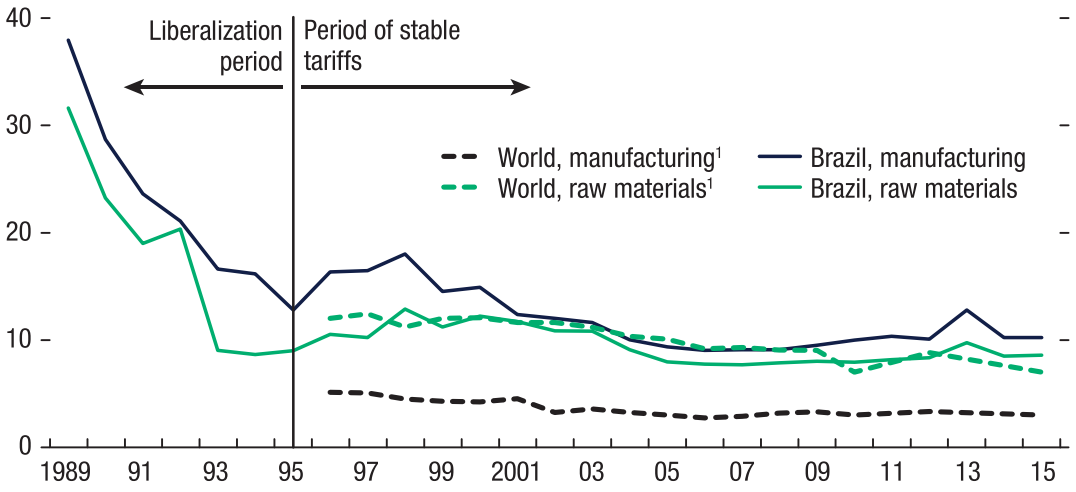


Source: Castilho and others (2014).
Note: 1 Oil and natural gas; 2 Livestock and fisheries; 3 Other in the extractive industry; 4 Oil refining and coke; 5 Iron ore; 6 Cement; 7 Agriculture, forestry, logging; 8 Newspapers, magazines, records; 9 Pharmaceutical products; 10 Non-ferrous metal metallurgy; 11 Wood products, excluding furniture; 12 Chemical products; 13 Electricity and gas, water, sewage and urban cleaning; 14 Medical and hospital devices and instruments, measuring and optical; 15 Alcohol; 16 Office machines and computer equipment; 17 Other transport equipment; 18 Machinery and equipment, including maintenance and repairs; 19 Other non-metallic mineral products; 20 Miscellaneous chemical products; 21 Manufacture of steel and its byproducts; 22 Cellulose and paper production; 23 Metal products, excluding machinery and equipment; 24 Rubber and plastic products; 25 Pesticides; 26 Electrical machinery, apparatus and material; 27 Furniture and products of miscellaneous industries; 28 Paints, varnishes, enamels and lacquers; 29 Food and beverages; 30 Parts and accessories for motor vehicles; 31 Leather and footwear; 32 Electronic material and communications equipment; 33 Perfumery, hygiene and cleaning; 34 Manufacture of resins and elastomers; 35 Appliances; 36 Textiles; 37 Clothing articles and accessories; 38 Tobacco products; 39 Cars, vans and utility vehicles; 40 Trucks and buses.

On average, Brazil has higher import tariffs for manufactured goods than for raw materials. That average, however, hides a broad range of sectoral variations. Some sectors, especially intermediate goods such as petrochemicals, cement, and metallurgy, are subject to low levels of protection. Other final goods, such as automobiles, trucks, textiles, and garments, are subject to high levels of protection. This variation holds both for nominal protection (that is, import duties levied on that sector) and for the effective level of protection (that is, considering the sector's input structure and the degree of protection on the value added by that sector to the final product).

The dispersion of Brazil's tariff structure is just as important as the average levels of nominal protection. Whenever nominal tariffs on intermediate goods are reduced but the high nominal tariffs on final goods remain unchanged, the effective level of protection on final goods is higher. This dispersion in nominal tariffs explains why effective protection in specific sectors, particularly the automobile industry, is significantly higher than the Brazilian average (Figure 7.2).

Figure 7.3. Brazil and the World: Applied Tariffs in Major Sectors
(Percent)



Source: Authors' calculations using World Bank data.
[1]Global average weighted by trade flows.

HETEROGENEOUS EFFECTS OF TRADE LIBERALIZATION ON REGIONAL LABOR MARKETS: PAST EVIDENCE

The tariff structure in Brazil can be divided into two periods over the past 30 years. From 1990 to 1995, Brazil's import duties fell significantly, both for manufactured goods (from 37 percent to 12 percent) and for raw materials (from 31 percent to 9 percent). Since 1995, Brazil's import duties have been relatively stable (Figure 7.3).

Even so, the tariff structures for manufactured goods and raw materials are different. While Brazil's average tariffs for raw materials converged to a rate near the world average (about 8 percent in 2015), Brazil's manufacturing sector is still much more protected than those of the rest of the world. In 2015, average duties effectively levied on imported manufactured goods in Brazil were about 10 percent, compared with the global average of 3 percent.

The decline in tariffs improved efficiency. Labor productivity in industry, which had fallen in the late 1980s, grew strongly after trade liberalization (Rossi and Ferreira 1999). Productivity gains in industry were achieved both directly, from the pressure of foreign competition through more imports, and indirectly, from the lower cost of machinery, equipment, and inputs for Brazilian firms (Lisboa, Menezes-Filho, and Schor 2002).

Despite the sectoral effects of liberalization in the 1990s, long-term nationwide aggregate effects on the labor market were minor. However, Kovak (2013) and Dix-Carneiro and Kovak (2017) find that the country's regions that previously specialized in the industries most affected by trade liberalization experienced a greater reduction in formal sector employment than did other regions in the

country. Those studies estimate that the impact on formal employment continued for more than 20 years after the trade liberalization process began, and they conclude the following:

- The level of trade protection differs across regions and depends on the geographic concentration of each industry; therefore, the post-liberalization trade shock is also heterogeneous.
- Although the aggregate impact on formal employment and income is minor, regional impacts are significant.
- Costs are concentrated because of the low degree of integration of labor markets and, possibly, the rigidity of labor laws, inducing workers to shift from the formal to the informal sector in regions more affected by liberalization.

These outcomes are consistent with other analyses that find a low degree of integration in Brazil's domestic labor market (Góes and Matheson 2017). Those conclusions indicate that estimates of the regional effects on the labor market of future trade liberalizations can be helpful in designing public policies that favor adjustments in the labor market, facilitating the migration of affected workers from one sector to another.

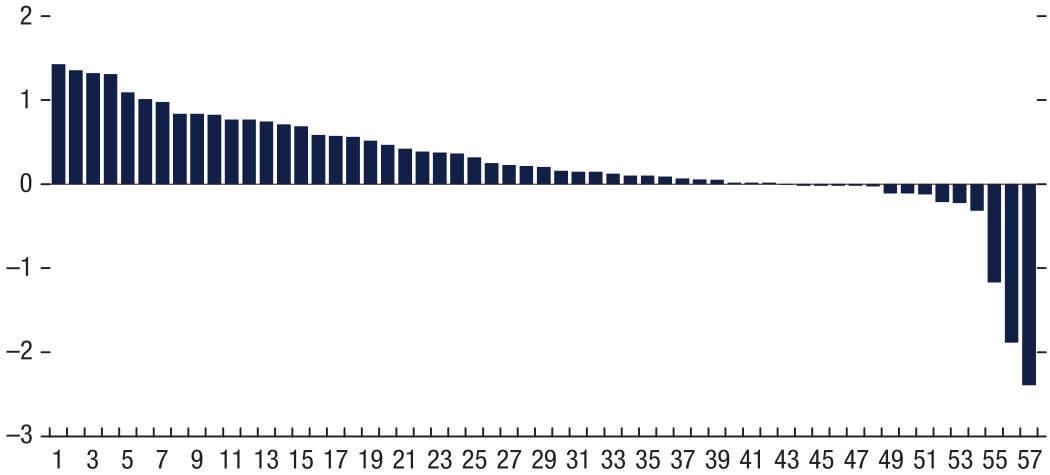
HETEROGENEOUS EFFECTS OF TRADE LIBERALIZATION ON REGIONAL LABOR MARKETS: FORWARD-LOOKING ESTIMATES

The estimates presented here were derived using a general equilibrium model that aggregated information on production, employment, wages, prices, imports, and exports in 57 economic sectors in Brazil and other countries. The complete methodology, including the estimated equations and statistical appendices, are available in Góes, Messa, and Leoni (forthcoming).

The analysis employs a computable general equilibrium model using input-output matrices for 57 economic sectors in Brazil and another 25 countries, the European Union, and an aggregate for the rest of the world. As seen in Caliendo, Dvorkin, and Parro (2015), the exercise extends the study done by Eaton and Kortum (2002) to multiple sectors, modeling the interaction between them using input-output matrices from each country covered by the analysis. Trade between countries arises from differences in productivity, making the sensitivity of trade flows to variations in tariff rates dependent on the degree of dispersion of that productivity.

The model includes some 2.5 million equations that describe interactions between firms and workers, who maximize their utility and change sectors based on a cost-benefit analysis. The model also estimates the probability that workers in a given sector will move to another in the following period. The model is assumed to be in equilibrium in the initial period. Following a shock introduced exogenously, which represents a change in Brazil's tariff structure, the changes in

Figure 7.4. Brazil: Net Expected Variation in Employment, per Sector, 20 Years after a Trade Liberalization
(Percent)



Source: Authors' calculations based on the computable general equilibrium model described in Góes, Messa, and Leoni (forthcoming).
Note: 1 Gas; 2 Oil; 3 Coal; 4 Other ores; 5 Petroleum products; 6 Oilseeds; 7 Wheat; 8 Other grains; 9 Other crops; 10 Non-ferrous metals; 11 Meat *in natura*; 12 Other meat; 13 Sugar; 14 Livestock; 15 Paper; 16 Fruits and vegetables; 17 Sugar cane; 18 Other animal products; 19 Plant fibers; 20 Vegetable oils; 21 Gas distribution; 22 Rice *in natura*; 23 Fish; 24 Forest products; 25 Other transportation equipment; 26 Iron and steel; 27 Electricity; 28 Chemicals; 29 Other food products; 30 Other transport; 31 Wood; 32 Water transport; 33 Processed rice; 34 Non-metallic minerals; 35 Air transport; 36 Business services; 37 Communications; 38 Water; 39 Financial intermediation; 40 Trade; 41 Milk; 42 Insurance; 43 Dairy products; 44 Construction; 45 Wool; 46 Recreation; 47 Government; 48 Residences; 49 Electronic equipment; 50 Cars and car parts; 51 Beverages and tobacco; 52 Other machinery; 53 Other manufactures; 54 Metal products; 55 Leather; 56 Textiles; 57 Clothing.

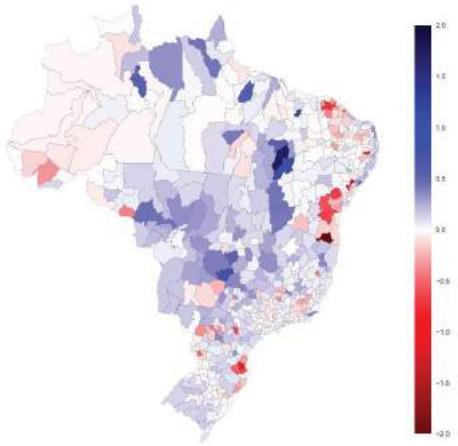
prices, production, imports, exports, wages, and jobs in the different sectors of the economy evolve dynamically. After a given period, the economy reaches a new, stationary equilibrium and the long-term effect for the aggregate economy and for each of the 57 sectors covered by the model can be observed.

The results from the estimation suggest that, following trade liberalization, workers tend to move out of sectors that had been more protected—and less competitive—into more competitive sectors. The total level of employment remains substantially unchanged because the main effect is intersectoral migration.[1] During the entire period that followed the trade liberalization, 75 percent of the sectors of Brazil's economy expanded their employment and, 20 years later, only three sectors of Brazil's economy are expected to experience more than a 0.5 percent reduction in employment (Figure 7.4).

Nationwide outcomes were used as sectoral shocks that, combined with the geographic distribution of the sectors and the heterogeneous regional elasticities, caused a net effect on employment in each sector of the economy in each of Brazil's 558 microregions. The weighted sum of the sectoral effects in each region

[1]More precisely, a 0.015 percent reduction in unemployment is expected.

Figure 7.5. Brazil: Net Expected Variation in Employment, 20 Years after a Trade Liberalization by Microregion
(Percent)



Source: Authors' calculations based on the computable general equilibrium model described in Góes, Messa, and Leoni (forthcoming).

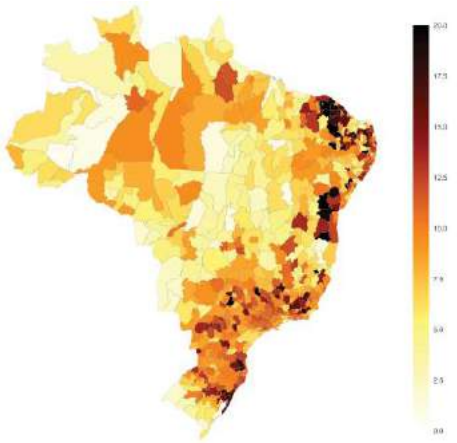
led to the net regional effect, aggregating all sectors of the economy for each microregion (see Annex 7.1 for details). In about two-thirds of Brazil's 558 microregions, the long-term effect of liberalization on formal employment is positive. In 85 percent of the microregions, the effect on formal employment varies from –0.25 percent to +0.25 percent. Even the most extreme cases are within the range of –2 percent to +2 percent of the workforce.

This exercise identifies which regions are far from the average. The Center-West is slightly above the national average, as are southern Piauí and Maranhão, and some microregions in Pará, Amazonas, Roraima, and Amapá, with gains in formal employment of up to 2 percent. In other regions, the expected effect is basically zero, except for the Itajaí Valley in Santa Catarina, southern Bahia, and a cluster of microregions in northwestern Ceará where a reduction in formal employment may occur in sectors now active (Figure 7.5).

These variations are largely explained by the regional concentration of Brazil's different economic sectors, along with their different tariff levels. Microregions have varying levels of trade protection because their labor forces and regional production sectors can be concentrated in sectors with higher degrees of protection. These microregions are the ones that will tend to be more affected by trade liberalization (Figure 7.6).

The level of tariff protection can be computed for each microregion by weighting the duties levied nationally on imports of diverse goods and services by the sectoral makeup of the region's labor force (see Annex 7.2 for details). This calculation reveals the disparate geographic distribution of tariff protection in Brazil. Although 80 percent of the country's microregions have tariff protection of less

Figure 7.6. Brazil: Regional Tariffs by Microregion
(Effective average tariff, ad valorem percent; average weighted by the sectoral distribution of the labor force)



Source: Authors' calculations.

than 12 percent, a few specific microregions have much higher levels of protection, greater than an ad valorem tariff of 20 percent.

Because regions currently have different levels of trade protection, trade liberalization takes place to different degrees in each of them. As expected, the microregions with higher tariff protection today tend to have more negative long-term outcomes regarding permanent reductions of formal employment (Figure 7.7).

Another factor that influences the expected outcome of a trade shock on the labor market is the size of the microregions. Those more concentrated on the positive and negative extremes of expected variations in employment tend to have smaller populations. Larger cities tend to present variations close to zero. This outcome is intuitive because the economic structure of larger cities is more diversified. Therefore, in response to price shocks imposed by a trade opening, workers in those cities simply migrate to other sectors in the same microregion, with a net variation of zero.

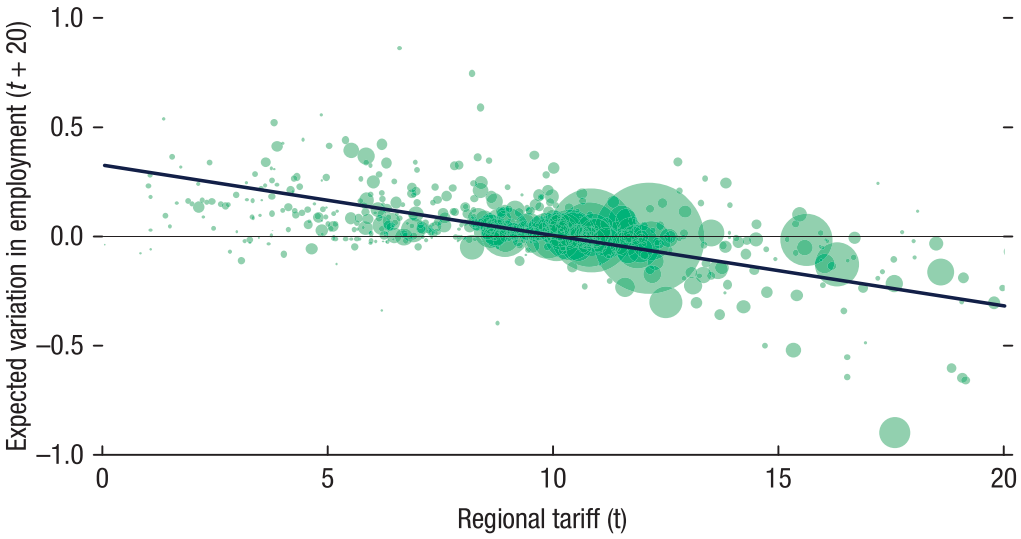
ACTIVE LABOR MARKET POLICIES TO CATALYZE ADJUSTMENT TO TRADE LIBERALIZATION

In the context of labor market impacts during Brazil's trade liberalization, active labor market policies are preferable for two main reasons:[2]

[2]Public policies for the labor market can be divided into passive and active policies. Passive policies provide complementary income for individuals during periods of unemployment (such as unemployment insurance). Active labor market policies, in contrast, seek to reduce unemployment by improving workers' skills (through retraining programs), to reduce asymmetries in market

Figure 7.7. Brazil: Net Expected Variation in Employment and Regional Tariffs by Microregion

(Bubbles are proportional to the microregion's workforce.)



Source: Authors' calculations based on the computable general equilibrium model described in Góes, Messa, and Leoni (forthcoming).

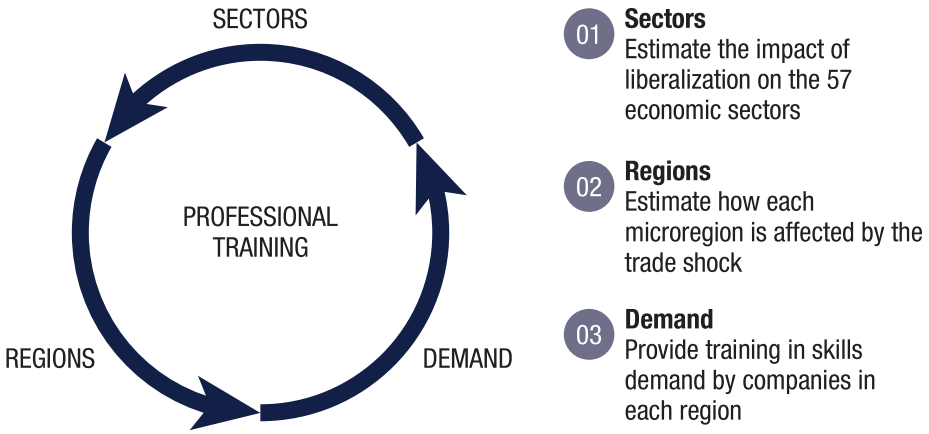
- Evidence suggests that, because of the limited integration and flexibility of the Brazilian labor market, passive policies may not be sufficient to minimize the regional effects of liberalization.
- The regions and sectors that will be most affected both positively and negatively during the transition period can be identified in advance, and resources can be focused more efficiently, thus facilitating the transition of workers from declining to expanding sectors.

Brazil's most significant recent active labor market policy is the National Program for Access to Technical Education and Employment (Pronatec). Despite significant progress, Pronatec has not achieved its main objective, which is to ensure significantly more employment and income for its graduates. The main reason for this shortfall lies in the mismatch between the supply of courses and the demand for training in the market. While the market was signaling greater demand for workers with STEM (science, technology, engineering, and mathematics) skills, the bulk of the program's courses were for administrative assistants and computer operators.

In addition to Pronatec, different federal agencies began to launch slightly different programs to achieve the same goal of retraining Brazilian professionals,

information (the distance between job seekers and job providers), or to give companies incentives to hire workers in specific categories (such as special regimes for apprentices and youth). These policies are aimed at keeping individuals active in the labor market and facilitating their reintegration into the labor force by fighting market imperfections.

Figure 7.8. Brazil: Pillars of an Active Labor Market Policy, Adapted to the Context of Trade Liberalization



Source: SAE (2018).

thus creating a veritable public policy laboratory for comparing various alternatives. One variation of Pronatec, implemented by the Ministry of Industry, Foreign Trade and Services, included a mechanism for identifying regional demand for skills in cities and regions, using an official database from companies surveyed about their real need for skilled workers. O'Connell and others (2017) found that graduates of this program had a significantly higher (approximately 8 percent) probability of being employed, especially in sectors reliant on STEM skills, some of whom displayed marginal employability gains higher than 10 percent. The rest of Pronatec not run by the Ministry of Industry, Foreign Trade and Services—which did not use local information on demand for skills—showed no statistically significant postcourse gains in employability or income (Barbosa Filho, Porto, and Delfino 2015).

By introducing changes in its existing programs, Pronatec can be reformed to help the labor market better adjust to the new reality of an open economy. To make such an active labor market policy efficient and suitable for accommodating the trade shock, three kinds of information must be combined:

- What regions will be most affected by the trade shock?
- In which sectors will employment expand (or contract) after trade opening?
- What skills are in demand, and how will that demand evolve, in each geographical area?

Designing an active labor market policy to be applied alongside a trade liberalization process would help maximize welfare and mitigate transitional costs likely to be borne by specific regions and groups of workers (Figure 7.8). In addition, because a trade opening tends to shift investment and production from less-productive and profitable sectors into more efficient sectors, a policy to facilitate individuals' access to new skills would be essential for workers to shift from negatively affected sectors into those favored by the new context.

CONCLUSIONS

Using a computable general equilibrium model with labor frictions and heterogeneity in productivity, this chapter estimates the heterogeneous regional effects of trade liberalization on labor markets in a forward-looking analysis. It uses two different lines of research: the inclusion of frictions and heterogeneity into forward-looking analytical models and the regionally heterogeneous labor effects of trade shocks in backward-looking empirical models.

The main results show a heterogeneous effect of trade on regional labor markets. In about two-thirds of Brazil's 558 microregions, trade liberalization is estimated to have positive, but small, long-term effects on formal employment.

The heterogeneity of estimated regional effects, explained largely by the spatial concentration of various sectors of Brazil's economy, coincides with the conclusions of Dix-Carneiro and Kovak (2017): regions that now enjoy higher regional trade protection are likely to experience relatively greater impact on their labor markets.

The methodology developed in this study has major implications for public policy. Using this methodology, policymakers can anticipate uneven effects and design active labor market policies to mitigate the impact of trade liberalization on the most affected regions and facilitate the intersectoral and interregional migration of workers. Doing so would allow aggregate gains from trade to be achieved without penalizing disproportionately specific workers for the costs of a transition toward a more open economy.

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ANNEX 7.1 DATA USED TO ESTIMATE REGIONAL EFFECTS

The production and trade data used in this analysis come from the Global Trade Analysis Project (GTAP), version 9, base year 2011. Each simulation involved 27 economic regions: Argentina, Bolivia, Brazil, Canada, Chile, China, Colombia, Egypt, India, Indonesia, Japan, Korea, Malaysia, Mexico, Nigeria, Paraguay, Peru, Russia, Saudi Arabia, South Africa, Switzerland, Turkey, the United States, Uruguay, Vietnam, the European Union, and the rest of the world grouped as a single region. From those 27 economic regions, each was broken down into 57 sectors using the maximum disaggregation of the GTAP Sectoral Classification, Revision 2, data for domestic production, input-output matrices, and bilateral trade flows, and bilateral tariffs were extracted.

The labor market data come from the Annual Social Information Report (RAIS), published by the Ministry of Labor. Each year since 1976, the RAIS has organized individualized information about workers employed in the formal Brazilian labor market.

The labor census uses forms completed and filed by employers, with individualized data on each formal labor relationship in their companies. Because employers can be fined for not filing the forms on time or for providing false information, they have strong incentives to answer the census correctly. Data from the RAIS are therefore considered to be of high quality.

The public version of the RAIS data provides, among other products, anonymized data on each worker that cover the economic sector of the employer company, wages, age of the worker, and so on. This analysis used only the number

of employees in the employer's economic sector, including only active labor contracts.

To allow RAIS data to fit into the GTAP sectors, a transition matrix was built that matches the codes in Brazil's National Economic Activities Register, used for the RAIS, with those sectors. Based on the local and national aggregations produced by that matrix, the computable general equilibrium model and local elasticity estimates were calibrated.

To obtain local elasticities and calibrate the computable general equilibrium model, time series were constructed with RAIS data from 2002 to 2016, for each sector–microregion dyad. National and state aggregates were then created, with the sum of the sectoral workforce in each of the states calculated as follows:

$$e_{g,t} = \sum_{s=1}^{27} e_{s,g,t} = \sum_{s=1}^{27} \sum_{m=1}^{M_s} e_{m,s,g,t}$$

in which $e_{m,s,g,t}$ is employment in microregion $m = [1, \ldots, M_s]'$ of state $s = [1, \ldots, 27]'$ in sector $g = [1, \ldots, 57]'$ and in year $t = [2002, \ldots, 2016]'$.

The elasticities were combined with the results of the computable general equilibrium model—that is, national variations in employment, for each sector, after a specific tariff shock, for a specific horizon. Assuming elasticities to be homogeneous in each state-sector, the exercise arrived at the employment variations expected for each sector in each microregion following liberalization:

$$\Delta e^*_{m,s,g,t+k} = \phi_{m,s,g} \Delta e^*_{g,t+k}, \phi_{m,s,g} = \phi_{s,g} \forall m$$

in which the asterisks denote simulated values; t denotes the year of liberalization, k represents the simulated future horizon, $\phi_{m,s,g}$ represents the specific elasticity for each microregion and sector, and $\Delta e^*_{g,t+k}$ represents the cumulative variation in employment simulated for each sector g between liberalization year t and the simulation horizon k.

Finally, the expected net effect on employment was calculated for each microregion by computing a weighted average that incorporates the weight of each sector g for each microregion $\lambda_{m,s,g}$:

$$\Delta e^*_{m,s,t+k} = \sum_{g=1}^{57} \lambda_{m,s,g} \phi_{m,s,g} \Delta e^*_{g,t+k}.$$

ANNEX 7.2 METHODOLOGY FOR CALCULATING REGIONAL TARIFFS

Using the methodology described in Dix-Carneiro and Kovak (2017) and Kovak (2013), the level of tariff protection for each microregion can be calculated by weighting national duties levied on various imported goods and services with the sectoral composition of the regional labor force, as follows:

$$\tau_{m,s,g} = \sum_{m,s}^{M,S} \beta_{m,s,g} \tau_g$$

$$\beta_{m,s,g} = \frac{\lambda_{m,s,g} \frac{1}{\chi_{m,s,g}}}{\sum_{m,s}^{M,S} \lambda_{m,s,g} \frac{1}{\chi_{m,s,g}}}$$

in which, for each sector g in each microregion of different states r,g, $\lambda_{m,s,g}$ is the initial share of labor allocated to sector g in microregion m,s, which is heterogeneous between microregions; $\chi_{m,s,g}$ is the share of remuneration of factors except for labor in sector g, which is heterogeneous between different sectors; and τ_g is the nationwide tariff levied on sector g caused by the change in tariffs.

A heterogeneous regional tariff that is eliminated during trade liberalization can therefore be calculated using the expected tariff variation for different sectors of the national economy:

$$\Delta\tau_{m,s,g} = \sum_{m,s}^{M,S} \beta_{m,s,g} \Delta \ln\left(1 + \tau_{m,s,g}\right)$$

$$\Delta\tau_{m,s,g} = \sum_{m,s}^{M,S} \beta_{m,s,g} \left[\ln\left(1 + \tau_{m,s,g}^{t+k}\right) - \ln\left(1 + \tau_{m,s,g}^{t}\right)\right]$$

$$\tau_{m,s,g}^{t+k} \equiv \tau_{g}^{t+k} \forall m, s, t.$$