Mexico and Brazil and the 2008–09 Global Financial Crisis:

A Counterfactual Look at Its Welfare Effects

Maurizio Bussolo, Rafael de Hoyos, Peter Dixon,

Maureen Rimmer,and George Verikios

This chapter studies the incidence impact of the 2008–09 global financial crisis on Brazil and Mexico. During the last decade, Mexico has been on a slow growth path, whereas Brazil has enjoyed a sustained and accelerating expansion of its economy, accompanied by a reduction in income inequality. Because of its close commercial ties with the United States, Mexico was much more severely affected by the global crisis than Brazil, which not only trades with a more diversified set of countries, but also exports commodities and agricultural goods whose demand and prices were less affected by the crisis. During 2009, the gross domestic product (GDP) of Mexico contracted by about 6 percent but only 0.3 percent in Brazil. Compared with a counterfactual—no-crisis—scenario, Mexico lost about 9 percentage points of its GDP (instead of growing by 2.8 percent in 2009, it contracted by 6.2 percent), whereas Brazil lost 4 percentage points. The size of the crisis has thus been very different across these two countries and that is reflected in the much larger rise in poverty in Mexico than in Brazil.

The features of the macro shock were also different across the two counties. When the crisis and no-crisis scenarios are compared, changes in public consumption were not very significant in either country. Imports and exports dropped in both countries, but consumption was more resilient in Brazil than in Mexico. The relative reduction in investment demand (i.e., with respect to a 1 percent reduction in GDP) was much larger in Brazil. A large number of studies have described the reasons for these differences in aggregate demand adjustments, and this study, while not offering further explanations for this macro shock, contributes to the understanding of its incidence impacts. In fact, what matters more for distribution, and for designing adequate protective policies, is not the overall size of the shock but its incidence. A crucial (incidence-relevant) difference between Mexico and Brazil is the impact of the shock on labor markets. But this difference is not visible at once. For each percentage point reduction in GDP (when comparing the no-crisis to the crisis scenario), employment contracted by 0.2 percent in both Mexico and Brazil. However, when employment is measured in number of hours worked and not in number of people employed, the picture that emerges is quite different. Mexico experienced a sharp reduction in hours worked, whereas these were almost unaffected in Brazil. In Mexico, for the same 1 percent slowdown of GDP (the same “dose” of crisis), employment, when using the new definition of number of hours worked, contracts sixfold more, 1.2 percent instead of 0.2 percent.

These aggregate quantity adjustments mask more complex dynamics. In Mexico, more skilled jobs were hoarded while unskilled ones were shed, and this produced some widening of inequality. In Brazil, unskilled workers in the nontradable sectors (a group that is close to the bottom of the income distribution) actually experienced some employment gains, reducing income dispersion. .

Wages also adjusted differently: they were less flexible in Brazil than in Mexico. Earnings changes were progressive in Mexico, as skilled workers and those in the nontradable sectors—groups with higher

labor incomes—experienced a fall in their wage premia. Brazil's skill premium increased slightly and generated some unequalizing pressures.

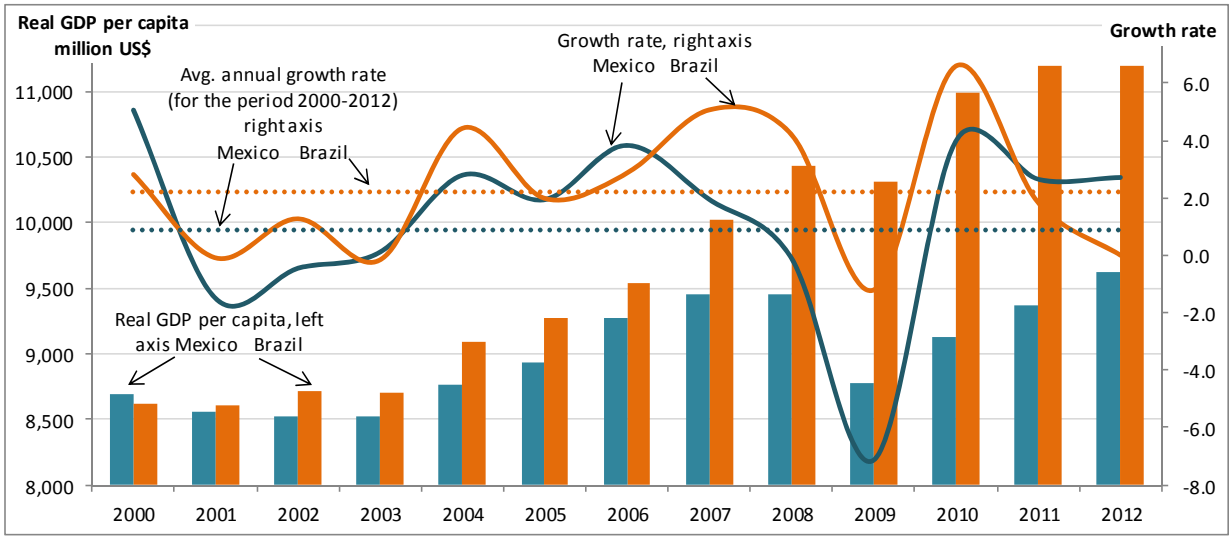
Notwithstanding the larger magnitude of the shock in Mexico and its negative impact across all parts of the distribution, the opposing forces of change in terms of employment and earnings combined to produce a similar overall incidence of the crisis across the two countries.[1] Our analysis discovered that the transmission channels were different, which provides useful insights for designing policy measures.

Setting the Problem

From 2000 to 2012, Brazil's per capita GDP grew cumulatively by about 30 percent, achieving an average annual growth rate of 2.2 percent. By contrast, growth in Mexico was rather weak, with an average annual growth rate of GDP per capita of less than 1 percentage point over the same period (see figure 5.1). Between 2008 and 2009 during the global financial crisis, Mexico's GDP per capita contracted by 7.4 percent, whereas Brazil experienced a reduction of only 1.2 percent.

A large number of papers— Gray et al. (2010); Lane and Milesi-Ferretti (2010); Rojas-Suarez (2010); Devereux, Kollmann, and Roeger (2011); Hollweg, Chudik and Fratzscher (2011); Rose and Spiegel (2011); Lederman, and Reyes (2012); Fernandez, Lederman, and Gutierrez-Rocha (2013)—have analyzed the aggregate impacts (GDP growth and aggregate demand adjustments) of the crisis. However, less is known about how these macro impacts affected poverty and the distribution of income (see Kaplan, Lederman, and Robertson 2012). The key contribution of this chapter is to shed light on the links between this macro shock and its micro consequences.

Figure 5.1 Growth Performances: Mexico and Brazil, 2000–2012



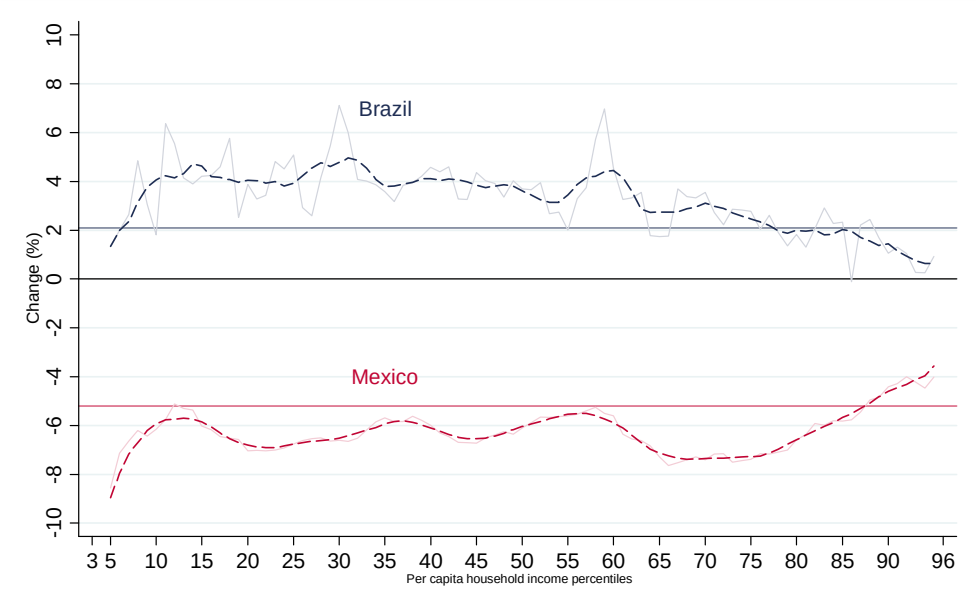
Source: Development Prospects Group (DECPG), World Bank.

[1] The features of the distributional changes described here refer to a comparison of two scenarios, one with the crisis and another without the crisis. As explained shortly, this is quite a different comparison than one contrasting the situations before (2007) and after (2009 or 2010) the crisis (as was conducted in chapter 3 on poverty).

The incidence of the crisis was drastically different across Brazil and Mexico, as shown by the growth incidence curves (GICs) in figure 5.2. In Mexico, all households suffered a reduction in income between 2008 and 2010 (years when household surveys are available), but income reductions were more acute among households at the lower part of the distribution, and particularly so among the poorest 10 percent of the population. By contrast, household surveys in Brazil for 2008 and 2009 report positive income changes for all households, with those in the middle of the distribution enjoying the largest increases.[2] The changes in income in the different parts of the distribution are summarized by changes in the Gini index of inequality, which in Mexico increased 0.3 percentage points and in Brazil showed fell 0.5 percentage points.[3]

A moderately negative growth effect, not captured by household surveys, combined with a progressive change in income distribution in Brazil, explains a reduction of 1.4 and 0.5 percentage points in its poverty headcount and gap, respectively. This is in stark contrast to Mexico, which experienced a sharp reduction in economic activity and an increase in income inequality, both of which explain the increase in the poverty headcount and gap of 2.6 and 1.1 percentage points, respectively.[4]

Figure 5.2 Growth Incidence Curve: Brazil, 2008–09, and Mexico, 2008–10



Sources: Brazil: Pesquisa Nacional por Amostra de Domicílios (PNAD, National Household Survey Sample), 2008 and 2009; Mexico: La Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH, National Household Income and Expenditure Survey), 2008 and 2010.

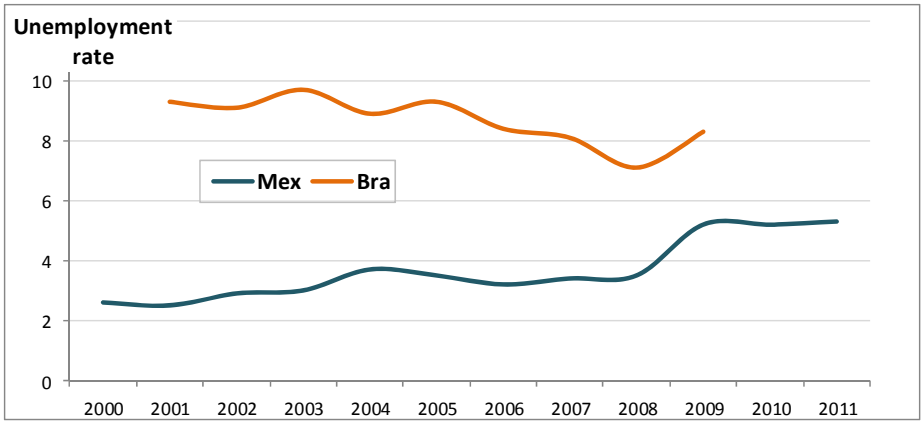
[2] Note that for Brazil there is a clear inconsistency between changes in GDP per capita (measured by national accounts) and changes in household incomes per capita, as measured by the Pesquisa Nacional por Amostra de Domicílios (PNAD, National Household Survey Sample). Inconsistencies between macro- and microdata sources have been at the center of a long and still open debate. For discussions on the subject, see Robilliard and Robinson (2003) and Deaton and Kozel (2005).

[3] For more details, see chapter 3.

[4] For more details, see chapter 3.

The global financial crisis most directly affected poverty and distribution through the labor market. Monthly wages in Mexico declined by almost 10 percent during the crisis period,[5] whereas in Brazil wages rose by 3 percent. The unemployment rate in Brazil rose from 7.1 percent to 8.3 percent, a moderate increase consistent with the minor contraction in GDP. However, as shown in figure 5.3, the crisis interrupted a trend of declining Brazilian unemployment. The increase in the unemployment rate in Mexico from 3.5 percent in 2008 to 5.2 percent in 2009 was similar in magnitude to that in Brazil, despite the much larger drop in GDP. However, the genuine full employment effect in Mexico should include, as mentioned at the outset of this chapter, the loss of worked hours. When these are considered, the total loss of "full-time equivalent" employment is 5.3 percentage points (compared with a 1.1 percentage point reduction in the number of people employed).

Figure 5.3 Unemployment Trends: Mexico and Brazil, 2000–2011



Source: World Development Indicators (database), World Bank (average yearly rates).

These figures illustrate changes in GDP and employment as percent differences between their respective levels before and after the crisis. An alternative is to compare the crisis levels of GDP and employment with the levels they would have reached in the absence of the crisis. The difference between a before-and-after and a counterfactual approach is not trivial, especially when one would have expected growth to continue at the pace observed before the crisis. Similarly, the incidence, or micro, effects of the crisis can be assessed by comparing income data from household surveys undertaken before and after the crisis, or by estimating the income distribution that would have emerged in absence of the crisis. Building macro- and microcounterfactuals or scenarios is the main methodological challenge faced in this study.

Conceptual Framework and the Macro-Micro Model

An analysis of links between a macroeconomic shock and its poverty effects cannot rely just on changes at the aggregate levels (GDP or prices). It requires an investigation of distributional changes, essentially in terms of factor market adjustments and relative price changes and their incidence at the level of the

[5] Here the crisis period refers to 2008 and 2010 for Mexico, and 2008 and 2009 for Brazil. These are the years for which household surveys were collected for the two countries. However, in the formal model-based analysis used later in the chapter, 2009 is the crisis year for both countries.

individual household. A general conceptual framework linking a macro shock to its micro impacts is summarized graphically in figure 5.4.

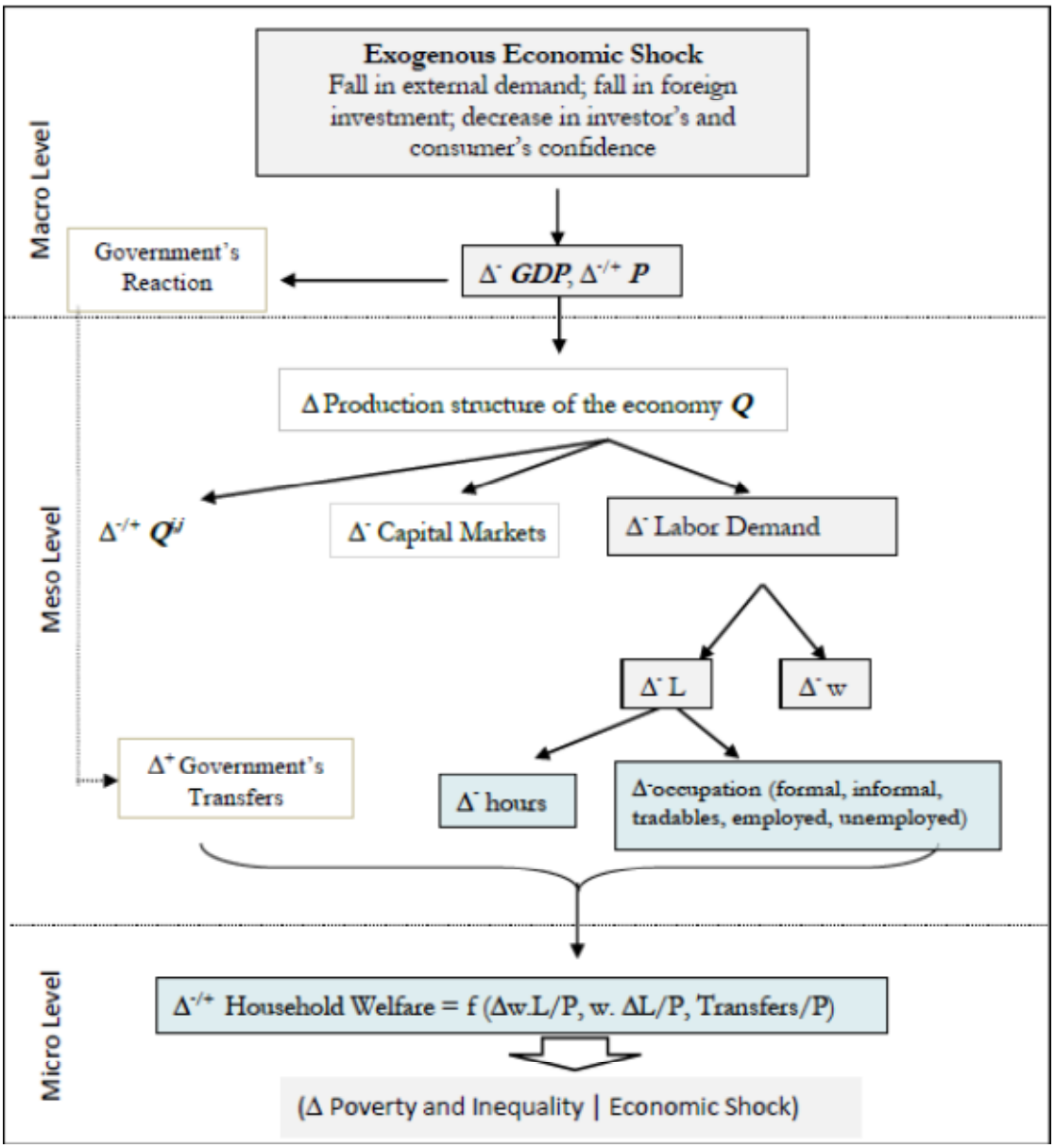
Economies are exposed to systemic risks that arise from different types of large shocks, or crises. The types of shocks range from natural disasters, conflicts, or civil unrest to economic crises. In the first group of shocks, one normally observes the destruction of physical and human capital with dire consequences for the affected countries. This study does not focus on this type of crisis; rather, it focuses on economic crises. These crises can be a consequence of either supply or demand side shocks. At the macro level (top panel of figure 5.4), demand and supply shocks can have the same effect —a reduction in aggregate output—but their impact on relative prices determines the reallocation of resources, the effects on input prices, and ultimately the incidence of the shock. Other things being equal, the magnitude of the initial shock and the slopes of aggregate demand and supply (which embed deep structural parameters of the affected economy) will determine how much GDP will contract and changes in relative prices.

Moving from the macro to the "meso" level (middle panel of figure 5.4), the fall in aggregate output can be mapped in the shrinkage of individual sectors and related contractions of factor incomes. For the sake of simplicity, assume that the economy has just two factors of production: capital and labor. A reduction in factor income can thus be the result of a fall in profits or a fall in the wage bill. These reductions may stem, for example, from a drop in export demand for a sector that uses more intensively one factor or the other factor. Once again, the structure of the economy, in particular the degree of competition and the functioning of the labor markets, will determine the size of the final income contraction. In turn, a lower demand for labor can be accommodated through a reduction in employment, a reduction in wages, or a combined reduction in both, or by shifting workers from formal (full-time, well-paid) jobs to informal (part-time, lower-paid) ones.

Given their relevance to the lower tail of the income distribution, this study focuses on labor market adjustments rather than on adjustments affecting capital incomes. Lack of good household-level data on capital endowments and income presents additional obstacles in moving beyond labor in modeling household income dynamics.

Changes in real factor income and real public and private transfers are mapped onto changes of household per capita income or consumption, poverty, and income distribution at the micro level (bottom panel of figure 5.4). *Real* is used here to take into account the changes in prices of the bundle of goods consumed by households.

Figure 5.4 Conceptual Framework: Linking a Macroeconomic Shock to Its Microeconomic Impacts



The strength of the transmission channels—from a shock to its poverty impacts—between the macro, meso, and micro levels and within them depends on structural characteristics of the economy such as the level of competition and contestability of relevant markets, the dynamism of labor markets, the ex ante risk management tools, and the ex post coping strategies of individual agents. The macro features of an economy—that is, its macroeconomic policies, institutions, and initial macro fundamentals—can be interpreted as risk management tools. On the eve of the 2008–09 global financial crisis, the degree of macro preparedness of most Latin American economies was fairly good. And similarly, at the micro level improvements in social protection programs provided an additional line of defense against risks. The responses to the shock also affected the strength of the transmission channels. Most governments

responded at the macro level by adopting countercyclical fiscal stances and accommodative monetary policies and at the micro level by expanding different types of programs and transfers.

To operationalize the conceptual framework, this chapter developes a structural macro-micro model that can be best described as a sequential two-step process. In the first step, a computable general equilibrium (CGE or macro) model is used to create two scenarios, one in which the crisis does not take place and a second in which the observed outcome of the crisis is reproduced. In a second step, three sets of general equilibrium effects, also called linkage aggregate variables (LAVs)—growth, wages, and employment by sector and skill—are mapped to households in a microsimulation model. This procedure generates macro- and microcounterfactuals.

The approach taken in this chapter is based on macro-micro simulation methodologies developed in the recent literature—Bourguignon, Bussolo, and Pereira da Silva (2008) describe its advantages and drawbacks. Variants of this methodology have been used in various contributions to this literature. These range from ex post studies, such as Robilliard, Bourguignon, and Robinson (2008), to ex ante simulation studies, such as Bourguignon, Ferreira, and Leite (2002); Chen and Ravallion (2004); Bussolo, Lay, and Van der Mensbrugghe (2006); and Bourguignon and Savard (2008). Comprehensive surveys are found in Bourguignon and Pereira da Silva (2003); Bourguignon, Bussolo, and Pereira da Silva (2008); and Davies (2009). A 2010 special edition of the *International Journal of Microsimulations* was fully dedicated to macro-micro modeling frameworks.[6]

The Macro Model

A MONASH-style[7] CGE model is used as the top macro model in this study. Production takes place under perfect competition and constant returns to scale, and it is modeled in a nested constant elasticity of substitution (CES) fashion to reflect various substitution possibilities across inputs. All labor and capital income accrues to the households.

The output of production activities is transformed into consumed commodities by means of a transition matrix, which takes into account the fact that multiple activities can produce the same commodity and that multiple commodities can be the output of a single activity. Household demand is allocated across commodities according to the linear expenditure system (LES), in which consumers maximize a Stone-Geary utility function subject to the disposable income constraint. Other final demand agents—government and investment—use the CES expenditure system.

International trade is modeled using the nested Armington specification, in which consumer products are differentiated by region of origin and combined using CES functions. World import prices are fixed, which means that any increase in import demand can be satisfied without affecting global prices (a small-country assumption). On the supply side, producers allocate output for domestic and export markets according to a constant elasticity of transformation (CET) specification. In contrast with the

[6] For more details, see the spring 2010 special issue of *International Journal of Microsimulation*, entitled "Macro-Micro Analytics: A Guide to Combining Computable General Equilibrium and Microsimulation Modeling Frameworks," at http://www.microsimulation.org/IJM/.

[7] See, for example, Dixon and Rimmer (2002) and Dixon et al. (2012). For Brazil, the CGE model is a 57-sector, single-country model built around Global Trade Analysis Project (GTAP) input-output tables for 2007. For Mexico, it is a 33-sector, single-country model built around Organisation for Economic Co-operation and Development (OECD) input-output tables for the mid-2000s.

import side, exporters have some degree of market power and therefore face a downward sloping demand curve.

The aggregate stock of capital is allocated across various sectors with a finite elasticity of transformation, resulting in imperfect capital mobility. Skilled and unskilled workers are freely mobile throughout the economy. Although international migration is likely to be an important element in the dynamics of the Mexican labor market, it is not considered here. Finally, the model allows for changes in the degree of resource utilization or unemployment for labor (via short-term wage stickiness) and excess capacity for capital.

The volumes of government current spending are fixed as shares of real GDP, as is the deficit (in real terms). Public revenues adjust to clear the government balance by means of a flexible household direct tax rate. Investment demand, derived from the production function, has to equal investment financing; the latter is represented by an upward sloping curve with respect to rates of return. Financing comes from a pool of domestic and international savings. Indeed, the current account balance is endogenous and equals the difference between domestic investment and domestic saving.

The model is solved in a recursive dynamic mode in which subsequent end-of-period equilibria are linked with a set of equations that update the main macroeconomic variables. There are three determinants of real GDP growth in the model: labor supply growth, capital accumulation, and increases in productivity. The volumes of skilled and unskilled labor grow exogenously at the growth rate of the working-age population (aged 15–64 years) obtained from World Bank population forecasts. The capital stock in each period is the sum of depreciated capital from the period before and new investment. For all sectors, total factor productivity is exogenous, but can be switched to endogenous, depending on the simulation closure rule.

In addition to the productivity case, switching variables from endogenous to exogenous according to the type of simulation is one of the major advantages of using a MONASH-style model. Three distinct simulation modes (and related closure rules) are used in this study: historical, forecast, and decomposition. These are described as follows:

- The *historical* mode switches naturally endogenous variables[8] such as consumption, investment, government spending, exports, imports, employment, and capital stocks at the detailed commodity/industry level to exogenous and sets them equal to their respective levels observed in a specific year. Correspondingly, historical simulations produce disaggregated estimates of many naturally exogenous, but often unobservable, variables representing investor and consumer confidence, positions of export demand and import supply curves, industry technologies, household preferences, and required rates of return on capital.
- The *forecast* mode is used in simulations designed to produce a baseline picture of a future or counterfactual evolution of the economy. The underlying philosophy of this simulation mode is similar to the historical one. In both modes, we exogenize variables for which we have information with no regard for causation. Rather than exogenizing variables for which we have historical observations, in the forecast mode we exogenize variables for which we have forecasts, or counterfactual levels. This might include macro variables, exports by commodity, and demographic variables.

[8] By "naturally" endogenous variables we mean those that are normally explained by CGE models. For example, for consumption quantities in a consumption equation, consumption quantity is the naturally endogenous variable, and the propensity to consume out of income is the parameter or naturally exogenous variable.

- The *decomposition* mode is used to assess the contribution of each individual transmission mechanism—represented, for example, by changes in confidence, export demand, technology—to the full change in the naturally endogenous variables of interest such as income, employment, and wages of different categories of workers. In this mode, confidence parameters, export demand curve positions, technology, preferences, and other such variables are set exogenous and are shifted, one at the time, with the movements estimated for them in the comparison between historical and forecast (or counterfactual) simulations.

By using these three simulation models, the CGE model assesses the relative importance of the various transmission mechanisms of the crisis. In addition, with these simulations, the CGE model provides the LAVs to run the appropriate counterfactual microsimulations, thereby allowing investigators to go beyond the imprecise before and after approach.

From Macro to Micro

The CGE-generated LAVs are used to "shock" the bottom micro module so that a counterfactual income distribution can be estimated.[9] The following equations represent the core of the micro module:

(5.1) $$W_h = f(Y_h, P_h) \cong \frac{Y_h}{P_h}$$

(5.2) $$Y_h = \sum_l \theta^{\ell}_{h,l} \theta^{e}_{h,l} w_l + Y_h^o$$

(5.3) $$P_h = p_f \theta_{f,h} + p_{nf} (1 - \theta_{f,h})$$

The welfare of household *h*, W_h, is defined as a function of income and a household-specific price index, P_h. The income of household *h*, Y_h, is defined as the sum of labor remunerations $(\sum_l \theta^{\ell}_{h,l} w_l)$, and an exogenous nonlabor income (Y_h^o). For the sake of simplicity, the household-specific price index is defined as the sum of economy-wide food and nonfood price indexes weighted by the household's budget allocated to these consumption items. Welfare effects are approximated by the following general expressions:

(5.4a) $$dW_h = \frac{\partial W_h}{\partial Y_h} dY_h + \frac{\partial W_h}{\partial P_h} dP_h$$

(5.4b) $$dW_h = \frac{\partial W_h}{\partial Y_h} \left\{ \frac{\partial Y_h}{\partial \theta^{\ell}_{h,l}} + \frac{\partial Y_h}{\partial \theta^{e}_{h,l}} + \frac{\partial Y_h}{\partial w_l} \right\} + \frac{\partial W_h}{\partial P_h} dP_h .$$

Therefore, changes in welfare are determined by changes in household income and the household-specific price index. In turn, changes in the household price index, dP_h, are solely determined by changes

[9] Note that the macro-micro analytical framework used here does not contain any explicit bottom-up feedback from the micro module to the macro model.

in the food and nonfood price indexes, keeping the budget shares, θ_f, constant. Changes in household income are solely determined by changes in labor remunerations, and these in turn are allowed to vary as a result of changes in the allocation of workers in the different labor market segments (i.e., employed versus unemployed and, if an individual is employed, the sector of occupation), tradable and nontradable sectors $(\Delta\theta^{\ell}_{h,l})$, hours worked $(\Delta\theta^{e}_{h,l})$, and the returns to skilled and unskilled labor in the different labor market segments (Δw_l). A new household welfare aggregate is computed by adding the exogenous household income to the sum of simulated labor incomes for each member of the household (given his or her skill endowments, employment status, and sector of employment) and deflating the new total household income by the new household-specific price index. Based on the simulated welfare aggregate, a counterfactual distribution of income is generated and compared with the initial distribution. Finally, growth effects are distribution-neutral changes in per capita household income.

A key issue in this modeling framework is the connection between the macro CGE part and the micro module, and therefore a major difficulty is satisfactorily mapping the sources of incomes from the CGE model to the micro model. For example, the microsimulation module defines an exogenous household income (Y^o_h) as all nonlabor income components such as transfers, imputed rents, and capital remuneration. This exogenous income is not modified during the simulations. Thus, although consistency between macro and micro is always pursued, the changes in capital remunerations predicted by the CGE are not reflected in the microdata.[10]

A structuralist feature introduced in the model is the assumption of labor market segmentation. Some degree of labor segmentation is allowed between the tradable and nontradable sectors. The labor market segmentation assumption gives rise to wage differentials across labor market segments.[11] At the micro level, workers are reallocated among employment and unemployment and tradable and nontradable sectors by means of a probit model, where the probability of losing or getting a job (or switching sectors) is estimated as a function of several personal and household characteristics. Workers are allowed to switch between labor market segments until the CGE -estimated differences in labor allocations between the crisis and no-crisis scenarios are achieved. For workers who switch, a labor income is imputed on the basis of observable characteristics and the return of them prevailing in the receiving labor market segment. For example, if a worker abandons unemployment, that worker will be imputed a wage based on his or her observable characteristics such as age, gender, and education. If a worker loses his or her job, that worker's labor income will be set to zero.

The top-down approach used here takes into account important sources of household heterogeneity such as the structure of income by labor segment and the composition of consumption in food versus nonfood items—θs in equations 5.2 and 5.3. In other words, although only a handful of variables link the macro and the micro, macro shocks will have different welfare impacts across households. In addition, allowing for full heterogeneity means that in the new, *simulated* distribution, households, as well as individuals, can be identified according to the complete set of socioeconomic characteristics recorded in the survey. It is thus easier to identify a specific characteristic—such as region of residence, employment

[10] The decision to treat capital remunerations as exogenous, thereby losing some of the macro-micro consistency, conforms with the limitations of household surveys in capturing incomes deriving from capital (see Székely and Hilgert 2007).

[11] The Chow tests for equality on the Mincer equation parameters between tradable and nontradable sectors were rejected at the 95 percent level of confidence, empirically supporting labor market segmentation.

status, gender, education, or age—that may strongly correlate with larger than average losses from the global crisis and then use this information in designing targeted compensatory measures.

Explaining the Welfare Effects of the Crisis

Macroeconomic and Aggregate Labor Market Effects

The macroeconomic and the aggregate labor market impacts of the crisis, when compared with a noncrisis counterfactual, were quite different in Mexico and Brazil. Mexico's labor market adjusted via a robust drop in hours worked and a moderate reduction in hourly wages. Employment measured in hours worked shrank by 7 percent, but only 2.1 percent of people lost their jobs.[12] Clearly, working fewer hours had a negative effect on incomes, but it generally represented a transitory and less severe loss than the one associated with becoming unemployed. In Brazil, the inflexibility of the real wage did not support employment when aggregate demand dropped. In terms of job losses, the crisis had a relative impact (i.e., for each 1 percent reduction of GDP) that was similar across the two countries. This and the next subsection focus on these cross-country differences at the macro and meso levels (see figure 5.4), and the third subsection considers the micro (poverty and distribution) impacts.

If the global financial crisis had not happened, the economies of Mexico and Brazil would have expanded by about 3 and 4 percent, respectively, during the simulation period, as shown in table 5.1. These "forecasts," or counterfactuals, impose GDP growth slightly higher than the trend growth observed in the recent past (2001–07) because they are based on the view of the world prevailing prior to the global financial crisis. In this view, Latin American countries—specifically those that have natural resources and that underwent structural reforms and have reached and maintained a stable macroeconomic framework—were considered likely to enjoy strong growth.[13]

Growth rates of supply of primary factors are also exogenously imposed. For Mexico, employment growth is projected at a little under 2 percent a year. Projected investment growth is above that of GDP. For Brazil, labor input growth is projected at about 2 percent a year, and investment growth at around that of GDP. Given this investment growth and the high initial (2008) investment to capital ratio, capital growth is projected at about 6 percent.

By fitting these paths, the model estimates endogenously the changes in a set of (normally exogenous) variables. For example, given a target in terms of growth of factor inputs and GDP, the model calculates the growth in total factor productivity (TFP). For Mexico, total factor productivity growth is estimated at 0.2 percent for 2009 and 0.7 percent a year for 2010. This would have been enough to support steady wage growth of about 1 percent a year in real terms. For Brazil, given the targeted GDP growth and the evolution of factors of production, the implied growth of total factor productivity is about −0.2 percent for 2009 and −0.3 percent for 2010. The small decrements in TFP over 2009–10 support zero wage growth in real terms.

[12] These figures are different from those reported earlier in this chapter because here they refer to the differences between a crisis and no-crisis scenario, whereas the earlier section was reporting the differences in levels before and after the crisis.

[13] To put in perspective the growth rates of 3–4 percent assumed in the counterfactual scenario of no crisis for Mexico and Brazil, compare the forecasts reported in the International Monetary Fund (IMF) staff reports for the Article IV consultations in these countries. These reports were forecasting for Mexico growth rates of 3.6–3.8 percent for the period 2008–12 (IMF 2007, 19, table "Medium-term Staff Scenario") and for Brazil a growth rate of 4.9 percent for 2008 (IMF 2008).

Table 5.1 Evolution of Main Macroeconomic Variables in the No-crisis and Crisis Scenarios (Growth Rates): Mexico and Brazil *percent*

		No-crisis or forecast simulation			Crisis or historical simulation			Difference		
	Average, 2001–07	2008	2009	2010	2008	2009	2010	2008	2009	2010
Mexico										
Real private consumption	3.8	1.8	3.3	3.5	1.8	-7.2	5.0	0.0	-10.2	-8.8
Real investment	3.8	5.9	4.4	4.4	5.9	-12.1	6.2	0.0	-15.8	-14.3
Real public consumption	0.5	1.0	1.5	1.5	1.0	3.2	2.4	0.0	1.7	2.6
Real exports	5.1	0.5	5.2	5.5	0.5	-13.5	21.7	0.0	-17.8	-5.2
Real imports	5.6	2.8	6.4	5.0	2.8	-18.6	20.5	0.0	-23.4	-12.2
Inventories[a]		-0.6	0.0	0.0	-0.6	-0.6	-0.6	0.0	-0.6	-1.2
Real GDP	2.3	1.2	2.8	3.5	1.2	-6.0	5.3	0.0	-8.5	-7.0
Aggregate employment in hours[b]	1.8	4.4	1.8	1.8	4.4	-5.3	5.4	0.0	-7.0	-3.7
Aggregate capital input		3.2	3.5	3.4	3.2	0.4	5.0	0.0	-3.0	-1.5
Total factor productivity[c]		-2.2	0.1	0.7	-2.2	-2.7	-0.2	0.0	-2.8	-3.7
Average real hourly wage rate[d]		-3.7	1.3	1.2	-3.7	-1.6	-4.5	0.0	-2.9	-8.3
Aggregate employment[e]	1.7	2.1	1.4	1.5	2.1	-1.1	3.0	0.0	-2.5	-1.0
Total factor productivity[c]		-0.7	0.2	0.7	-0.7	-5.2	0.1	0.0	-5.4	-6.0
Average real wage rate[d]		-1.6	1.0	1.0	-1.6	-7.5	-3.5	0.0	-8.4	-12.5
Brazil										
Real private consumption	3.3	5.7	3.8	3.8	5.7	4.4	6.9	0.0	0.6	3.7
Real investment	3.9	13.6	3.9	3.9	13.6	-6.7	21.3	0.0	-10.2	4.9
Real public consumption	3.3	3.2	3.3	3.3	3.2	3.1	4.2	0.0	-0.1	0.8
Real exports	9.1	0.5	9.1	9.1	0.5	-9.1	11.5	0.0	-16.7	-14.9
Real imports	6.9	15.4	6.3	6.3	15.4	-7.6	35.8	0.0	-13.1	11.1
Inventories[a]		-0.6	0.0	0.0	-0.6	-0.6	-0.6	0.0	-0.6	-1.2
Real GDP	3.4	5.2	4.0	4.0	5.2	-0.3	7.5	0.0	-4.1	-0.9
Aggregate employment[e]	3.0	5.0	1.4	1.7	5.0	0.4	3.6	0.0	-0.9	0.9
Aggregate capital input		5.0	6.0	5.6	5.0	3.5	4.7	0.0	-2.3	-3.1
Total factor productivity[c]		-0.4	-0.2	-0.3	-0.4	0.0	1.7	0.0	0.2	2.2
Average real wage rate[d]		1.3	0.0	0.0	1.3	0.6	0.0	0.0	0.6	0.6

Source: World Bank data.
a. Inventory change as a percentage contribution to GDP.
b. Employment measured as full-time equivalent number of people (derived from the hours worked).
c. GDP per unit of primary factor input.
d. Calculated as a weighted average of the percentage movements in wage rates by occupation and sector, with the weights in the year *t* calculation reflecting wage bill shares halfway between those in years $t - 1$ and *t.*
e. Measures labor input as number of people employed.

Other endogenous results from these forecast simulations include: changes in investor confidence, propensity to consume, preferences across domestic or imported goods, international prices, and related foreign demand and supply of goods and services.[14]

In the historical or crisis run, Mexico's GDP and all of its expenditure components, except public consumption, contracted in 2009. The drop in investment and trade were, because of the nature of the crisis, substantial. Exports declined by 14 percent, in contrast with a no-crisis expansion of 5 percent, and imports collapsed by almost 20 percent,[15] compared with a no-crisis increase of nearly 7 percent. Public consumption grew by 3 percent, compared with baseline growth of 1.5 percent. A higher public expenditure was part of the Mexican government's response to the global financial crisis.

In 2009, trade and investment also collapsed in Brazil, confirming that the crisis this time around was originating outside of Latin America. However, GDP and private consumption were much less affected in Brazil than in Mexico. This is an important difference: in Mexico, a 6 percent contraction in GDP was accompanied by a 12 percent reduction in investment (a 1:2 relationship). In Brazil, a less than half a percent slowdown in GDP growth was accompanied by a drop of 7 percent in investment (a 1:20 relationship). The crisis-related adjustments in the structure of aggregate demand were very different across the two countries, with important consequences for the differential adjustment of the factor markets and especially of the labor markets (see the next subsection).

By contrasting the forecast scenario and the historical scenario—that is, the no-crisis scenario with the crisis one—the model unveils the size of the change in key unobservable variables. For both countries, the magnitudes of the loss of investor confidence, the shift of export demand curves, and changes in consumer behavior as related to the drops in *I*, *X*, *M*, and *C* are summarized in table 5.2. The crisis also featured changes on the supply side. Mexico and Brazil experienced a reduction in the use of capital, changes in the intensity of use of different types of labor, and wage adjustments. For example, the recession of 2009 had little effect on the capital stocks available to Mexican and Brazilian businesses, but it did affect the amount of capital in use. According to the available estimates, in 2009 recession-related excess capacity (capital not in use) was about 3.0 percent for Mexico and 2.5 percent for Brazil. The implied effects on unobservable variables, such as technological and productivity shifts, of these supply-side changes were also estimated comparing the two scenarios and are shown in table 5.2.

[14] As explained earlier, during the forecast simulation the model swaps naturally endogenous variables with naturally exogenous ones. In the case of investment, the model would naturally explain it as the equilibrium point where investment demand (derived from the demand for capital in the production function) and investment supply (financing of investment opportunities derived from savings) meet. However, in the forecast mode this point (i.e., the level of investment) is given, and the model calculates what happens to investor confidence, so that this level is actually compatible with the data that underpin this investment market for each country.

In the case of consumption, given a target of its actual level, together with income growth and relative prices, the model estimates the propensity to consume. For exports, given the supply of Brazilian and Mexican products for the international markets, the position of the foreign demand compatible with the actual observed export flows is calculated. And so on.

[15] In addition to the usual MONASH features, the model for Mexico incorporates Mexico's manufacturing re-export activity. Re-exporting, in which large volumes of imports are processed entirely for export, is an important aspect of the Mexican economy. Because of the crisis, imports in Mexico contracted not only because of a fall in incomes but also because of a fall in export demand. And the second link is a direct link—that is, over and above the indirect link that a contraction of export demand has on incomes.

Table 5.2 Summary of the Main Shocks from and Adjustments to the Global Financial Crisis Based on Contrasting the Forecast Scenario and the Historical Scenario: Mexico and Brazil

	Mexico	Brazil
Investor confidence	The crisis and its associated loss of confidence mean that for the same level of investment, investors require a higher rate of return. In a nonrecessionary situation, the average rate of return on capital in Mexico in 2009 is 8 percent. To overcome the intensified risk aversion, the increase in the rate of return is 6.25 percent—that is, to justify the nonrecessionary level of investment, the rate of return rises from 8.0 percent to 8.5 percent.	In the nonrecessionary situation, the average rate of return on capital in Brazil in 2009 is 13.9 percent. The upward movement in the capital supply schedule caused by the loss of confidence related to the recession is 15.1 percent. This implies that the rate of return required justifying the nonrecessionary level of investment moves from 13.9 percent to 16.0 percent.
Trade	A large reduction in foreign (mainly U.S.) demand for Mexican products; changes in preferences toward domestic goods and away from imports; deterioration in the terms of trade. Quantitatively, these shocks correspond to a 12.3 percent reduction in foreign demand—that is, at any foreign price Mexico could sell 12.3 percent less in the recession than it would have been able to sell in the nonrecession situation—and a change in preferences reducing the ratio of import quantities to domestic quantities by 37 percent at any ratio of import prices to domestic prices.	Reduction in demand for Brazilian products; changes in preferences toward domestic goods; deterioration in the terms of trade. These effects correspond to a 21.2 percent reduction in foreign demand and a change in preferences that reduces the ratio of import quantities to domestic quantities by 14.7 percent at any ratio of import prices to domestic prices.
Public expenditure	An increase in public expenditures of 1.7 percent.	An increase in public expenditures of 0.63 percent.
Propensity to consume	A smoothing of consumption—that is, an increase in the average propensity to consume (public and private) out of GNP. The increase in the average propensity to consume is 3.7 percent.	The increase in the average propensity to consume is 4.8 percent.
Excess capacity (Δ capital in use)	A reduction of capital in use (excess capacity) of 2.9 percent. This shock also includes the effects of a change in inventories.	A reduction in capital in use (excess capacity) of 2.35 percent. This shock also includes the effects of a change in inventories.

Productivity	A reduction in total factor productivity of 2.7 percent.	A reduction in total factor productivity of 2.0 percent. For Brazil, this shock also contains the effects of a technology change favoring labor over capital.
Wage rates	A reduction in the aggregate real wage rate of 2.8 percent.	An increase in real wage rates of 0.60 percent.
Technology shift	A shift in employer preferences in favor of skilled workers and against unskilled workers.	A shift in employer preferences in favor of unskilled and against skilled workers. The shift is about 15 percent in the nontraded sectors—that is, the ratio of unskilled employment to skilled employment increases by 15 percent because of the recession, above and beyond wage changes.

Source: World Bank data.

What Explains the Different Labor Market Impacts of the Crisis in Mexico and Brazil?

The aggregate labor market impacts of the crisis have already been described. However, to fully capture the micro consequences of the main cross-country differences in terms of adjustments of jobs versus hours worked and of wage increases versus reductions, adjustments at a more disaggregated level need to be analyzed. And the picture becomes slightly more complicated when these changes are analyzed for different categories of workers (skilled and unskilled) and for different sectors (tradables and nontradables)—see table 5.3.

In Mexico, workers in the tradable sectors suffer larger (hour) employment losses, but milder wage declines than workers in the nontradable sectors. These differential adjustments result in an increase in the tradable to nontradable sectoral wage premium. Similarly, unskilled workers are more likely to lose jobs than skilled ones, and, correspondingly, the unemployment rate rises more for unskilled workers vis-à-vis skilled ones. However, the skill wage premium is almost unaffected. A main adjustment channel of the Mexican labor market is captured by the change in the factorial intensity shown in the bottom panel of table 5.3. For both the tradable and nontradable sectors of the economy, the skilled to unskilled employment ratio increases by about 3 percent. In the no-crisis scenario, Mexico would have normally employed 1.02 and 2.18 (effective) skilled workers per each unskilled worker in the tradable and nontradable sectors, respectively. But because of the crisis, these ratios become 1.06 and 2.26. This change in the skill intensity of Mexican labor markets is enough to save about 1 million skilled jobs during the crisis.[16]

[16] In the no-crisis scenario, employment of effective workers equals 13.6 million for unskilled workers and 23.5 million for skilled workers and an overall ratio of skilled worker per unskilled worker of 1.73. In the crisis scenario, this ratio increases to 1.81, and thus—assuming that nothing happens to the level of employment of unskilled workers—the number of employed skilled workers is estimated at 24.5 million (13.6 million x 1.81). The difference in employment for skilled workers between the two scenarios is equal to 1 million.

In Brazil, employment in the tradable sectors goes down as well, and more severely for unskilled workers. The nontradable sectors react differently and register a slight increase in employment. However, the increase benefits only unskilled workers. This positive impact does not fully compensate for the job losses in the tradable sectors that are large enough to amount to a collective loss of employment of about 1 percent for unskilled workers. The adjustment in the Brazilian labor markets appears to have been the substitution of skilled by unskilled employment in the nontradable sectors and the reverse in the tradable sectors. This is highlighted by the changes in factor intensities in table 5.3. These quantity adjustments are accompanied by negligible changes in the skill and sectoral wage premia.

These cross-country differences in the labor market adjustment are the joint result of the type of shock that hit these countries, the institutional settings of their product and factor markets, and agents' reactions to the shock. A decomposition analysis (performed by using the CGE model in decomposition mode) sheds light on the contribution of these different mechanisms.

Table 5.3 Labor Market Performance (Percentage Difference between the Crisis and No-Crisis Scenarios in 2009): Mexico and Brazil

	Mexico	Brazil
Real wages[a]		
Unskilled workers in tradables	-1.7	1.2
Unskilled workers in nontradables	-4.3	-0.3
Skilled workers in tradables	-0.7	-0.5
Skilled workers in nontradables	-4.2	1.1
Wage premia		
Skilled/unskilled workers	-0.2	0.3
Trade/nontrade	3.3	0.5
Employment[b]		
Unskilled workers in tradables	-12.3	-6.7
Unskilled workers in nontradables	-7.8	2.7
Skilled workers in tradables	-9.4	-3.7
Skilled workers in nontradables	-4.3	0.2
Unskilled workers	-9.6	-1.3
Skilled workers	-5.5	-0.6
Tradables	-10.9	-5.7
Nontradables	-5.4	1.2
Sectoral skill intensities		
Skilled/unskilled workers in tradables	3.3	3.2
Skilled/unskilled workers in nontradables	3.8	-2.4
Unskilled unemployed labor	49.1	19.4
Skilled unemployed labor	45.3	6.0
Overall real GDP (growth effect)	-8.5	-4.1

Source: MONASH model simulations based on historical and forecast runs.
a. Real wages are measured as monthly average wages for Brazil and hourly average wages for Mexico.
b. Employment is number of workers for Brazil and effective employment for Mexico (i.e., the number of worked hours per week divided by 48—equivalent to full-time employment).

Starting with the type of shock, for Mexico loss of investor confidence, trade shocks, underutilization of capital, consumption smoothing (a temporary reduction in saving to compensate for losses of income), and expansion of public expenditures jointly explain about 60 percent of the total loss of employment.[17] This share is quite large but not uniform. Together, these mechanisms capture 70 percent of the reduction in the employment of skilled workers but only 40 percent of the employment of unskilled ones.

This finding clearly indicates that the institutional settings and the agents' reactions play an important role. Wage downward flexibility actually helps to conserve employment (more or less equally for the skilled and unskilled), and thus productivity and labor hoarding have to explain the residual share of the change (60 percent for unskilled labor and 30 percent for skilled labor). Employers' decisions to hold on to their more skilled workers (labor hoarding) and shed unskilled jobs increase the share of accounted reduction of unskilled employment by another 30 percent. The residual 30 percent of unexplained change in employment (for both skilled and unskilled workers) is dealt with by negative productivity shifts. These come from adjustments within the sectors (such as churning of firms) and are not explicitly determined by the model.

The case of Brazil is quite different. Crisis-related demand side changes account jointly for almost 500 percent of the full reduction in employment between the two scenarios—by about 300 and 800 percent of the drop in the employment of skilled and unskilled workers, respectively. This finding implies that there are very strong adjustments (conserving jobs) in the labor markets, and that they are of greater magnitude for the unskilled.

Before describing Brazil's labor market adjustments, we will consider separately the specific impacts on workers of the investment, private consumption, and trade shocks. In Brazil, the large drop in investment demand because of the loss in investor confidence by itself explains more than 400 percent of the reduction in employment of unskilled workers. Because of the concentration of very low-skilled workers in the construction sector, this fall in investment barely affects skilled employment. In fact, in Brazil the drop in investment alone explains about 140 percent of the total reduction in employment for all workers. By contrast, the same shock explains only 14 percent of the loss of employment in Mexico.

The change in private consumption and its consequences for employment are also quite different across the two countries. Because of the drop in their incomes and the relative prices they are facing, consumers in both countries adjust upward their propensity to consume (consumption smoothing), but they do so more significantly in Brazil. This private consumption shift supports GDP in both countries, but the effect on employment is of the opposite sign. Employment (both skilled and unskilled) in Mexico benefits from it, but not in Brazil. There the shift in the composition of aggregate demand—toward more private consumption—entails a reallocation of resources from the more labor-intensive production sectors (essentially tradables) to those less labor-intensive.

[17] The combined effect is estimated by summing the changes in *L* in the first row of table 5A.1 in annex A for columns (1) to (5). This sum is equal to 4.08 percent, and it represents 58 percent of the total change, 7.0. Each column of the table represents the isolated impact of an individual driver or shock. For example, the model can identify the impact of the reduction in investor confidence (as described in **table 5.2**) in isolation (by imputing the change in investor confidence from the no-crisis to the crisis scenario while leaving the average propensity to consume, trade flows, government expenditure, etc. on their no-crisis paths) on GDP, employment, and wages. This impact can then be compared with the total impact to estimate the relative contribution of the reduction of investment confidence. (a detailed analysis is offered in annex B).

Finally, the trade shock decreases aggregate employment in both countries in roughly the same proportion, explaining between 40 and 50 percent of the total reduction in employment. But in Brazil it affects more significantly unskilled workers, whereas in Mexico skilled workers suffer larger losses.

In summary, it is clear that the *shape* of the shock affected Mexican and Brazilian labor markets quite dissimilarly. However, as mentioned earlier, in Brazil the labor market's adjustment mechanisms (wages, productivity, and hoarding) were also very different from those described for Mexico. In Brazil, the slight rise in real wages added to the difficulty in retaining workers. But, more important, productivity and labor hoarding shifts strongly contributed to conserving employment and specifically unskilled employment. First, during the crisis there was a general shift in production toward using more intensively labor versus capital. Second, and in contrast to Mexico, unskilled labor, especially in the nontradable sectors, was hoarded. However, for the tradable sectors the adjustment was similar to that observed in Mexico: exporting firms or firms producing traded goods for the domestic market competing with imports tended to preserve their more skilled workers.

Poverty and Income Distribution Effects of the Crisis

The overall welfare effect of the crisis can be decomposed into growth and distributional impacts. The growth component is simply the difference between the observed level of GDP per capita (which is also the level reproduced in the historical mode) and the level that would have been observed in the absence of the crisis (forecast mode). The global crisis caused an 8 percent contraction of GDP per capita in Mexico and a 4 percent reduction in Brazil. In the absence of the crisis, GDP per capita in Mexico and Brazil would have been US$970 and US$260 higher, respectively, than the level observed in 2009. However, the income loss was not the same for all socioeconomic groups. For example, Mexican workers in the tradable sectors of the economy suffered a milder reduction in wages but larger employment losses as a result of the crisis.

In more formal terms, the distributional impact depends on changes of (1) unemployment rates (or, more precisely, full job losses), (2) number of hours worked, and (3) hourly wages, all of which are differentiated by sector (tradables versus nontradables) and by skill level.

The full distributional impact is decomposed into the individual contributions of each of these changes and is illustrated by growth incidence curves capturing their ceteris paribus effect. A GIC with a positive slope indicates a regressive effect—that is, poorer households lose more (or gain less), in relative terms, than richer ones. Our baseline is the Mexican household survey, La Encuesta Nacional de Ingresos y Gastos de los Hogares, (ENIGH, National Household Income and Expenditure Survey), for 2008 and the Brazilian survey PNAD for 2009. The Mexican survey, ENIGH 2008, is then shocked with the negative effects of the crisis captured by the difference between the historical (observed) crisis scenario and the forecast no-crisis scenario. For Brazil, the starting point is PNAD 2009, which already contains the effects of the crisis. Thus households are affected with a positive shock to construct the hypothetical scenario of Brazil in 2009 without the crisis (forecast mode).

Distributional Effects of Changes in Wages

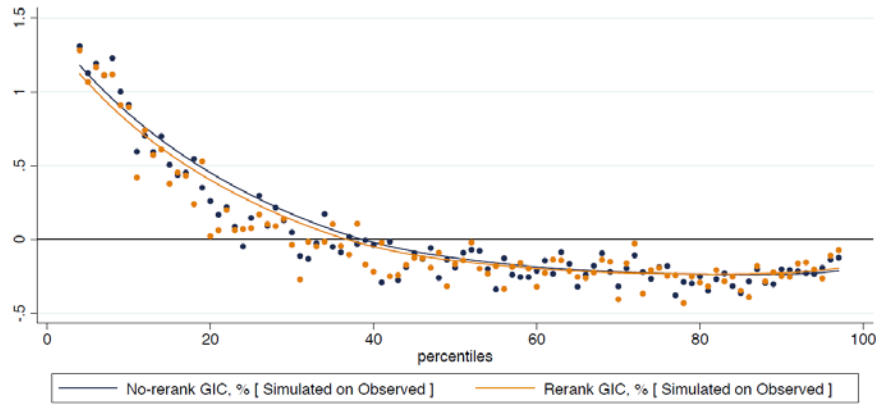
In Mexico, the hourly wage reductions observed during the crisis were much milder in the tradable sectors than in the nontradable sectors (a reduction of more than 4 percent for both skilled and unskilled workers in nontradables, and contractions of 1.7 and 0.7 percent, respectively, for unskilled and skilled workers in the tradables—see the relevant data in table 5.3). Overall, the crisis reduced the wage gap between tradable and nontradable sectors and did not have a significant effect on the skill

wage premia. Because workers in tradable sectors earn lower wages, the distributional effect through this channel was relatively mild and progressive.

Figure 5.5 shows the (growth-neutral) distributional effect of the change in hourly wages brought about by the crisis. Empirically, this microsimulation is performed by simply changing the hourly wages of all individuals in the household survey ENIGH 2008 according to their position in the labor market (skilled, unskilled, tradable, nontradable) and the shocks shown in the upper panel of table 5.3.[18]

The negative slope of the growth incidence curve in figure 5.5 shows that had the crisis only affected hourly wages in Mexico income inequality would have declined as a consequence of the shock. The progressivity of this shock is explained by the relatively mild wage adjustment in the tradable sectors, where labor remuneration is lower than in the nontradable sectors. Much of the progressivity is determined by the differentiated income effects among the poorest households and those located in the middle of the distribution and less so between the latter and the richest households.

Figure 5.5 Distributional Effects of Changes in Hourly Wages, Observed and No-Crisis Scenarios: Mexico



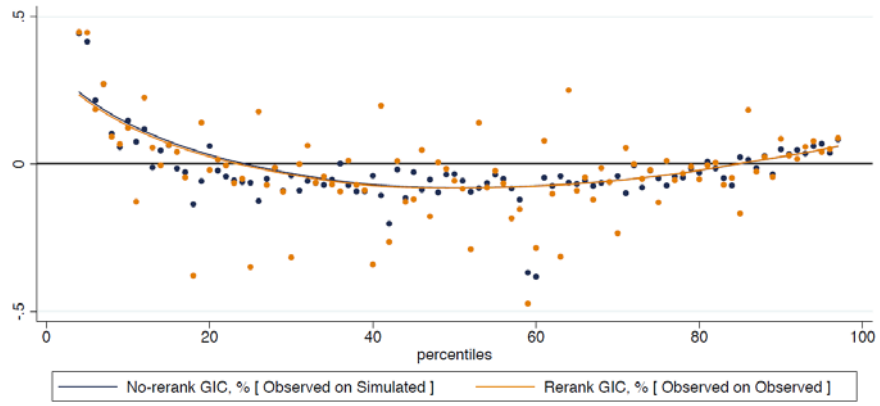
Source: Authors' own computation using the results from the microsimulation

Figure 5.5 shows two growth incidence curves that practically overlap; one does not allow for a re-ranking of households along the income distribution (blue line) and the other does (orange line). Although in this particular case the two GICs are practically the same, conceptually they are quite different.[19] The blue (no-reranking) line depicts changes in average per capita household income following the same households in the observed and simulated scenarios. By contrast, the orange GIC, which allows re-ranking, treats households in the observed situation and simulated scenario as if they were coming from different surveys. The difference between the GICs captures changes in the position of households along the income distribution between the historical and forecast scenarios—that is, the economic mobility brought about by the crisis.

[18] In this simulation, the average per capita household income is kept constant to emphasize that changes in labor market outcomes (wages, labor allocation, and hours worked) are determining the distributional effects of the crisis, while the changes in average incomes are solely determined by the growth effect of the crisis as estimated by the macro model.

[19] See Bourguignon (2011) for a detailed discussion on this topic.

Figure 5.6 Distributional Effects of Changes in Monthly Wages, Observed and No-Crisis Scenarios: Brazil



Source: Authors' own computation using the results from the microsimulation

The distributional effects of changes in (monthly) wages in Brazil are significantly different from those in Mexico (figure 5.6). Because of wage inflexibility, unskilled workers in tradable sectors, the lowest earning group, and skilled workers in services, the group with the highest earnings, experienced an *increase* in real wages as a consequence of the crisis (see table 5.3). By contrast, unskilled workers in the nontradable sectors and skilled workers in tradable sectors (those located in the middle of the income distribution) experienced a decrease in real wages as a consequence of the crisis. Therefore, figure 5.6 shows a fairly flat U-shaped GIC, with those at the extremes of the per capita household income distribution benefiting from wage rigidities but not those toward the middle of the distribution.

Overall, the changes in (hourly) wages brought about in Mexico by the crisis were progressive—although all labor market segments experienced a wage loss, and in Brazil the changes in (monthly) wages were slightly regressive—that is, they increased inequality. The difference in incidence is explained by the way in which the tradable versus nontradable sectors, as well as the skilled versus unskilled wage gaps, changed in the two countries. The negative shock of the international crisis on Mexico's tradable sectors (employing workers earning on average less than workers in the nontradable sectors) was accommodated more through a reduction in quantities than in hourly wages. In fact, reducing the number of hours worked saved jobs while permitting employers to reduce costs–with no need for larger cuts in hourly wages—when facing the crisis. Adjustments in the nontradable sectors entailed both losses of hours worked (but less intensive than in the tradable sectors) and hourly wages (with larger negative magnitudes). In particular, skilled workers in the nontradable sectors, the largest group of workers in this segment and the group with the highest earners, endured a large drop in hourly wages. These adjustments entailed both an increase in the tradable to nontradable wage gap and a reduction in the skill premium. Both of these changes are equalizing and explain the progressivity of the GIC. Brazil's adjustments implied a slight increase in the skill wage gap and a very minor improvement in the intersectoral gap. The combination of an unequalizing and an equalizing pressure generated the mild U-shaped GIC shown in figure 5.6.

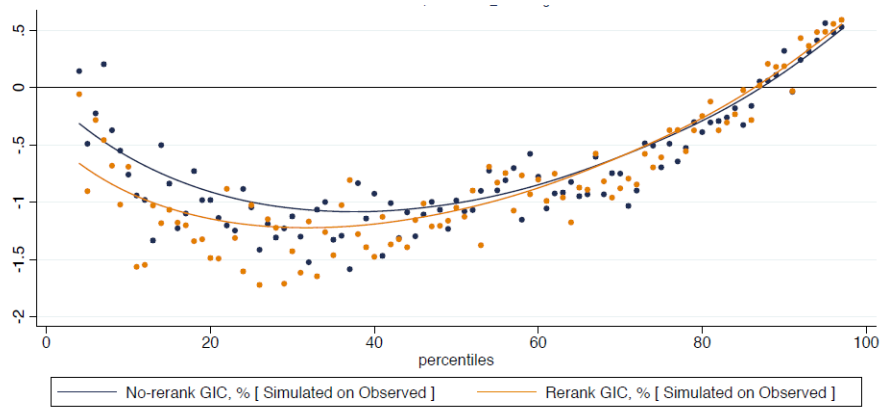
Distributional Effects of Changes in Total Hours Worked

In Mexico, the adjustment mechanism applied to reductions in labor demand differed between the tradable and nontradable sectors. The tradable sector adjusted mainly through quantities, with

relatively mild reductions in hourly wages; the nontradable sector adjusted through wages but relatively small reductions in effective employment (see table 5.3 for details).

How do the simulated crisis-related changes in total hours worked affect the incomes of households at different parts of the distribution? Figure 5.7 answers this question using the 2008 Mexican household survey and imposing the negative shocks in effective employment as reported in table 5.3 while keeping all other variables and average income constant. Overall, the effects are regressive, but the largest negative impacts are borne by households located between the 20th and 40th percentiles. Note that there is a small difference between the GIC that allows for re-ranking (orange line, assuming anonymous households) and the GIC that does not allow for re-ranking (blue line, "following" households), showing that the crisis-mandated changes in hours worked and their implied change in income were large enough to change the ordering of some households in the lower part of the distribution. The hours worked in Brazil did not vary significantly between the crisis and no-crisis scenarios, and thus this feature is not considered for Brazil.

Figure 5.7 Distributional Effects of Changes in Hours Worked, Observed and No-Crisis Scenarios: Mexico



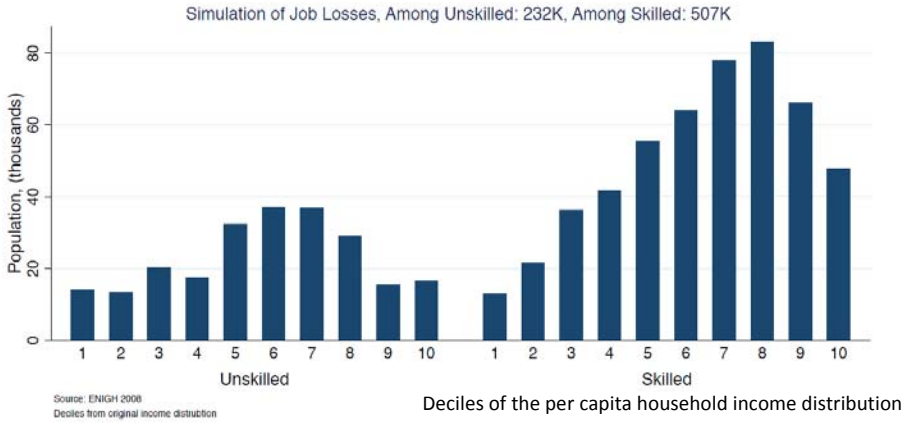
Source: Authors' own computation using the results from the microsimulation

Distributional Effects of Increased Unemployment Rates

A reduction in total hours worked or effective employment is the outcome of a reduction in the number of people employed and, among those who kept their jobs, a reduction in hours worked (in the case of Mexico). In Mexico, the unemployment rate among unskilled workers increased from a simulated no-crisis scenario of 2.8 percent to an observed level of 4.2 percent during 2009, for an increase of 1.4 percentage points or 49.1 percent as reported in the bottom panel of table 5.3. For skilled workers, the unemployment rate increased 1.9 percentage points, from 4.1 percent in the simulated no-crisis scenario to 6.0 percent during the crisis (an increase of 45.3 percent as reported in the bottom panel of table 5.3). These changes in unemployment rates meant that 739,000 Mexican workers were pushed into unemployment, of which 232,000 were unskilled and 507,000 were skilled. The difference in the numbers of workers is explained by the larger population being classified as skilled workers (i.e., those with at least nine years of formal schooling). But who are those 739,000 workers who lost their jobs as a consequence of the crisis? Or, more specifically, were these workers male or female? Were they earning similar wages, were they of similar ages, or did they share other characteristics? Using the information at the micro (household) level, it is possible to ascertain the differential (and incidence) impact of an increase in aggregate unemployment. By means of a probit model, which estimates the probability of

being unemployed as a function of sex, years of schooling, age, a rural/urban dummy, and geographic location, the microsimulation module identifies those who are most likely to lose their jobs. By construction, the workers chosen to become unemployed by the probit model are those whose characteristics are closest to those of unemployed individuals.

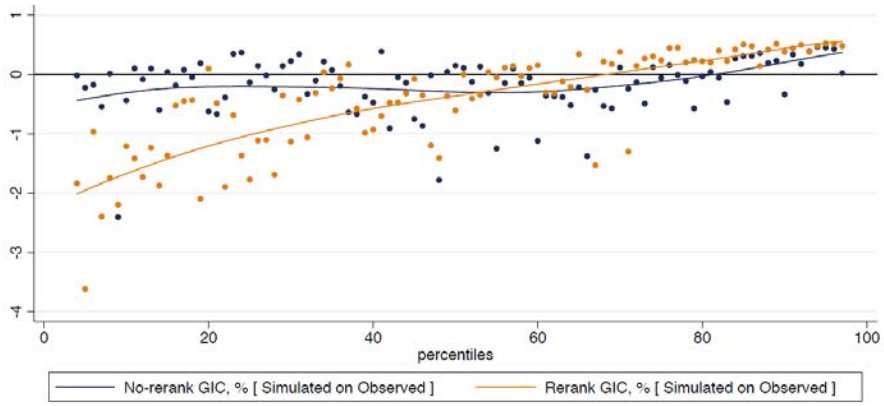
Figure 5.8 Distribution of Job Destruction Caused by the Global Financial Crisis, by Decile and Skills Level: Mexico



Source: ENIGH, 2008.

Based on use of the microsimulation results to compare the crisis versus no-crisis scenarios, figure 5.8**Figure 5.8** shows the incidence of job destruction caused by the global financial crisis among deciles of the income distribution, distinguishing by skill levels. Among unskilled workers, the largest effects are concentrated in deciles 5 to 8, and for skilled workers the incidence is more progressive, concentrating in deciles 5 to 9. Although the reduction in per capita household income among households that experience a job loss is quite large (35 percent), the total jobs lost because of the crisis represent only 1.7 percent of the total working population of almost 43 million. For this reason, as shown in figure 5.9, the isolated distributional effect of unemployment when following the same households in the scenarios with and without the crisis (not allowing for re-ranking) are quite neutral. However, when the GIC allows for re-ranking, the incidence of the crisis-mandated increase in unemployment rates shows a regressive effect. The difference between the two incidence curves shown in figure 5.9 reveals that unemployment has large mobility effects—in other words, every time a household experiences a job loss with its subsequent income contraction, its position in the income distribution changes.

Figure 5.9 Distributional Effects of Job Losses, Observed and No-Crisis Scenarios: Mexico

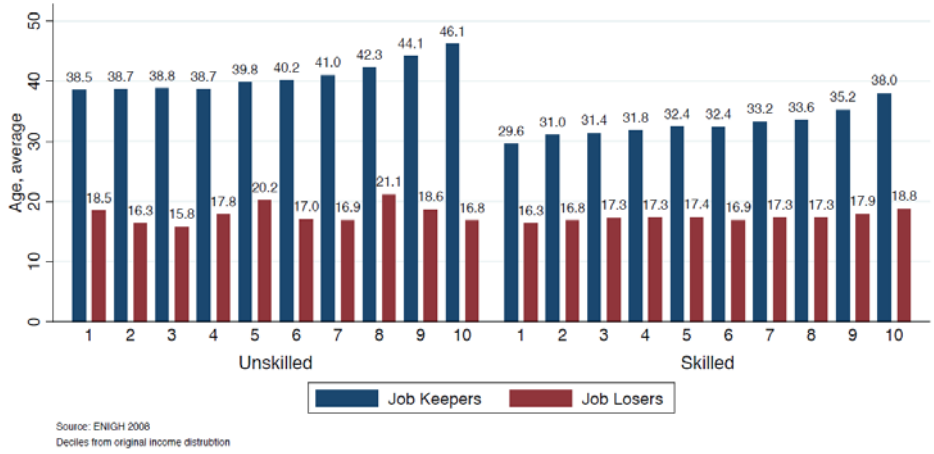


Source: Authors' own computation using the results from the microsimulation

Two other household characteristics also help explain the distributional effects of job losses: (1) heterogeneity in the source of income and (2) heterogeneity in the share of household members having a job. Labor earnings account for a lower share of total household income among households in the lowest and highest deciles of the income distribution. The poorest households in Mexico obtain a significant proportion of their income from transfers, whereas capital earnings account for a sizable proportion of the incomes of the richest households. Therefore, changes in labor income triggered by a job loss have a heterogeneous welfare effect among households located at different points in the distribution. Furthermore, the proportion of household members who have a job is significantly lower among the poorest households in Mexico. These two features explain why the largest income reductions brought about by job losses are concentrated among households located in the middle part of the income distribution.

An interesting result of the unemployment effects in Mexico is its concentration among the youth. In Mexico, being young is one of the most common characteristics of the unemployed; therefore, the probit model identifies young workers as the most likely to lose their jobs because of the crisis (figure 5.10).

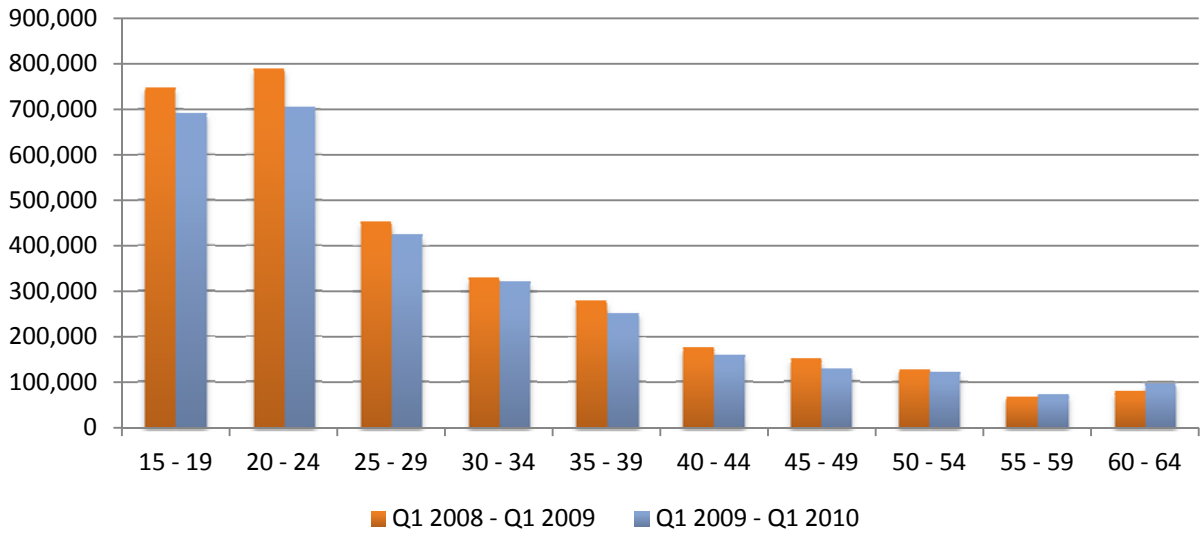
Figure 5.10 Average Age of Job Keepers and Job Losers: Mexico (Results of Microsimulation)



Source: ENIGH, 2008.

But are these effects the outcome of the assumptions of the model (i.e., the mechanical way in which the probit model is selecting workers to become unemployed), or do they find some empirical support? Using data from the Mexican employment survey, Encuesta Nacional de Ocupación y Empleo (ENOE, National Survey of Occupation and Employment) from the first quarters of 2008, 2009 and 2010, we find that the age groups that lost more jobs during the crisis were, indeed, those between the ages of 15 and 29 (figure 5.11). Although workers of this age accounted for less than a third of total employment in Mexico, this age group filled 6 of every 10 jobs destroyed in Mexico during the first quarter of 2008 and the first quarter of 2010.[20] The incidence of job losses is not as concentrated among youth as simulated by our model, but this evidence supports the results produced by the model: youth are the group most likely to lose a job during a negative economic shock.

Figure 5.11 Job Destruction: Mexico



Source: Encuesta Nacional de Ocupación y Empleo (ENOE).

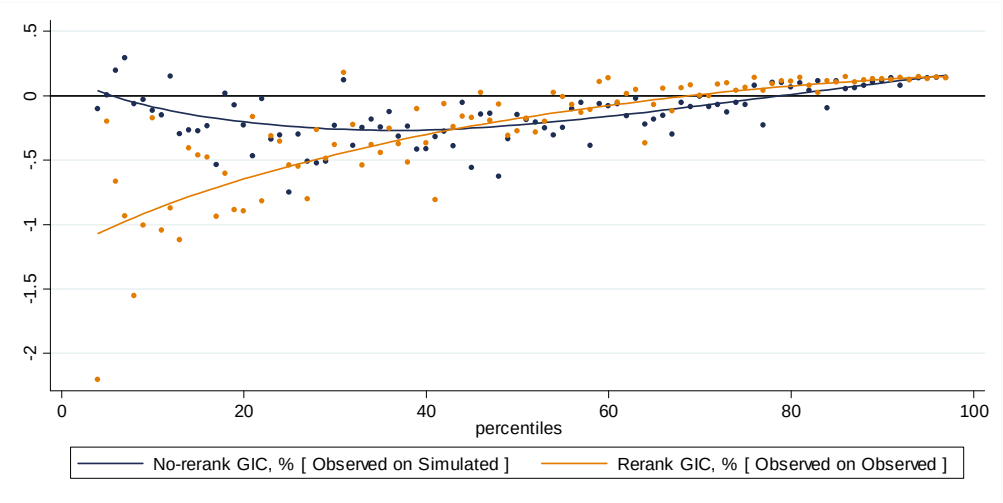
The distributional effects of the crisis through an increase in unemployment rates in Brazil are not very different from the effects in Mexico. If households are followed over time (growth incidence curve with re-ranking in figure 5.12) the effects seem to be quite mild, with households located in the middle part of the distribution suffering the largest income losses because of the increase in unemployment rates. The shape of the blue GIC in figure 5.12 (not allowing for re-ranking) is explained by the larger increase in the unemployment rate among unskilled workers (primarily in the nontradable sectors) vis-à-vis the smaller increase in the unemployment rate among skilled workers (primarily those in the nontradable sectors).

As in Mexico, unemployment effects are an important determinant of changes in the position of Brazilian households along the income distribution (economic mobility). The mobility effects of the crisis-mandated changes in unemployment rates explain the difference between the two GICs depicted in figure 5.12. Another similarity between the countries in terms of the welfare effects of an increase in

[20] See http://www.inegi.org.mx/est/contenidos/proyectos/encuestas/hogares/regulares/enoe/default.aspx.

unemployment is related to its bias toward youth. Brazilian youth also suffered disproportionally from the increase in unemployment rates. Although the bias is not as strong as in Mexico, young workers between the ages of 15 and 29 had a larger probability of being sacked as a result of an exogenous income shock in Brazil.

Figure 5.12 Distributional Effects of Job Losses, Observed and No-Crisis Scenarios: Brazil



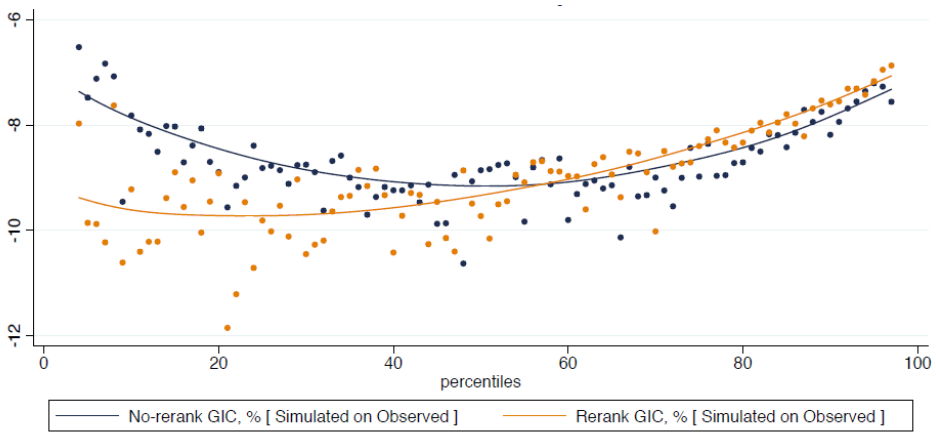
Source: Authors' own computation using the results from the microsimulation

Total Distributional Effects of the Crisis

When all effects, wages, hours worked (in the case of Mexico) and unemployment rates are jointly simulated, the effects of the crisis are shown to be regressive but largest among households located in the middle part of the per capita household income distribution in both Mexico and Brazil (see GICs with no-rerank in figures 5.13 and 5.14, respectively). The average household in Mexico loses 8 percent of its income as a result of the crisis (comparing the incomes in a scenario without the crisis with the observed levels) with households located in the middle part of the income distribution losing more than 9 percent of their per capita household income as a result of the crisis. For Brazil, the effect is milder, with an average loss in income of 4 percent, which is close to 5 percent among households located around the 40th percentile of the income distribution.

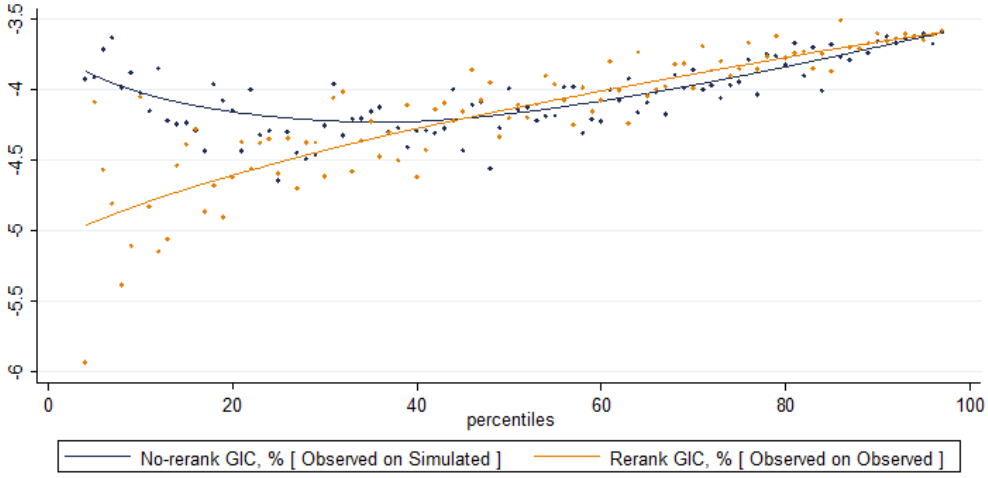
The crisis also causes some mobility in both Mexico and Brazil. In Mexico, reductions in hours worked are enough to push some households originally located in the middle part of the distribution into lower income brackets. More important, in both Mexico and Brazil increases in unemployment shift the position of households originally situated in the middle part of the income distribution toward the bottom percentiles.

Figure 5.13 Overall Distributional Effects of the Crisis, Observed and No-Crisis Scenarios: Mexico



Source: Authors' own computation using the results from the microsimulation

Figure 5.14 Overall Distributional Effects of the Crisis, Observed and No-Crisis Scenarios: Brazil



Source: Authors' own computation using the results from the microsimulation

Conclusion

The macroeconomic and the aggregate labor market impacts of the 2008–09 global financial crisis, when compared with a no-crisis counterfactual, were quite different in Mexico and Brazil. Mexico's labor market adjusted via a robust drop in the number of hours worked and a moderate reduction in hourly wages. Employment measured in hours worked shrank by 7 percent, but only 2.1 percent of people lost their jobs. Clearly, working fewer hours had a negative effect on incomes, but that approach generally represented a transitory and less severe loss than the one associated with becoming unemployed.

In Brazil, the inflexibility of the real wage did not support employment when aggregate demand dropped. In terms of job losses, the crisis had a relative impact (i.e., for each 1 percent reduction in GDP) that was similar across the two countries.

For both countries, the crisis meant a severe contraction of exports, but, notwithstanding the different sizes of the GDP contraction, investment collapsed by about 10 percent in both countries, rendering the reduction in investment relatively more severe in Brazil. Because of the diverse factor intensities (in terms of skilled and unskilled labor and capital inputs) in tradables and sectors linked to investment activities (such as construction), the decline in employment and wages affected, to varying degrees, workers and households in different parts of the income distribution.

The simulation results show that labor markets in Mexico and Brazil reacted differently to the global financial crisis, and particularly the labor market adjustments across the tradable and nontradable sectors of these two countries. The tradable sectors in Mexico adjusted mainly through a reduction in employment and average hours worked, with mild changes in wages. The nontradable sectors suffered larger losses in wages but milder ones in employment. And for both groups of sectors, unskilled workers lost relatively more than skilled workers. In Brazil, as a consequence of the crisis, the employment adjustment in the tradable sectors was similar to that of Mexico—that is, skilled workers lost relatively fewer jobs than unskilled workers (although they suffered from reduced wages). However, in the nontradable sectors unskilled workers found additional employment at almost constant wages, whereas skilled workers did record some losses.

The distributional effects of the crisis in Mexico—transmitted from a fall in external demand and through the ensuing adjustment in the labor market—are explained as follows: (1) job losses disproportionally affected unskilled workers in the tradable sectors; and (2) number of hours worked contracted more for unskilled workers, particularly among those in the tradable sectors who are typically located in the middle part of the Mexican income distribution. These two regressive effects were partly offset by a relatively milder reduction in hourly wages among unskilled workers in the tradable sectors—the groups with the lowest earnings in Mexico. The contraction in wages in Brazil was much milder and more concentrated among skilled workers in the tradable sectors and unskilled workers in the nontradable sectors, typically located in the middle or lower part of the Brazilian income distribution. The regressive effects of changes in wages were partly offset by an increase in employment among unskilled workers in the nontradable sectors, the group with the lowest earnings in the country. Finally, in Mexico, and to a lesser extent in Brazil, the simulation results show that workers between the ages of 15 and 29 were particularly vulnerable to external shocks increasing domestic unemployment.

These employment and related wage effects generated welfare effects at the level of the household. By comparing the actual crisis with a counterfactual (no-crisis) scenario, this chapter shows that in both countries households located between the 40th and 60th percentiles of the income distribution suffered the most and that income inequality widened. The overall crisis effects were therefore regressive. In Mexico, households located in the middle of the income distribution experienced a reduction in per capita household income of more than 9 percent, whereas the effect was close to 8 percent and 7 percent among the poorest and richest households, respectively. The regressive effects of the crisis are summarized by an increase in the Gini coefficient of 0.6 percentage points for Mexico and 0.3 percentage points for Brazil. The increase in income inequality (distributional effect) coupled with the significant reduction in average incomes (growth effect) resulted in an increase in the proportion of the population under the poverty line in both countries: the extreme poverty headcount ratio passed from a no-crisis level of 16.7 percent to a crisis level of 19.7, for an increase of 3 percentage points attributable to the crisis. In Brazil, the extreme poverty headcount ratio passed from 6.6 percent to 7.2 percent, an increase of 0.6 percentage points due to the crisis.

From a policy perspective, the results shown here have important implications. One of the most important findings is that, contrary to what some might have thought, the poorest households were not

hit disproportionally by the external shock. The fact that households located in the middle part of the distribution, just above the moderate poverty line, bore a significant proportion of the shock poses new challenges to the governments in a region that has invested in the design of social protection programs targeting the bottom of the distribution. For example, when external shocks affect the vulnerable middle class, it limits the effectiveness of expansions in current social protection policies such as Oportunidades in Mexico and Bolsa Familia in Brazil to cushion the effects of the crisis. A second policy-relevant finding arises from the way in which the tradable sectors in Mexico adjusted to the crisis by means of job destruction and reductions in average hours worked while leaving wages almost constant. This degree of labor market flexibility in the mostly formal tradable sectors is positive as long as it is coupled with unemployment insurance or training programs for workers losing their jobs. The study's findings suggest that during times of external shocks, governments should be prepared for an increase in youth unemployment because workers between the ages of 15 and 29 are particularly vulnerable to reductions in external demand.

Annex A

Decomposition of the Global Financial Crisis Shock

Table 5A.1 Driving factors: Decomposition of Recession-Induced Deviations in 2009, Mexico

differences between crisis and no-crisis scenarios, percent

		Driving factor							
Variable	Total deviation	Investor confidence	Trade shocks	Government spending	Capital in use	Average propensity to consume	Productivity	Wage shift	Occupation shift
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L	-7.0	-1.01	-2.77	0.29	-2.48	1.89	-5.34	2.44	0.00
GDP	-8.5	-0.58	-1.93	0.11	-2.97	1.33	-5.69	1.21	0.00
I	-15.8	-4.67	-9.63	-0.09	-3.26	6.39	-7.93	3.39	0.00
C	-10.2	-2.23	-8.37	-0.28	-3.70	8.64	-6.24	2.02	0.00
X	-17.8	4.97	-5.57	0.35	1.54	-16.00	-1.06	-2.01	0.00
M	-23.4	-1.18	-21.18	0.10	-1.96	2.87	-3.13	1.03	0.00
G	1.7	0.00	0.00	1.69	0.00	0.00	0.00	0.00	0.00
W/P_c	-2.9	0.00	0.00	0.00	0.00	0.00	0.00	-2.85	0.00

Employment									
Skilled	-5.5	-0.99	-2.79	0.27	-2.25	1.93	-4.76	2.25	0.85
Unskilled	-9.6	-0.75	-1.82	0.25	-2.42	1.21	-5.58	2.31	-2.75
Employment									
Skilled, nontradables	-4.9	-1.63	-4.68	0.36	-2.36	3.57	-3.89	2.90	0.80
Unskilled, nontradables	-8.4	-1.60	-4.61	0.35	-2.32	3.51	-3.82	2.92	-2.83
Skilled, tradables	-10.0	0.85	2.76	0.07	-2.90	-3.13	-9.95	0.90	1.39
Unskilled, tradables	-12.9	0.95	3.77	0.07	-2.87	-3.45	-9.72	1.25	-2.85
Output									
Nontraded	-8.7	-0.95	-2.54	0.14	-2.65	1.90	-6.06	1.45	0.00
Traded	-6.3	0.44	0.98	0.03	-2.88	-1.59	-3.63	0.40	0.00
Employment									
Nontraded	-5.4	-1.55	-4.45	0.34	-2.24	3.39	-3.69	2.77	0.00
Traded	-10.9	0.88	3.07	0.07	-2.87	-3.21	-9.80	1.01	0.00

Source:

Note:

Table 5A.2 Driving Factors: Decomposition of Recession-Induced Deviations in 2009, Mexico

percent contributions

		Driving factor							
Variable	Total deviation	Investor confidence	Trade shocks	Government spending	Capital in use	Average propensity to consume	Productivity	Wage shift	Occupation shift
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L	100	14	40	-4	36	-27	77	-35	0
GDP	100	7	23	-1	35	-16	67	-14	0
I	100	30	61	1	21	-40	50	-21	0
C	100	22	82	3	36	-85	61	-20	0
X	100	-28	31	-2	-9	90	6	11	0
M	100	5	90	0	8	-12	13	-4	0
G	100	0	0	100	0	0	0	0	0

W/P_c	100	0	0	0	0	0	0	100	0
Employment									
Skilled	100	18	51	-5	41	-35	86	-41	-15
Unskilled	100	8	19	-3	25	-13	58	-24	29
Employment									
Skilled, nontradables	100	33	95	-7	48	-72	79	-59	-16
Unskilled, nontradables	100	19	55	-4	28	-42	46	-35	34
Skilled, tradables	100	-8	-28	-1	29	31	99	-9	-14
Unskilled, tradables	100	-7	-29	-1	22	27	76	-10	22
Output									
Nontraded	100	11	29	-2	30	-22	70	-17	0
Traded	100	-7	-16	-1	46	25	58	-6	0
Employment									
Nontraded	100	29	82	-6	41	-63	68	-51	0

Traded	100	-8	-28	-1	26	30	90	-9	0

Source:

Note:

Table 5A.3 Driving Factors: Decomposition of Recession-Induced Deviations in 2009, Brazil

differences between crisis and no-crisis scenarios, percent

		Driving factor							
Variable	Total deviation	Investor confidence	Trade shocks	Government spending	Capital in use	Average propensity to consume	Productivity	Wage shift	Occupation shift
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L	-0.9	-1.30	-0.47	-0.06	-1.77	-0.97	4.03	-0.38	0.00
GDP	-4.1	-3.75	-1.35	-0.05	-5.04	1.78	4.74	-0.46	0.00
I	-10.20	-15.13	6.91	-2.27	-0.01	2.29	-0.28	0.00	-1.72
C	0.60	-6.02	8.72	-1.71	0.02	2.32	-0.36	0.00	-2.37
X	-16.70	29.82	-36.80	-6.85	-0.02	0.81	0.42	0.00	-4.04
M	-13.70	-9.27	6.70	-10.58	-0.01	-0.02	0.20	0.00	-0.75
G	-0.14	0.00	0.00	0.00	-0.14	0.00	0.00	0.00	0.00

W/P_c	0.60	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00
Employment									
Skilled	-0.58	0.04	-0.12	-0.05	-1.11	-0.61	2.88	-0.26	-1.36
Unskilled	-1.31	-5.50	-1.38	-0.05	-2.48	-1.22	4.16	-0.44	5.59
Employment									
Skilled, nontradables	0.24	-2.40	2.72	-0.68	-0.08	4.36	-0.42	-2.28	-0.98
Unskilled, nontradables	2.74	-12.02	7.17	-2.19	-0.04	4.82	-0.22	6.58	-1.37
Skilled, tradables	-3.75	8.20	-12.12	1.64	-0.01	-0.02	0.10	0.75	-2.29
Unskilled, tradables	-6.71	10.13	-13.85	1.18	-0.01	-0.66	-0.40	-1.06	-2.04
Output									
Nontraded	-1.80	-2.74	2.05	-0.59	-0.03	1.47	-0.19	0.00	-1.76
Traded	-1.60	5.10	-7.30	0.69	0.00	2.32	-0.06	0.00	-2.30
Employment									

Nontraded	1.24	-6.85	-1.50	-0.10	-1.52	5.43	6.29	-0.52	0.00
Traded	-5.70	10.30	1.66	-0.01	-2.51	-14.69	-0.32	-0.13	0.00

Source:

Note:

Table 5A.4 Driving Factors: Decomposition of Recession-Induced Deviations in 2009, Brazil

percent contributions

		Driving factor							
Variable	Total deviation	Investor confidence	Trade shocks	Government spending	Capital in use	Average propensity to consume	Productivity	Wage shift	Occupation shift
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L	100	140	51	7	190	104	-433	41	0
GDP	100	91	33	1	122	-43	-115	11	0
I	100	148	-68	22	0	-22	3	0	17
C	100	-1,003	1,453	-285	3	387	-60	0	-395
X	100	-179	220	41	0	-5	-3	0	24
M	100	68	-49	77	0	0	-1	0	5

G	100	0	0	0	100	0	0	0	0
W/P_c	100	0	0	0	0	0	98	0	0
Employment									
Skilled	100	-7	21	9	190	104	-493	44	232
Unskilled	100	421	106	3	190	93	-319	34	-428
Employment									
Skilled, nontradables	100	-1019	1155	-289	-34	1851	-178	-968	-416
Unskilled, nontradables	100	-439	262	-80	-1	176	-8	240	-50
Skilled, tradables	100	-219	323	-44	0	1	-3	-20	61
Unskilled, tradables	100	-151	206	-18	0	10	6	16	30
Output									
Nontraded	100	152	-114	33	2	-82	11	0	98
Traded	100	-319	456	-43	0	-145	4	0	144

Employment									
Nontraded	100	-555	-122	-8	-123	440	509	-42	0
Traded	100	-181	-29	0	44	258	6	2	0

Source:

Note:

Annex B

Decomposition of the Global Financial Crisis Shock Using the CGE Model

This annex describes in detail the results of the decomposition analysis shown in tables 5A.1 (Mexico) and 5A.3 (Brazil). Each column of these tables represents the individual effect of a single driving factor on the macro or labor market variables in the rows of the tables. For example, column (1) of table 5A.1 shows that the reduction in investor confidence caused a reduction in aggregate investment of 4.59 percent. This reduction is calculated as that caused by imputing the change in investor confidence from the no-crisis to the crisis scenario while leaving the average propensity to consume, trade flows, government expenditure, etc. on their no-crisis paths.

Column (0)—which equals the sum of all the other columns—represents for 2009 the full discrepancy between the values each variable takes in the crisis and no-crisis scenarios.

The decomposition of the impacts on the labor market in terms of changes in both employment and wage is embedded in this decomposition exercise. For all but one of the drivers (columns), the labor market is assumed to operate with sticky real wages. However, because a reduction in wages was actually observed in Mexico during the crisis, this is implemented in column (7) as an "outward" shift of a positively sloped supply of labor—that is, workers are willing to work the same amount of hours at a lower wage. This shift in the labor supply counterbalances the negative effect on employment generated by the other shocks (however, Brazil experienced a slight wage increase and so the reverse occurred). What follows considers the results of the decomposition in greater detail.

Investor Confidence

The effect of an "exogenous" reduction in investment demand consistent with the difference in investor confidence estimated in the historical (crisis) and forecast (no-crisis) runs of the model is shown in column (1). How is this shock transmitted through the economy? GDP is determined by the aggregate production function (i.e., by the availability of labor and capital and the level of productivity), and therefore a reduction in investment, with an initially fixed supply (fixed GDP), must be accompanied by an increase in net exports.[21] This is accomplished via a real depreciation: demand for nontradables falls—a large share of investment demand is accounted for by nontradables such as construction—and their prices, determined domestically, go down. However, prices for tradables, determined in the international market, do not fall as much, which generates the real depreciation and the incentive for producers to shift resources toward tradables (exportables and other products that compete with imports). In Mexico, exports (by volume) increase by almost 5 percent, while imports decrease by about 1 percent—see column (1) in table 5A.1.

Because Mexican exporters face a downward sloping foreign demand, they have to reduce prices to increase their volume of sales in international markets. This reduction, combined with fixed import prices,[22] generates a terms of trade loss. To remain profitable at these lower prices, firms have to reduce their costs. However, with sticky wages, the only way to do so is to reduce employment. Such a

[21] This is evident from the equation GDP = $C + I + G + (X - M)$. With fixed GDP, a reduction in I has to be compensated for by an increase in net exports because C is a function of income (GDP) and G is fixed.
[22] As described in the macro model section, the model assumes that Mexico and Brazil face downward sloping foreign demand for their exports, but that these economies have no market power on the import side.

reduction, combined with a fixed stock of capital,[23] increases the marginal product of labor. With fewer but more productive workers, firms remain competitive.

Once this employment contraction is established, it is fairly straightforward to explain the reduction in GDP via the production function and the effect on consumption via a reduction in income. The reductions in employment by skill level and by sector depend on the factorial intensity of the sectors producing investment goods, and, as already stated, on the fact that a large share of investment is accounted for by the nontradable construction sector.

In Brazil, the crisis-related drop in investor confidence yields results *qualitatively* similar to those just described for Mexico. However, Brazil suffered a drop in investment activity *quantitatively* much larger than the Mexican one. This is an interesting result: had investment confidence in Brazil decreased by the same magnitude as in Mexico, the model would have been unable to account for the full observed reduction in investment activity. In fact, the loss of confidence in the case of Brazil accounts for more than the total drop in investment (148 percent, which means that other shocks supported investment by counterbalancing the loss of confidence), whereas it explains less than a third in Mexico.[24] This signals that Brazilian investment was probably already close to a ceiling perhaps because of its loose monetary policy and that the crisis caused a large retrenchment by investors.

Another interesting quantitative difference is the trade adjustment that accompanies the investment shock. Because in Brazil trade is far less open than in Mexico—the ratios of imports and exports to GDP are 30 and 60 percent, respectively—a reduction in investment that entails a positive impact on the trade balance generates a larger percentage change in imports and exports. Finally, when all these effects are combined they produce quantitatively larger effects on employment in Brazil.

Trade Shock

The next large crisis-related shock is a reduction in export demand.[25] This shock has the same qualitative effects in the two countries. However, these effects have larger magnitudes in Mexico. The trade shock accounts for 40 percent of the total GDP contraction in Mexico and 20 percent in Brazil.

The reduction in exports generates a terms of trade deterioration that has to be counterbalanced by a reduction in employment to moderate production costs. The reduction in employment, while increasing the marginal product of labor, lowers the marginal product of capital. Because the rental rate is not fixed, the reduction in the marginal product of capital is accompanied by falling rates of return. This outcome negatively affects investors, who are then less willing to finance investment with lower rates of

[23] The reduction in Investment affects the accumulation of capital and thus the future stock of capital but not the current one.

[24] For Brazil, the share of the change in investment explained by the reduction in investor confidence is calculated from the figures in table 5A.3 as −15.1/−10.2 × 100 = 148 percent. For Mexico, the share of the change in investment is calculated (using figures from table 5A.1) as −4.7/−15.8 × 100 = 30 percent.

[25] Column (2), which describes the impact of the reduction in export demand, also includes a simultaneous reduction in imports (via a shift in the preferences of Mexican demand toward domestic products). A further decomposition of this combined trade shock is available upon request. The size of the trade shocks is obtained from comparing the historical (crisis) versus the forecast (no-crisis) simulations. The change in preferences for domestic as opposed to import varieties can be viewed as the residual change that is needed to bring about the observed reduction in imports over and above that endogenously produced by the observed relative price change. During the recession, Mexico and Brazil experienced real exchange rate depreciation, but it was not enough to account for the full reduction in imports.

return. In Mexico, as observed in column (2), *I* goes down by 9 percent. This produces a real depreciation as explained for the case of investor confidence.

The fall in employment reduces GDP and drags down private consumption and imports. Private consumption also goes down because of the real depreciation. However, these endogenous effects cannot account for the full observed drop in imports. Therefore, the model suggests that, during the crisis, there was a shift in preferences away from imports.[26] This, in turn, results in an additional contraction of imports that counteracts the real exchange rate depreciation due to a reduction in absorption (and investment in particular). The real exchange rate strengthens (or, more precisely, goes down less than it could) with negative consequences for exports. However, overall net exports improve.

The combined effect of the change in the structure of aggregate demand results in a slightly higher reduction in employment for skilled workers in relation to unskilled workers. And, because of the especially large contraction in imports, it results in a slight increase in employment in the tradable sectors (the sectors producing import-competing goods) and a loss of employment in the nontradable sectors.

Government Spending

The mild countercyclical fiscal policy accounted for in column (3) has the initial effect of shifting the structure of aggregate demand. With GDP determined from the aggregate production function, higher government consumption crowds out private consumption.

This shift in the composition of aggregate demand is relevant to the labor market because an increase in public consumption reallocates demand toward goods and services whose production is more intensive in labor inputs. Achieving the new sectoral composition of the combined private and public demand requires a larger amount of labor inputs. And because wages are fixed, this results in an increase in employment. In Mexico, the increase is similar for skilled and unskilled employment—0.3 percent —but in Brazil the demand for skilled workers increases more. For both countries, higher government expenditures result in higher employment in the nontradable sectors than in the tradable sectors.

The Capital in Use Shock

Another mechanism operating during the recession was reducing the use of capital. Firms became more risk-averse and reduced their level of production by leaving capital idle. Because of the fixed wage assumption and no effect on the terms of trade, a reduction in the capital input has to be accompanied by a proportionate reduction in labor inputs. Otherwise, the marginal product of labor would be below the fixed wage and firms would generate losses.

In Mexico, working below full capacity (a reduction of about 3 percent of capital in use) brings about a reduction in employment of about 2.5 percent and a reduction in GDP of 2.8 percent. There are negligible effects on sectoral occupation because both input types (labor and capital) go down in parallel. The capital to labor ratio does not change, and thus there is no specialization toward either tradables or nontradables.

[26] This finding should be analyzed further. It may indeed be the result of rationing imports rather than a voluntary change in preferences. A disruption of logistics and a delay of shipments from the United States to Mexico may have caused this. Exporters in the United States may have been affected by the drying up of credit and may have either deferred production or decided to shift their sales to the domestic market.

Consumption Smoothing

The crisis-related contraction of incomes would normally entail a larger drop in private consumption than the one actually observed. This implies that, consistent with the permanent income theory, the drop in income was perceived as temporary, and households reduced their saving to smooth consumption. In terms of column (5), this is equivalent to an upsurge in the propensity to consume, which results in an increase in *C* of more than 8 percent for both countries.

In Mexico, an increase in consumption, other things being equal, requires a reduction in net exports and thus a real appreciation. As exports are reduced, their prices rise and the terms of trade improve. Once again, with fixed wages, the improved terms of trade make it profitable to employ more workers even if, given the fixed availability of capital, the marginal product of labor is decreasing. Additional labor inputs raise the marginal productivity of capital and thus its rate of return. This in turn stimulates investment. The joint effect of a large reduction in exports, an increase in imports, and an increase in investment in labor markets is job creation in the nontradable sectors and job losses in the tradable ones.

These transmission mechanisms operate differently in Brazil. The increased consumption results in slightly lower aggregate employment because the shift in the composition of aggregate demand—toward more private consumption, investment, and imports and fewer exports—entails a reallocation of resources from more labor-intensive to less labor-intensive production sectors.[27] However, the relative adjustment for the tradable and nontradable sectors is similar across the two countries.

Labor Market Adjustment Mechanisms: Productivity, Wage, and Skill Shifts

Changes in productivity, real wages, and occupation—the columns to the far right in the decomposition tables—are important adjustment mechanisms for both Brazil and Mexico. The starting point is the observation that in Mexico productivity changes differently across sectors with a significant fall in the nontradable segment and a rise in the tradable one.[28] Wages follow the same pattern as these productivity shifts: workers in the tradable sectors suffer lower wage losses than those in the nontradable sectors. Column (6) in table 5A.1 isolates the impact of this differential productivity shock. A reduction in productivity in the nontradable sectors generates an increase in their prices, which pushes up the real exchange rate and thus hurts the tradable sectors. Producers of exportables are negatively affected because their goods are less competitive, and producers of importables are also hurt because imports are cheaper. This real appreciation hurts employment in the tradables more than in the nontradables.

The next step in the decomposition considers the effect of the wage shift, shown in column (7). Lower real wages combined with unchanged labor productivity create an incentive to increase employment (movement along the demand for labor curve), and firms employ more workers until the decreasing productivity of the marginal worker equals the new lower wage. The increase in employment then produces an increase in output. In addition, the (aggregate demand) composition of GDP changes because an increase in employment with fixed capital stock produces an increase in the marginal

[27] The increase in GDP associated with a slight reduction in employment seems perplexing at first glance. However, the shift in demand toward consumption and imports implies a shift toward GDP components that have higher indirect taxation. Therefore, when measured at market prices, GDP is slightly higher in the specific shock of column (5).

[28] With respect to the no-crisis scenario, the output of the tradable sectors contracts by about 6 percent and that of the nontradable sectors by almost 9 percent. These are accompanied by reductions in labor inputs of 11 and 6 percent, respectively.

productivity of capital and thus pushes up the demand for it. This push in turn propels up the rate of return, thereby allowing the economy to move up the supply of investment, which increases by 3 percent. Finally, an increase in *I* affects the trade balance negatively. A decrease in the average wage benefits employment in the nontradables more than in the tradables. This is explained via an appreciation in the real exchange rate.

The last run of the model, the shift in the skill intensity of employment, represents a residual. Because the changes in relative goods and factor prices and shifts in demand are observed and "exogenous," the model cannot reproduce the shift toward skilled workers, nor equivalently can it explain the bias against the unskilled. To fit the data, a change in the technology equivalent to an exogenous increase in the skill intensity of employment is assumed. The effects of this exogenous change are shown in column (8).

In the case of Brazil, the combined effect of the first five columns indicates a much larger loss of employment than the one actually observed. Moreover, the slight increase in average real wages also induced some employment loss, as shown in column (7). Thus how was Brazil's economy able to preserve employment if trade contraction, loss of investor confidence, and other crisis-related shifts in aggregate demand were causing job losses? An explanation that is consistent with the observed employment contraction is that firms chose a different input mix and used more labor and less capital. This can be represented by a technological shift that is capital-saving and labor-using. Column (8) reveals that a final twist in favoring unskilled employment, especially in the nontradable sectors, accompanied the adjustment to the crisis. For the tradable sectors, the adjustment was similar to that observed in Mexico: firms exporting or producing traded goods for the domestic market competing with imports tended to preserve their more skilled workers.

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